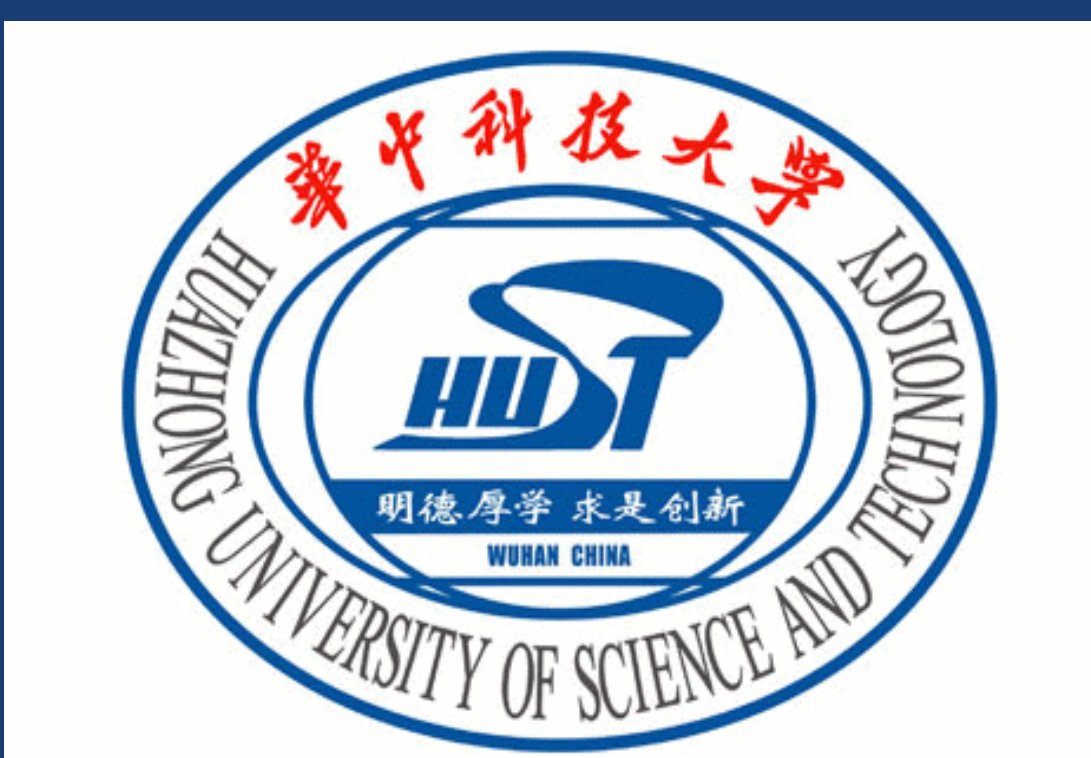


Physician Human Capital, Information-Processing Efficiency, and Diagnostic Test-Ordering Decisions Under Uncertainty: Evidence from a Vignette-Based Behavioral Experiment

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BACKGROUND

Unnecessary diagnostic test ordering remains a persistent challenge in clinical practice, contributing to rising healthcare costs and potential patient harm. Although previous research has examined system-level and organizational drivers of overtesting, less attention has been paid to physician-level determinants and the cognitive mechanisms underlying diagnostic test-ordering decisions.

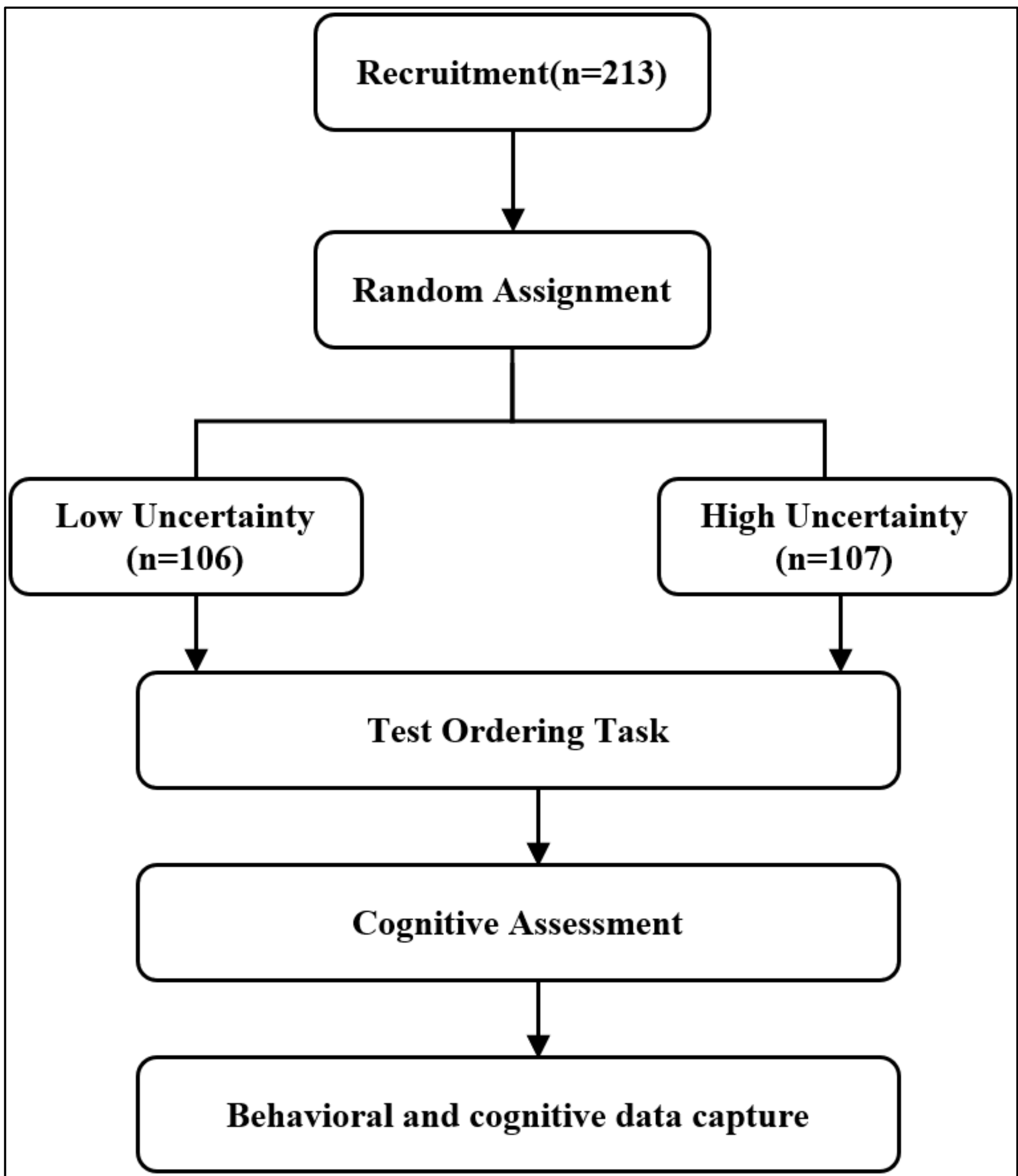
OBJECTIVES

This study examined the association between physician human capital and diagnostic test-ordering behavior, with particular attention to the mediating role of information-processing efficiency and the moderating effect of diagnostic uncertainty.

METHODS

A vignette-based behavioral experiment was conducted among 213 physicians from nine hospitals in China. Participants completed standardized clinical scenarios involving asthma and bronchiectasis, which varied in the level of diagnostic uncertainty. Diagnostic test-ordering decisions were assessed by the number of unnecessary tests ordered and the likelihood of ordering clinically necessary tests.

Study design and participants



Statistical analysis

Logistic regression analyses were performed to examine associations of physician human capital, information-processing efficiency. Mediation analysis was conducted using PROCESS Model 4 to test the mediating role of information-processing efficiency in the association between physician human capital and diagnostic test-ordering decisions. Moderated mediation was further examined using PROCESS Model 7

Results

Table1 Descriptive statistics of diagnostic test-ordering decisions

Category	Item	N	%
Ordering of Necessary Tests	Yes	151	70.89
	No	62	29.11
Number of Unnecessary Tests	0	24	11.27
	1	63	29.58
	2	75	35.21
	3	41	19.25
	4	10	4.69

Table2 Testing the mediating effect of information-processing efficiency

Variable	Information Processing Efficiency (OLS)		Number of Unnecessary Tests (Poisson Regression)		
	Model 1	Model2	Model 1	Model 2	Model 3
Guideline Awareness	0.039 (0.163)	-0.055 (0.148)	-0.051 (0.035)	-0.031 (0.030)	-0.032 (0.030)
Uncertainty Intolerance	0.025 (0.037)	0.040 (0.034)	0.019*** (0.008)	0.017*** (0.007)	0.018** (0.007)
Human Capital	-	1.004*** (0.147)	-	-0.204*** (0.029)	-0.164*** (0.031)
Information Processing Efficiency	-	-	-	-	-0.044*** (0.013)
R ²	0.013	0.196	-	-	-

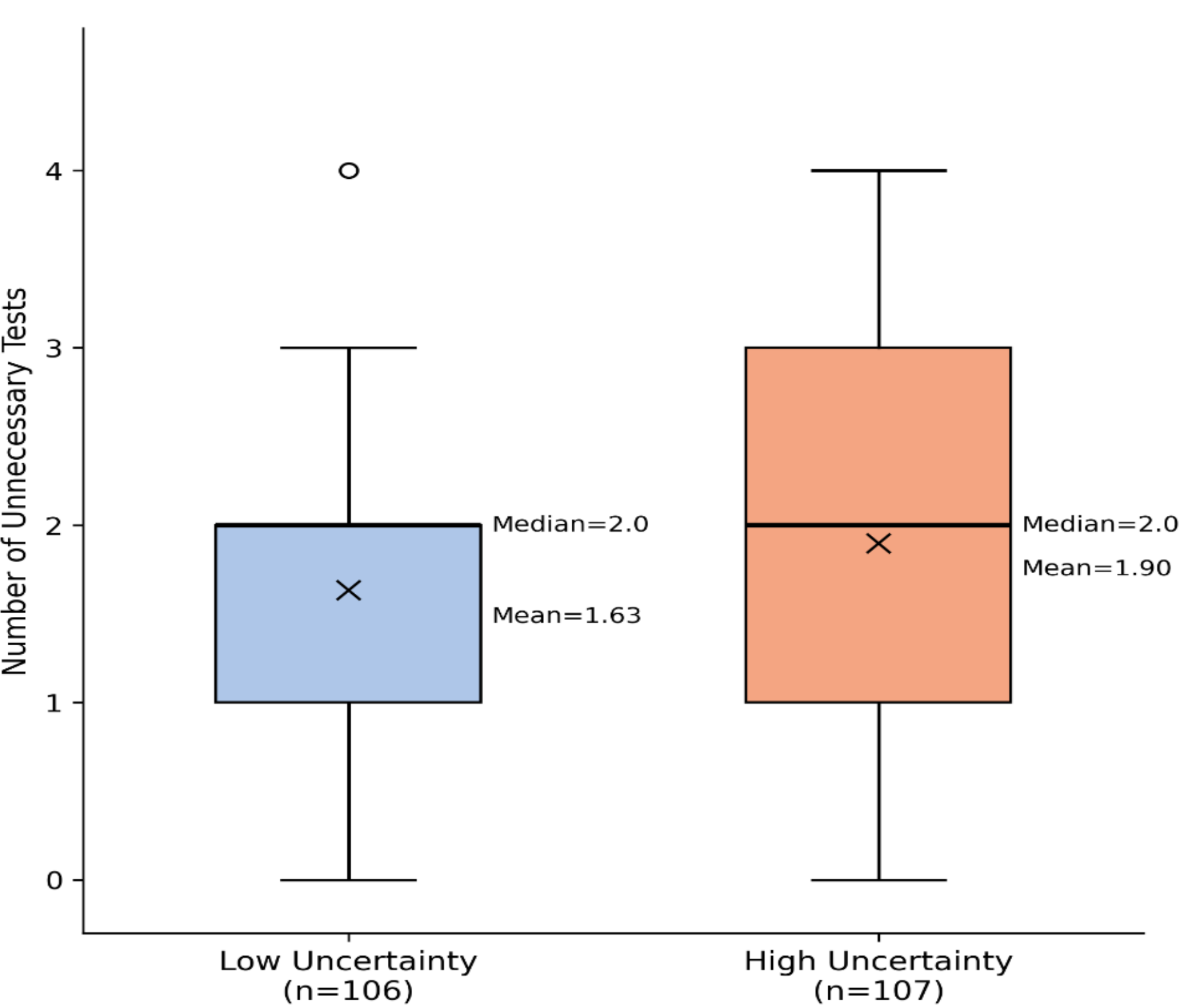


Fig1. Distribution of unnecessary diagnostic tests under different levels of diagnostic uncertainty

Table3 analysis of the moderating role of diagnostic uncertainty

Path/Condition	Number of Unnecessary Tests			Ordering of Necessary Tests		
	Effect	SE	95% CI	Effect	SE	95% CI
Mediating Effect						
Total Effect	-	0.050	[-0.457, 0.358]	-	-	-
Direct Effect	-	0.054	[-0.390, 0.282]	0.272	0.160	[-0.040, 0.585]
Indirect Effect	-	0.026	[-0.131, 0.075]	0.372	0.096	[0.231, 0.607]
Moderated Mediation Effect						
Low Uncertainty	-	0.031	[-0.157, -0.037]	0.472	0.119	[0.299, 0.768]
High Uncertainty	-	0.022	[-0.101, -0.013]	0.245	0.096	[0.100, 0.478]
Index of moderated indirect pathway	0.046	0.024	[0.007, 0.100]	-	0.115	[-0.492, -0.039]

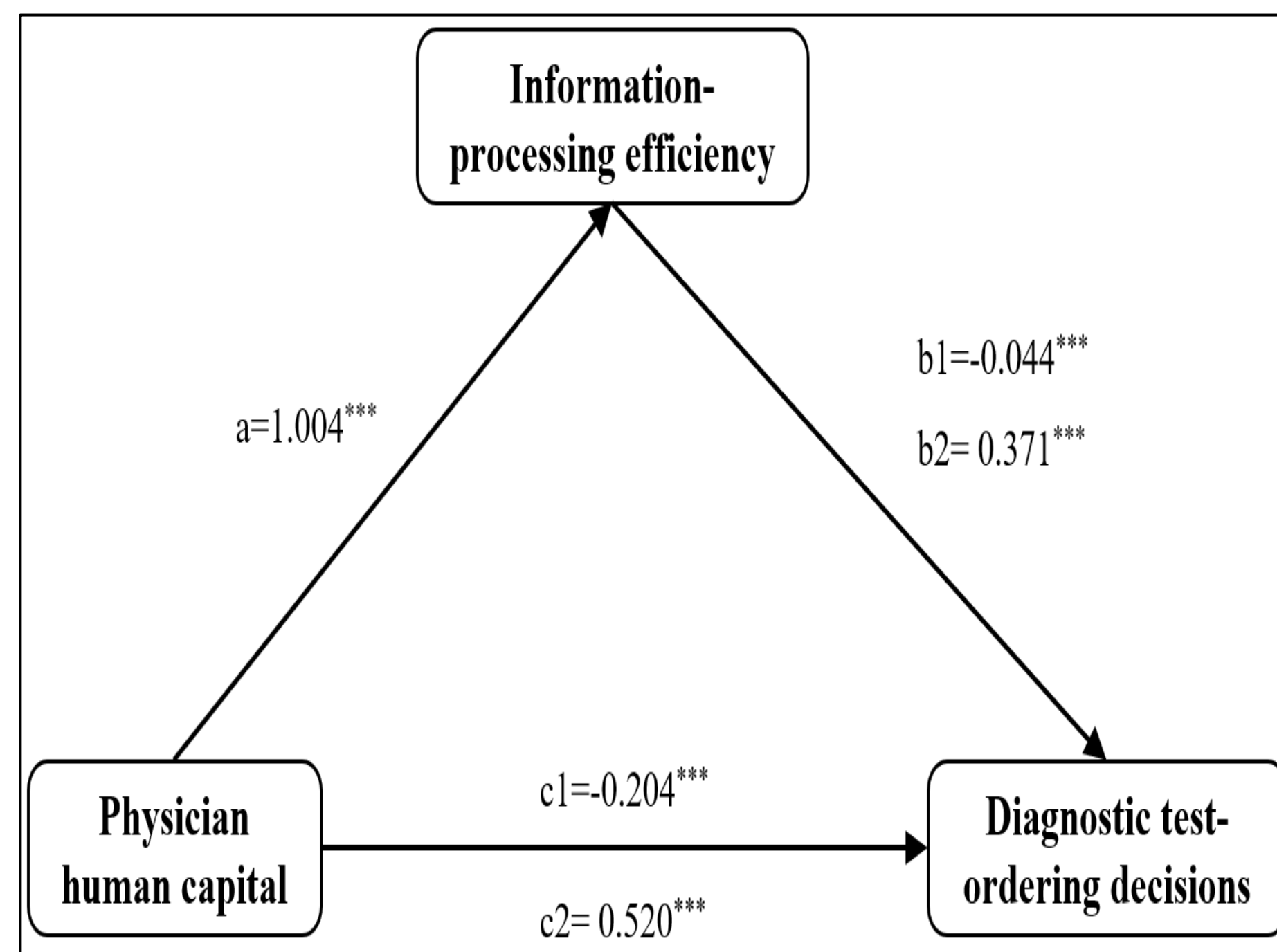


Fig2. Mediation model of information-processing efficiency

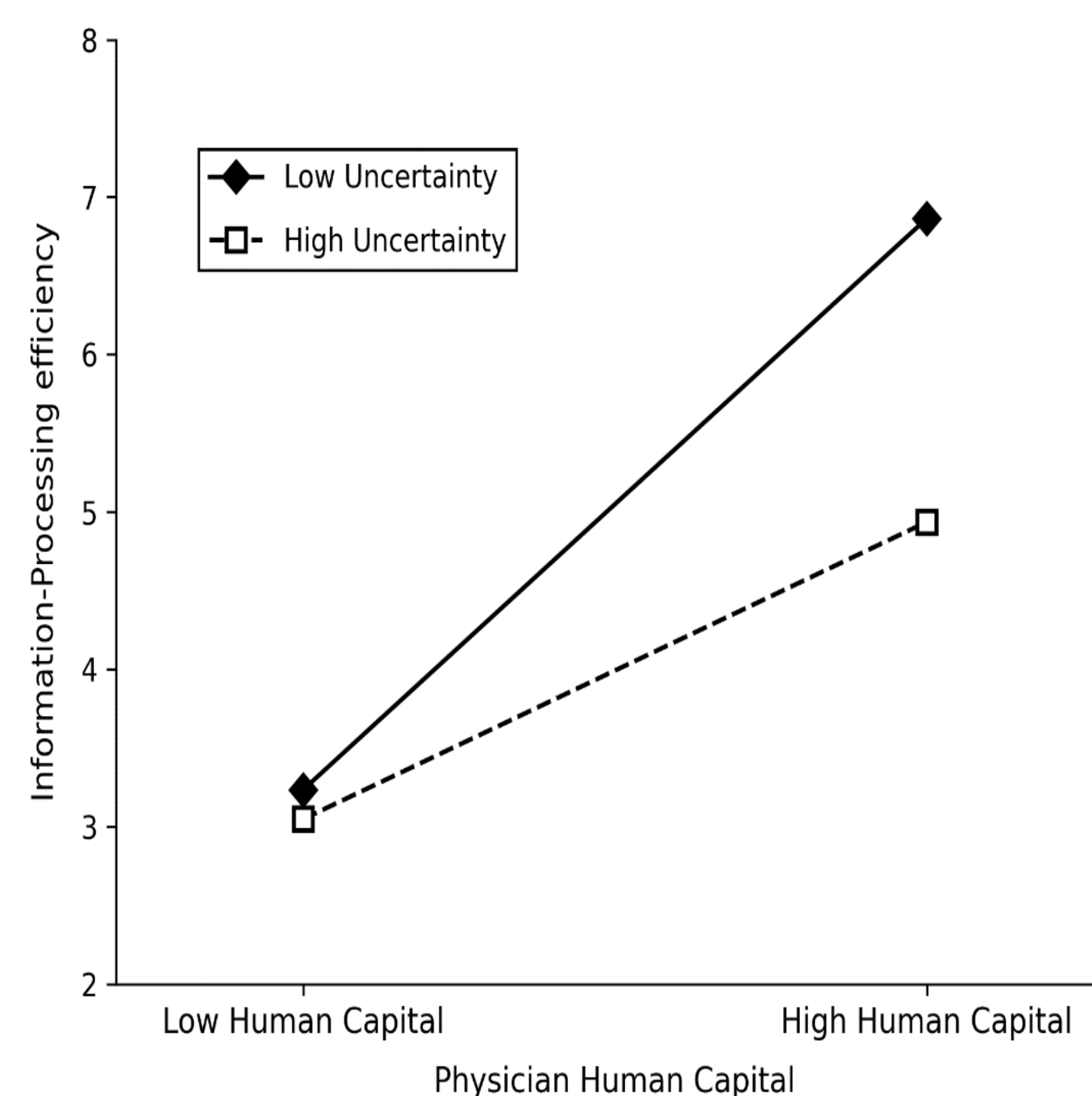


Fig3. Moderating effect of diagnostic uncertainty

Discussion & Conclusion

Principal findings and mechanism

Physician human capital was associated with fewer unnecessary tests and greater use of clinically necessary tests. Information-processing efficiency mediated these associations, while diagnostic uncertainty weakened the indirect effects..

Implications

The findings suggest that appropriate test ordering depends not only on physicians' knowledge and experience, but also on their ability to efficiently process clinical information under uncertainty. Strengthening diagnostic reasoning and providing targeted decision support may improve test-ordering appropriateness.

Limitations and conclusion

Vignette-based decisions and respiratory disease scenarios may limit real-world generalizability. Overall, physician human capital may promote appropriate test ordering through information-processing efficiency, although this cognitive advantage is constrained by diagnostic uncertainty.