

Assessment of Knowledge, Attitude and Behaviour Related to Chronopharmacology among Doctors in a Tertiary Care Hospital

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Abstract:

Background: Chronopharmacology is a branch of medicine that investigates the relationship between biological cycles and medication effectiveness. It is underappreciated, underrepresented, and underutilised in drug research, regulatory affairs, and clinical practice. Improving medical personnel's grasp of chronotherapeutic principles can encourage reasonable medication use, prevent overexposure, and reduce the incidence of adverse drug reactions. The purpose of this study was to assess doctors' knowledge, attitudes, and behaviours regarding chronopharmacology in a tertiary care hospital.

Methods: 196 doctors participated in a cross-sectional, descriptive study with a pretested and validated questionnaire. The questionnaire measured knowledge of individual drugs and their optimal timing, attitudes towards chronotherapy, and self-reported practices for medication timing and patient counselling.

Results: Most doctors correctly recognised the optimal timing for some prescriptions (e.g., nifedipine for hypertension in the morning, statins at night), but considerable gaps occurred for others (e.g., H2 blockers for ulcers before dinner, bronchodilators for asthma in the evening). Doctors were largely favourable about chronotherapy, believing it may lessen bad medication effects and improve efficacy. They also advocated for incorporating chronotherapy into patient counselling and including chronotherapeutic information in pharmacological reference materials. Most doctors include precise medication timing in prescriptions and coach patients on timing in their practice. Only a quarter of trainees got formal chronopharmacology coursework

This study demonstrates the potential benefits of chronotherapy and clinicians' positive opinions towards its use. However, it also indicates a major information gap regarding the best scheduling for various drugs. Integrating chronopharmacology information into medical curricula and updating pharmacological references could help to close this gap. Additional research is required to determine the cost-effectiveness of chronotherapy programmes.

Limitations: The study used self-reported data and had a small sample size. More research is needed to see whether this is applicable in other healthcare settings.

Conclusion: Doctors have positive attitudes towards chronotherapy, but lack thorough understanding. Addressing this knowledge gap through focused education will help to optimise pharmaceutical regimens and possibly enhance patient outcomes.

Keywords: Chronopharmacology, Circadian rhythm, Medication timing, Clinicians, INT.

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Introduction

Chronopharmacology is the science of optimising pharmacological effects and minimising side effects by scheduling drugs according to biological rhythms. [1] It contributes significantly to understanding the function of circadian rhythm in medication efficacy and tolerance. [2] This multidisciplinary discipline combines chrono biological and pharmacological principles to optimise therapeutic efficacy while minimising negative effects. Chronopharmacology is underappreciated, underrepresented, and

underutilised in drug development, regulatory affairs, and clinical practice. [3] The circadian rhythm, a critical component of physiological regulation, coordinates a wide range of bodily functions during a 24-hour period. This rhythmicity extends beyond sleep-wake cycles to include hormone, temperature, and metabolic oscillations. Furthermore; it plays a vital function in maintaining plasma concentrations, which affects drug efficacy. Knowing the temporal variability (ultradian, circadian, infradian, circaseptan, and

circannual) of the symptoms and the safety of drug use is the basis for a novel therapeutic method called chronotherapy [4,5]. Circadian medicine has improved greatly in recent decades, and biological rhythm is now considered a potential supplement to homeostasis.

Recent technological improvements have made it easier to design novel medication delivery systems that follow chronotherapeutic concepts. These include programmed, triggered, pulsed, and time-controlled drug delivery devices that release medications in sync with the body's natural circadian rhythms. When it comes to medication delivery precision, the potential for treating problems requiring temporal precision is enormous [4,5]. Examples include cancer, chemotherapy, gastric ulcers, respiratory disorders, and cardiovascular ailments. Chronotherapy has a growing body of data supporting its benefits, but its integration into regular clinical practice remains low.

Many medical experts continue to prescribe drugs without considering the ideal time to take them, which may reduce the effectiveness of the treatment. Furthermore, a scarcity of studies evaluating medical professionals' knowledge, opinions, and practices in chronopharmacology emphasises the need for improved awareness and educational initiatives in this field.

Given these criteria, projects aimed to expand understanding and encourage education in chronopharmacology are critical. Improving medical personnel's awareness of chronotherapeutic principles can encourage reasonable medication administration, limit overexposure, and reduce the incidence of adverse drug reactions [6].

Furthermore, by incorporating chronopharmacological insights into the process of generating new pharmaceuticals and establishing regulations, we can hasten the creation of personalised and effective treatments tailored to patients' specific circadian cycles. Despite tremendous advances in this area, more work remains to be done to incorporate chronopharmacological ideas into clinical practice and medical education. To recap, chronopharmacology is a revolutionary type of drug therapy that takes advantage of the body's natural cycles to boost therapeutic benefits. There have been very few studies undertaken among doctors to measure their knowledge, attitude, and behaviour towards chronopharmacology. As a result, this study is being done to measure their knowledge, attitude, and behaviour about chronopharmacology. This study will shed light on areas where education or intervention may be required to improve healthcare delivery to patients.

Methods:

Study Design & Setting: The study was cross-sectional, descriptive, and used a pre-validated questionnaire. It took place at the Sree Balaji Medical College and Hospital in Chennai.

Ethical approval and sample sizes: The Scientific Review Committee and the College's Institutional Ethics Committee both approved the conduct of this study. The trial lasted four months, from December 2023 to March 2024. The sample size of 196 doctors was calculated using the following formula: $n = z^2 * p * (1-p) / e^2$, where $z = 1.96$ for a 95% confidence level (α), $p =$ proportion (given as a decimal), and $e =$ margin of error.

$$n = 1.96^2 * 0.5 * (1 - 0.5) / 0.07^2 = 196.$$

The sample method used was purposive sampling.

The sampling criteria were as follows:

Inclusion Criteria: Medical officials, postgraduates, senior residents, and clinicians are welcome to participate in the study.

Exclusion Criteria: Those who did not wish to participate in the study were excluded.

Design of the questionnaire:

A pre-tested, validated questionnaire examining clinicians' knowledge, attitude, and behaviour towards chronopharmacology was distributed. The Questionnaire was briefly discussed. The questionnaire contained four sections:

1. The first section included respondents' personal information, such as gender and age.
2. The second segment comprised questions about participants' expertise of chronopharmacology.
3. The third section will include questions about participants' attitudes towards chronopharmacology.
4. The fourth portion will include questions about participants' behaviour towards chronopharmacology.

Statistical analysis: Data was inferred using Microsoft Excel, with statistical analysis performed using SPSS version 27. Descriptive statistics were calculated using frequency and percentages.

Results

The study included 53% males and 47% females. The majority of participants are between the ages of 30 and 45.

This KAP study investigates how people's circadian rhythms influence their knowledge, attitudes, and behaviour about medication timing. The majority of research participants (85.5%) accurately stated that taking nifedipine for high blood pressure

produced the best benefits in the morning. 89 percent of doctors correctly stated that statins for cholesterol are most effective at night. A high percentage of participants (70%) accurately replied that heart attacks are most likely between 6 a.m. and 12 p.m. This investigation delved deeper into certain drugs. Very few participants correctly stated that using H2 blockers for ulcers produced the best outcomes before supper (2.5%), whereas

bronchodilators for asthma are most helpful in the evening (17%). Similarly, just a few people (17% and 15%, respectively) correctly stated that inhalational corticosteroids for allergies are most effective at night, whereas oxaliplatin is most effective around 4 p.m. rhythms to potentially boost their effectiveness. The results are summarised in the table below.

Table 1: Questions about Knowledge of Chronopharmacology

S.No	Question	Percentage of Participants responding with correct answer
1	The study on effect of drugs which vary with biological timings and endogenous periodicities is called	Chronopharmacology (85%)
2	Circadian rhythm is associated with	24 hour time frame (94%)
3	Ideal time to administer H2 blockers like ranitidine in peptic ulcer is	Before dinner (2.5%)
4	Bronchodilators like theophylline or salbutamol sustained release preparations is more effective at	Evening (17%)
5	Administering a single daily dose of inhalational corticosteroid will be more effective at what time during the day	Night (17%)
6	There is an increased risk of Myocardial Infarction between	6am- 12 pm 70(35%)
7	ACE inhibitor: enalapril are highly effective in reduction of blood pressure if given in	Night- 12(6%)
8	The ideal time to administer calcium channel blocker nifedipine in the treatment of hypertension	Morning-171(85.5%)
9	The ideal time to administer platinum based chemotherapy agent oxaliplatin for treating bowel cancer is	4 pm (15%)
10	When do you think administration of statins would be more efficacious	During night -178(89%)

Questions related to attitude on Chronopharmacology: This KAP survey demonstrates that physicians have a positive opinion towards chrono pharmacology. The vast majority of physicians (more than 83%) feel chronotherapy can lessen adverse pharmacological effects, and nearly all (91.5%) consider it as a potential improvement in therapeutic efficacy. There is also widespread support for introducing

chronotherapy into physician practice, with more than 92% agreeing to counsel patients on optimal medication timing and nearly 93% supporting for the inclusion of chronotherapeutic information in drug references.

While a sizable proportion (73.5%) sees potential cost-effectiveness in such counselling, it appears to be a less widely held notion than the other features of chronotherapy.

Table 2: Questions about Attitude towards Chronopharmacology

S.No	Question	Percentage of Participants responding with correct answer
1	Chronotherapy could reduce the incidence of adverse drug effects.	Yes (83.5%)
2	Chronotherapy could increase the efficacy of a drug.	Yes (91.5%)
3	At therapy initiation, counselling should be done to the patients about more effective circadian-time windows for drugs, where this is applicable.	Yes (92%)
4	Counselling the patients about taking their medication at more effective circadian-time windows for a particular drug may lead better cost effectiveness, where this is applicable.	Yes (73.5%)
5	Chronotherapeutics information should be included in drug references	Yes (93%)

Behaviour-related questions in chrono pharmacology: This KAP study provides intriguing insights on medical practices and ideas

about chronotherapy. Physicians (97.5%) report that their prescriptions include precise medication scheduling. A large majority (88.5%) regard good

patient counselling on medication timing as an essential component of their practice. However, a gap in medical education is clear. Only one-quarter (25.5%) of physicians reported receiving formal chronopharmacology training throughout their education. This is supported by a strong consensus (83.5%) on the importance of including chronotherapy in the medical curriculum.

While only a small percentage (12%) have directly seen scenarios where poor timing resulted in drug ineffectiveness, the data suggest that greater chronotherapy education for clinicians could help patients.

Table 3: Questions related to Behaviour on Chronopharmacology.

S.No	Question	Percentage of Participants responding with correct answer
1	Correct timing of drug administration is always mentioned in your prescription.	Yes (97.5%)
2	Proper patient counselling regarding timing of drug intake is essential part of your practice.	Yes (88.5%)
3	Have you ever been taught chronopharmacology/ chronotherapeutics during your medical education.	Yes (25.5%)
4	Do you realize a need for including chronopharmacology/ chronotherapeutics in medical education curriculum.	Yes (83.5%)
5	Have you ever encountered a situation where drug prescribed was not effective enough due to incorrect timing of intake?	A. Yes (12%)

Discussion

This Knowledge, Attitudes, and Practices (KAP) study looked at how physicians were aware of and applied chronopharmacology principles. The results, when compared to data from two other relevant research, namely investigations performed by Sireesha M et al [7] and Meenu P et al [8], offer useful insights and identify areas for additional exploration.

Positive physician attitudes align with existing research: Our data show that physicians have a highly positive attitude on chronotherapy. A large majority (more than 83%) feel it can lessen side effects, and almost all (91.5%) believe it has the potential to improve therapeutic efficacy. This is consistent with recent research conducted by Sireesha M et al [7] and Meenu P et al [8], which highlighted the increased interest in chronopharmacology and its potential to optimise medication therapy.

High Physician Support for Integration, Despite Knowledge Gap: Physicians strongly support introducing chronotherapy into practice: more than 92% agree to counsel patients on appropriate medication timing, and almost 93% advocate for including chronotherapeutic information in drug references. This enthusiasm echoes the findings of a study conducted by Sireesha M et al [7], in which 77% of participants agreed that chronotherapy could lower the incidence of undesirable medication effects.

Chukwunyere and Abacioglu [9] found that awareness was impacted by age and practice. Our findings indicate a large knowledge gap. Only

25.5% of clinicians reported getting formal chronopharmacology training. This is consistent with the findings of Sireesha M et al. [7], who found that only 43% of physicians had undergone chronopharmacology education.

Addressing Knowledge Gaps and Potential Impacts: The found knowledge gap suggests that chronopharmacology principles should be integrated into medical education, similar to the recommendations given in Meenu P et al's study [8]. This could include specialised coursework, workshops, or online programs that examine the impact of circadian rhythms on drug absorption, metabolism, and therapeutic activity. It would also be advantageous to update medical school curricula to include chronotherapeutic knowledge in pharmacology courses and medication reference books. This comprehensive approach could provide future physicians with the knowledge and abilities needed to optimise pharmaceutical regimens using suitable scheduling tactics.

Cost-Effectiveness Considerations: While a sizable proportion (73.5%) of physicians believes that coaching patients on optimal drug scheduling has the potential to be cost-effective, this appears to be a less widely held notion than other parts of chronotherapy. More study is needed to determine the cost-effectiveness of chrono therapy in a variety of therapeutic settings. This could include evaluating the possible reduction in adverse effects, pharmaceutical waste due to inefficacy, and the necessity for subsequent therapies due to inadequate initial treatment. Given the high financial and time expenses associated with drug development, chronopharmacology could help to enhance the efficiency of the process, ensuring that

effective medications reach patients more quickly. More proof is required to fully explore chronopharmacology's therapeutic potential [10].

Limitations and Future Directions: This study uses self-reported data. Furthermore, the sample size and physician demographics require further examination to determine generalisability across various healthcare settings. It would be beneficial to investigate how chronotherapy education affects medical practices and patient results. Studies could analyse the efficacy of introducing chronotherapy modules into medical education and whether such interventions result in enhanced use of chronotherapy in real-world clinical practice. Furthermore, researching the cost-effectiveness of chronotherapy programs in different patient populations could help to strengthen their inclusion into healthcare systems. This study supports physicians' positive attitudes towards chronotherapy and their desire for better education in this area. Targeted educational strategies can help physicians personalise medication regimens by incorporating optimal timing considerations, potentially improving patient outcomes, reducing adverse drug effects, and contributing to cost-effectiveness.

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