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Concordance between Patient and Physician Predictions of PCR Results and Predictive Capacity of Presenting Complaints in Suspected Infectious Diseases

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ABSTRACT

Introduction: The aim of this study was to investigate the concordance between patient and physician predictions of polymerase chain reaction (PCR) results in suspected infectious diseases and evaluate the predictive capacity of presenting complaints to enhance diagnostic decision-making.

Methods: A cross-sectional design was employed to recruit 1,369 participants with symptoms associated with coronavirus disease-2019 (COVID-19) infection. Data on demographics, medical history, presenting complaints, and PCR results were collected. Concordance between patient and physician predictions was assessed using kappa statistics, providing insights into the alignment of patient beliefs and physician expectations.

Results: The study revealed a lack of concordance between patient and physician predictions of PCR results. Loss of taste and smell emerged as the most sensitive symptoms associated with positive PCR results, whereas cough demonstrated higher specificity. However, relying solely on these symptoms may lead to missed cases, emphasizing the need for a comprehensive clinical evaluation. The suboptimal predictive accuracy of both patients and physicians highlights the importance of incorporating objective diagnostic tools such as PCR testing to enhance diagnostic decision-making.

Conclusion: Improved communication and shared decision making between patients and physicians are crucial for optimizing diagnostic strategies. Integrating objective diagnostic tools with clinical judgment is essential for improving accuracy. By identifying specific symptoms strongly associated with positive PCR results, this study contributes to enhancing the efficiency of diagnostic decision-making and the development of evidence-based guidelines in the realm of infectious diseases, ultimately improving patient care and healthcare delivery.

Keywords: Physcian-patient relations, infectious diseases medicine, emergency medicine, COVID-19

Introduction

Concordance between the Patient and Physician

In the era of infectious diseases, accurate and timely diagnosis is of paramount importance in guiding patient management and implementing appropriate public health measures (1,2). The availability of diagnostic tests, such as polymerase chain reaction (PCR), has revolutionized the detection of infectious agents (3). However, the decision to order a diagnostic test is not merely based on clinical suspicion but also relies on the predictive value of symptoms and the perceived likelihood of disease presence (4). Both patients and physicians play crucial roles in this decision-making process because their beliefs and expectations can significantly influence the pursuit of testing. The decision to order a diagnostic test is influenced by patient beliefs and physician expectations. Understanding the concordance between patient and physician predictions of test outcomes is crucial for optimizing diagnostic strategies (5).

One key aspect that affects the decision to undergo diagnostic testing is the patient's perception of their disease status. Patients who lack belief in their own likelihood of infection may be less inclined to consent to testing or seek medical attention altogether (6). Conversely, patients who perceive a high probability of infection are more likely to cooperate with testing procedures (7). Similarly, physicians consider the pretest probability of disease when determining the necessity of diagnostic tests. In cases where clinical suspicion is low, unless the test is deemed essential or has significant prognostic implications, physicians may be less inclined to order it (8). Understanding the factors influencing patient

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and physician predictions of test outcomes is crucial for optimizing diagnostic strategies and promoting effective healthcare delivery.

The primary aim of this study was to investigate the concordance between patient and physician predictions of PCR results in the context of suspected infectious diseases. Furthermore, we sought to evaluate the predictive capacity of presenting complaints in relation to PCR test outcomes. Ultimately, these research endeavors to contribute to the development of evidence-based guidelines that optimize diagnostic practices and improve patient care in the realm of infectious diseases.

Methods

Study Design and Participants

This study employed a cross-sectional design to examine the concordance between patient and physician predictions of PCR results for the COVID-19 test and the predictive value of presenting complaints. A total of 1,369 participants were recruited from the University of Health Sciences Turkey, İstanbul Training and Research Hospital, Clinic of Emergency, representing diverse age ranges, medical conditions, and referral statuses. The inclusion criteria consisted of presenting to the emergency department with symptoms associated with COVID-19 infection and being ordered for a PCR test, while individuals with inconclusive data were excluded from the study.

Data Collection

Data collection involved a comprehensive approach to gather relevant information. Participants were invited to complete a detailed questionnaire that captured demographic data, medical history, and presenting complaints. The questionnaire was carefully designed to ensure comprehensive data collection. Clinical assessments were conducted by physicians, involving a thorough examination of each participant, including a review of medical records, physical examinations, and discussions with the patient. In addition, patient predictions of PCR results were obtained through direct questioning during the initial assessment, focusing on their beliefs regarding the likelihood of a positive test outcome.

PCR Testing

PCR testing was performed according to established protocols. Nasopharyngeal swabs were collected from each participant using sterile collection kits to ensure proper sample handling and preservation. The collected samples were processed in a designated laboratory by experienced technicians trained in PCR techniques. Quality control measures, including the use of internal controls and regular calibration of equipment, were implemented to ensure the accuracy and reliability of the PCR results.

Ethical Considerations

This study obtained ethical approval from the University of Health Sciences Turkey, İstanbul Training and Research Hospital Ethics Committee (approval number: 2833, date: 21.05.2021) to ensure participant protection and adherence to ethical guidelines. Informed consent was obtained from all participants before their participation in the study. Confidentiality of participant data was strictly maintained, and data were securely stored in compliance with data protection regulations. This study was conducted in accordance with the ethical principles of the Declaration of Helsinki.

Statistical Analysis

Statistical Package for Social Sciences (SPSS, IBM Corp., Armonk, NY, USA) was used for statistical analysis. Data analysis involved both quantitative and qualitative approaches. Descriptive statistics were used to summarize the demographic characteristics of the participants, presenting complaints, and PCR results. Measures of central tendency (e.g., means, medians) and dispersion (e.g., standard deviations, interquartile ranges) were calculated. The agreement between patient and physician predictions of the PCR results was evaluated using statistical measures such as kappa statistics or percentage agreement. The predictive capacity of presenting complaints was assessed by calculating the sensitivity, specificity, positive likelihood ratio, negative likelihood ratio, and accuracy. Subgroup analyses may be conducted to explore variations in concordance and predictive capacities among different patient demographics or clinical characteristics.

Results

A total of 1,369 patients were enrolled in the study, with a median age of 33 years (interquartile range: 25-45). Among the participants, 49.5% (n=679) were female. The most prevalent chief complaint observed among the patients was sore throat, accounting for 34.9% (n=479) of the cases, followed by fatigue (34.1%, n=467) and cough (31.1%, n=427) as the second and third most frequently reported symptoms, respectively. In terms of the PCR test results, 17.6% of patients (n=241) tested positive. Interestingly, when specifically asked, 46.5% of the patients (n=637) expressed their belief that their test results would be positive. Remarkably, physicians themselves anticipated a positive outcome in 32.7% of cases (n=448).

Evaluation of the predictive accuracy of physicians in determining PCR results yielded several performance metrics. For all patients, physicians exhibited a sensitivity of 45.23% [95% confidence interval (CI): 38.83%-51.74%], specificity of 69.88% (95% CI: 67.71%-72.55%), positive likelihood ratio of 1.5 (95% CI: 1.27-1.77), negative likelihood ratio of 0.78 (95% CI: 0.69-0.88), and accuracy of 65.52% (95% CI: 62.93%-68.04%). In the subgroup of presenting patients, physicians achieved a sensitivity of 61.83% (95% CI: 55.37%-67.99%), specificity of 56.67% (95% CI: 53.73%-59.61%), positive likelihood ratio of 1.43 (95% CI: 1.27-1.61), negative likelihood ratio of 0.67 (95% CI: 0.57-0.79), and accuracy of 57.59% (95% CI: 54.92%-60.24%).

Notably, when examining the predictive power of presenting complaints, both physicians and patients demonstrated the highest sensitivity in identifying cases characterized by loss of taste and smell, with sensitivities of 78.38% (95% CI: 61.79%-90.17%) and 75.68% (95% CI: 58.88%-88.23%), respectively. In contrast, the highest specificity values were observed for patients presenting with a cough complaint, with specificity of 63.02% (95% CI: 57.63%-68.18%) and 52.96% (95% CI: 47.48%-58.38%) in the physician and patient groups, respectively. Remarkably, physicians demonstrated the highest accuracy in predicting

PCR results for patients with a history of contact with a suspected case (60.92%, 95% CI: 54.71%-60.24%), whereas patients exhibited the highest accuracy for those presenting with a cough complaint (55.97%, 95% CI: 51.12%-60.74%).

Assessing the agreement between physicians and patients in predicting PCR positivity, there was a noteworthy lack of concordance. The responses provided by both groups demonstrated weak agreement for all patients (kappa = 0.167, 95% CI: 0.116-0.218, p<0.001). Furthermore, subgroup analyses based on presenting complaints confirmed this finding, revealing weak concordance for patients with fever (kappa = 0.148, 95% CI: 0.023-0.273, p=0.023), cough (kappa = 0.175, 95% CI: 0.085-0.265, p<0.001), and a history of contact with a suspected case (kappa = 0.252, 95% CI: 0.140-0.364, p<0.001). Notably, for patients reporting a complaint of loss of taste and smell, no agreement was observed in PCR predictions between physicians and patients (kappa = 0.08, 95% CI: -0.124-0.284, p=0.431).

Table 1. Participant characteristics and PCR results

Variable	(n=1369)
Age	33 (25-45)
Sex (female)	679 (49.5%)
Complaint	
Fever	225 (16.4%)
Cough	427 (31.1%)
Shortness of breath	90 (6.6%)
Throatache	479 (34.9%)
Myalgia	348 (25.4%)
Nausea	92 (6.7%)
Diarrhea	80 (5.8%)
Loss of smell and taste	96 (7%)
Chest pain	58 (4.2%)
Malaise	467 (34.1%)
Dizziness	40 (2.9%)
Headache	299 (21.8%)
Contact with the infected	261 (19%)
Physician	448 (32.7%)
Patient	637 (46.5%)
PCR results	241 (17.6%)

PCR: Polymerase chain reaction

Discussion

The present study provides intriguing insights into several key aspects related to the prediction of PCR results, concordance between patients and physicians, and predictive value of presenting complaints. The most noteworthy finding of this investigation is the observed lack of concordance between patient and physician predictions of PCR results. This finding underscores the complex nature of diagnostic decision making and highlights the need for improved communication and shared decision making between patients and healthcare providers.

The lack of concordance between patient and physician predictions can be attributed to several factors. First, patient expectations and beliefs regarding their likelihood of infection may be influenced by various factors such as their knowledge of the disease, personal experiences, and media exposure (9,10). Patients may overestimate or underestimate their risk based on these subjective factors, leading to discordant predictions. Similarly, physicians' predictions may be influenced by their clinical experience, biases, and the prevailing prevalence of the disease in the population (11,12). It is crucial to bridge this gap in expectations to ensure effective patient provider communication and appropriate testing strategies.

Another intriguing finding of this study is the variation in the predictive capacity of presenting complaints. Loss of taste and smell emerged as the most sensitive symptoms associated with positive PCR results (Table 2). This aligns with the growing evidence highlighting the significance of these symptoms in COVID-19 diagnosis (13). However, relying solely on these symptoms may lead to missed cases because they are not specific to COVID-19. Cough, on the other hand, demonstrated higher specificity, suggesting its utility in ruling out COVID-19 in certain scenarios (Table 3). These findings emphasize the importance of considering multiple symptoms and clinical factors when making diagnostic decisions.

Furthermore, the suboptimal performance of both patients and physicians in predicting PCR results warrants attention. The relatively low sensitivity and specificity values observed in this study indicate that

Table 2. Predictive performance of presenting complaints for PCR results

	Complaint	Sensitivity (95% CI)	Specificity (95% CI)	+LR (95% CI)	-LR (95% CI)	Accuracy (95% CI)
Pysician	Any	45.23 (38-83-51.74)	69.88 (67.71-72.55)	1.5 (1.27-1.77)	0.78 (0.69-0.88)	65.52 (62.93-68.04)
	Fever	51.43 (39.17-63.56)	58.28 (49.98-66.24)	1.23 (0.92-1.65)	0.83 (0.63-1.09)	56.11 (49.29-62.76)
	Loss of tastasis and smell	78.38 (61.79-90.17)	29.31 (18.09-42.73)	1.11 (0.88-1.41)	0.74 (0.36-1.54)	48.82 (38.04-58.9)
	Cough	52.81 (41.94-63.49)	63.02 (57.63-68.18)	1.43 (1.12-1.82)	0.75 (0.59-0.95)	60.89 (56.08-65.55)
	Contact with the infected	53.19 (38.08-67.89)	62.62 (55.76-69.12)	1.42 (1.03-1.95)	0.75 (0.54-1.03)	60.92 (54.71-66.88)
Patient	Any	61.83 (55.37-67.99)	56.68 (53.73-59.61)	1.43 (1.27-1.61)	0.67 (0.57-0.79)	57.59 (54.92-60.24)
	Fever	65.71 (53.4-76.65)	49.67 (41.44-57.91)	1.31 (1.04-1.65)	0.69 (0.48-0.99)	54.75 (47.94-61.44)
	Loss of taste and smell	75.68 (58.88-88.23)	37.93 (25.51-51.63)	1.22 (0.93-1.6)	0.64 (0.33-1.23)	52.63 (42.12-62.97)
	Cough	67.42 (56.66-76.98)	52.96 (47.48-58.38)	1.43 (1.19-1.72)	0.62 (0.45-0.85)	55.97 (51.12-60.74)
	Contact with the infected	72.34 (57.36-84.38)	50.47 (43.57-57.35)	1.46 (1.17-1.82)	0.55 (0.34-0.89)	54.41 (48.15-60.56)

+LR: Positive likelihood ratio, -LR: Negative likelihood ratio, CI: Confidence interval, PCR: Polymerase chain reaction

Table 3. Agreement (Kappa) between patient and physician predictions of PCR results

	Kappa	95% CI		p-value
Any	0.167	0.116	0.218	<0.001
Fever	0.148	0.023	0.273	0.023
Loss of taste and smell	0.08	-0.124	0.284	0.431
Cough	0.175	0.085	0.265	<0.001
Contact with the infected	0.252	0.140	0.364	<0.001

PCR: Polymerase chain reaction, CI: Confidence interval

relying solely on clinical judgment or patient beliefs may not be sufficient for accurate predictions (Table 2). This emphasizes the importance of incorporating objective diagnostic tools, such as PCR testing, to support clinical decision-making and enhance diagnostic accuracy.

The findings of this study have important implications for clinical practice and public health strategies. Enhancing patient education and awareness regarding disease risks and symptoms can help align patient expectations with clinical probabilities, facilitating more informed decision making (14). Improving physician knowledge and training on the predictive value of presenting complaints can aid in more accurate clinical assessments and appropriate testing strategies. Furthermore, considering the limitations of symptom-based predictions, the implementation of widespread and accessible diagnostic testing, such as PCR, remains crucial for timely and accurate disease detection (15).

In conclusion, this study sheds light on the discordance between patient and physician predictions of PCR results and highlights the importance of shared decision making and effective communication in diagnostic decision making. The varying predictive capacity of presenting complaints underscores the need for a comprehensive clinical evaluation that considers multiple factors. Moving forward, a multidimensional approach that integrates patient perspectives, clinical judgment, and objective diagnostic tools is essential for optimizing diagnostic strategies and improving patient outcomes.

Study Limitations

It is important to acknowledge the limitations of this study. The sample size and composition may limit the generalizability of the findings to broader populations. In addition, reliance on self-reported symptoms and predictions introduces the possibility of recall bias and subjectivity. The subjective nature of patient and physician predictions may also introduce variability and affect the concordance between predictions and actual PCR results. Furthermore, symptom-based predictions have inherent limitations because symptoms alone may not be specific to the target disease. Contextual factors, such as disease prevalence and variations in testing strategies, should also be considered. Finally, potential biases, including recall and selection bias, should be recognized. Future research with larger and more diverse samples, objective measures, and exploration of additional influencing factors is needed to address these limitations and strengthen the validity and generalizability of the findings.

Conclusion

This study highlights the importance of improved communication and shared decision-making between patients and physicians in diagnostic processes. The findings reveal a lack of agreement between patient and physician predictions. Enhancing patient education and physician training on the predictive value of presenting complaints is essential. Implementing accessible diagnostic testing methods, such as PCR, is crucial for timely disease detection. Future research should address limitations, including sample characteristics and reliance on self-reported data. Collaborative approaches that combine patient perspectives, clinical judgment, and objective tools are vital for optimizing diagnostics and improving patient care.

Ethics Committee Approval: This study obtained ethical approval from the University of Health Sciences Turkey, İstanbul Training and Research Hospital Ethics Committee (approval number: 2833, date: 21.05.2021) to ensure participant protection and adherence to ethical guidelines.

Informed Consent: Informed consent was obtained from all participants before their participation in the study.

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