Vol. 18, No. 31, Year 2025
ISSN: 2286-2102
E-ISSN:2286-2552

TRANSFORMATIONS OF MEDICAL PROFESSIONAL AUTHORITY IN THE AGE OF ARTIFICIAL INTELLIGENCE AND MEDICAL AUTOMATION: A PANEL ANALYSIS OF THE G20 HEALTHCARE SECTOR (2015–2022)

ABDERAHMANE DJERFI
University of Jijel, Algeria

DOI: 10.2478/eras-2025-0009

Abstract

This study explores the impact of artificial intelligence (AI) and automation technologies on the professional authority of physicians in G20 countries. By analyzing panel data from 2015 to 2022, the research investigates how the adoption of digital health infrastructure—measured through an ICT index—affects the average number of doctor visits per capita. The findings suggest a statistically significant negative relationship, indicating that as digital health tools become more prevalent, the traditional role and authority of physicians may shift. This transformation reflects broader changes in the doctor-patient relationship and raises sociological questions about trust, expertise, and control over medical knowledge. The study contributes to the sociology of professions by highlighting how technology can reshape established authority structures in healthcare systems.

Keywords

Artificial intelligence, medical automation, professional authority, G20 countries, health policies

Introduction

The provision of healthcare services across the world health systems has undergone a fundamental change in the last decades due to the fast development of technologies, especially in terms of artificial intelligence (AI) and medical automation. Such inventions have helped to increase the quality of services and health system performance. At the same time, however, they have also cast a doubt on the future of the professional expertise of physicians and the limits of technological interventions in medical choices (Jotterand & Bosco, 2022; National Academy of Medicine, 2022).

Professional authority refers to the capability of the physicians to monopolize medical knowledge, conditions of practice and finally influence health policy. This power is based on decades of schooling, knowledge and status in the society (Freidson, 2001). But this conventional framework is under the severe pressure given the advent of new technologies, including diagnostic algorithms such as clinical decision support systems and robotic surgical machines. Despite all the advantages, AI poses certain ethical responsibilities, the division of the labor between a human and a machine, and medical decision-making transparency (Davenport & Kalakota, 2019).

In this respect, G20 countries offer a perfect set of examples to analyze the changes in this scope because they have quite different health systems, different maturity of digitalization, and health expenditure levels.

The study is important because it examines the impact of various technological, economic, and social factors—such as the ICT index, AI readiness, health spending, GDP per capita, and the number of physicians—on indicators of physicians' professional authority. A drop in such indicator can indicate the loss of status of the physician as the central point of health decision making considering the growing trust to technology or self-care systems.

The literature reveals a persistent deficit in apples-to-apples quantitative analyses that jointly assess artificial intelligence (AI) integration and the long-term professional controlling power of physicians across diverse economic contexts such as the G20 (Grosser et al., 2025). Recent empirical work also highlights difficulties in establishing standardized, quantifiable indicators of professional authority within healthcare systems (Burden et al., 2024). Consequently, this study offers a bold attempt to formulate an alternative econometric specification that employs the density of doctor visits as a proxy for professional authority, supplemented by technological, economic, and health-system indicators (Nguyễn et al., 2025; Pendrith et al., 2022).

Moreover, recent evidence in the literature shows that there remains a substantial knowledge gap in studies focusing on the relationship between artificial intelligence (AI) and professional authority when using quantitative and analytical approaches, especially over longer periods (e.g., 2015–2022) and across diverse national contexts such as the G20 (Grosser et al., 2025; Choudhury et al., 2020; Funer & Wiesing, 2024; Burden et al., 2024). Most existing studies have addressed this issue through theoretical frameworks or case studies focused on individual countries or institutions, without macro-level empirical testing of explanatory models (Nguyễn et al., 2025; Ruan et al., 2023).

In this regard therefore, this study will fill this gap by developing econometric model to test the relationship between digital and health developments and transformations of medical professional authority through panel data of selected G20 countries between 2015 to 2022.

<u>Research Problem</u>

Although there is a wide range of studies regarding the connection between technology and medical practice (Topol, 2019; Banerjee et al., 2024; Witkowski et al., 2024), the majority of them address clinical or ethical aspects, whereas the structural effects of this connection on the medical profession—especially on professional authority—have been less well studied (Funer & Wiesing, 2024; Grosser et al., 2025). Additionally, the majority of these researches involve qualitative methods or are restricted to one particular nation without looking at both advanced and developing economies (Nguyen et al., 2025; Ruan et al., 2023).

The greatest question in this study is the following one:
How has digital transformation and artificial intelligence within the health sector impacted physician professional authority in G20 countries in the next three decades up to 2023?

<u>Sub-Questions</u>

1. How high is the G20 healthcare sector when it comes to AI and ICT adoption?
2. In what way is the utilization of AI connected to the per capita level of doctor visits to these countries?
3. Which economic and health-related factors (e.g. income, health expenditure, physician density, life expectancy) explain this effect?

DOI: 10.2478/eras-2025-0009

Study Objectives

1. To gauge the level of AI and automation effects on professional control of the physicians.
2. To bring out the importance of economics and demographic variables in explaining the correlation.
3. To add value to the small body of literature that is covered by the sociology of medical professions in the digital age.

Importance of the Study

The theoretical importance consists of closing a research gap in terms of the complicated connection between technology and professional control in the medical world. In practice, the survey can give policymakers clues to the possible effects that medical digitization can have on the nature of professional relationships in the health care field and further contribute to forming a policy balancing technological advancement and people-oriented care.

The present study informs both theory formulation and analytical improvement in understanding the impact of the digital revolution and AI to the medical profession. It gives empirical evidence to enlighten decision-makers in policymaking pertaining to health policies and medical education without lowering the stature of a physician that can amount to harming the value attached to technological transformation.

Literature Review

Recent decades saw significant change in the professional power of physicians due to extremely fast development of AI and the technologies of medical automation. Historically, the physicians have obtained their authority through specialized knowledge and the monopolies in the diagnosis and treatment (Freidson, 1970). To some degree, this power was restored to technology platforms and regulatory agencies by the implementation of AI systems in clinical diagnostics, medical imaging, and prediction algorithms.

Artificial intelligence as per the recent literature is transforming the connection between employment and power in various ways. To illustrate this, Abbott (1988), in case study of the theory of the system of professions, stated that technological threat is possible and it can make professions redefine their jurisdictions. AI-based solutions in the health sector revealed that they can now surpass the effectiveness of humans as diagnostic tools, and treatment facilities have to redefine traditional approaches and employ more collaborative systems in AI (Annas, 2018).

Sociological observations also suggest that the nature of such transformations is not only technical but it also presupposes institutional and cultural power change. Sharon (2022) has emphasized the power of AI in medicine: not only does it reduce the monopoly of the medical knowledge by the physicians, but also enables new surveillance and algorithmic transparency, implemented by the overseers (the designers and platforms). This is proportional to the idea of algorithmic authority as formulated by Kitchin (2017), when sometimes cases associated with decisions about treatment are made by AI-based tools, which restrict the discretionary power of the physician.

The redistribution of professional roles in healthcare increasingly stems from medical automation, including self-testing devices, remote monitoring systems, and surgical robots. As noted by Verghese et al. (2018), these technologies enhance efficiency by reducing human involvement in routine tasks but simultaneously challenge traditional clinical authority and diminish the humanistic dimension of care. In the AI era, professional authority must be understood through an integrated socio-technical lens, recognizing that decision-making power is now shared among practitioners, algorithms, and institutions (Topol, 2023; Jiang et al., 2023).

DOI: 10.2478/eras-2025-0009

Theoretical Frameworks

This study draws upon a multi-faceted theoretical framework to explain the relationship between AI adoption in healthcare and shifts in physicians' professional authority. Three main theories are employed:

Technological Modernization Theory

Developed in the aftermath of the works of Daniel Bells on the idea of the post-industrial society, the theory assumes that technological innovations specifically in ICT modify social and occupational lines (Bell, 1973). It is not uncommon in healthcare delivery to find that systems with high levels of readiness on AI reduce their dependence on conventional professional authority through automation of clinical decisions and dissemination of medical knowledge on widespread levels (Topol, 2019). This means the institutional and regulatory responses to assimilate AI have become ready to transition into a structural change that dilutes the monopolistic control of physicians in information and clinical expertise.

Sociotechnical Theory

This theory was developed by Eric Trist and other researchers at the Tavistock Institute in the 1950s and criticizes the occurrence of technological change without sufficient consideration of the social context in which this change is implemented. During the AI era, the level of the ICT Index in healthcare systems positively affects the adoption of intelligent care practices and automation, which further transforms professional roles and the balance of power between physicians and intelligent systems. This process leads to the decentralization and redistribution of professional power among algorithms, thereby diminishing the traditional singular control of physicians over medical decision-making (Trist & Bamforth, 1951; Mumford, 2006).

Professional Authority Theory

This theory, created by Eliot Freidson, underlines that professional authority equals the specialized knowledge and the self-regulation that provides the privilege of doctors in the society (Freidson, 1970). Nevertheless, this knowledge monopoly is called into question by the integration of AI into clinical practice, since smart systems that help diagnosing illnesses and prescriptions add a new player to clinical decision-making. Thereby, technological advancement undermines professional authority supported by the knowledge-based superiority.

Taken together, these three theories would help formulate an inclusive picture of the implication of AI adoption on the professional power of physicians, as the technology serves as a structuring tool that reorganizes both the social and professional systems and reallocates the power in healthcare establishments.

Hypotheses

The Technological Modernization Theory holds that the introduction of modern technologies into the institutions of the state (particularly, those related to professional work) causes the restructuring of traditional roles and rearrangement of authority (Bell, 1973; Castells, 2000). As the health field moves toward institutional preparedness to adopt AI, traditional jobs that used to only belong to physicians, including making diagnosis and clinical decisions, gradually move toward smart tools with algorithms behind them (Topol, 2019). According to the literature on empirical research, high AI readiness is a feature linked to legal and organizational systems that grant professional power to intelligent systems, diminishing the absolute control of physicians (WHO, 2021; Mittelstadt et al., 2016; Jotterand & Bosco, 2020).

H1: The higher level of national readiness to deal with AI corresponds to lesser professional control of physicians.

The Sociotechnical Theory suggests that technology is not separated and does not exist in a vacuum; although it interacts with the social and institutional contexts, which transforms professional and power relationships (Orlikowski, 1992; Bijker et al., 1987). An ICT Index that is high in a country implies the existence of a high digital infrastructure that enables the implementation of the smart and automated healthcare system.

Evidence reveals that extensive digitization processes (i.e., clinical information systems, electronic health records, telemedicine) limit individual power of physicians, who are no longer in charge of information flowing and choices on treatment options (Greenhalgh et al., 2009). Further, there is a massive digitization using which, performance can be monitored and the process of decision-making can be collectively done with data thereby reducing the discretionary power of the physicians as sole knowledge holders (Wears & Berg, 2005).

H2: An increase in ICT Index is related to reduced professional authority of the physicians.

Methodology

The panel data analysis cross-section was adopted because it helps in the simultaneous comparison of temporal and cross-sectional changes (among countries), thereby increasing the accuracy of findings and limiting statistical bias (Abderahmane & Mounir, 2023; Djerfi & Chaalal, 2023).

The paper centered on nine G20 economies - those of the United States, Canada, Germany, France, the United Kingdom, Australia, South Korea, Japan, and Italy, over the period ranging 2015 to 2022. Such countries were chosen because of the availability and revealing of the relevant indicators especially on AI readiness, health expenditure, as well as physician density. The credibility of the findings is high, because data was obtained as a result of reliable sources like the World Bank, the Oxford Insights AI Readiness Index and OECD, among others.

The panel data models were used to estimate the effect of the variables which included the use of AI (AI_USE), medical automation (MED_AUTOM), physician density (HUM_EXP) and health expenditure (GDP_HEALTH) on the dependent variable that is the professional medical authority (MED_AUTH). To ensure the best model selection, that is, fixed and random effects, statistical tests such as Hausman test were carried out to provide robust estimations and scientifically sound interpretations.

The mathematical formulation of the model in this paper is as indicated below:

$$MED\_AUTH_{it}=\beta_0+\beta_1 AI\_USE_{it}+\beta_2 MED\_AUTOM_{it}+\beta_3 HUM\_EXP_{it}+\beta_4 GDP\_HEALTH_{it}+\varepsilon_{it}$$

Where:

MED_AUTH_{it}: Index of Medical Professional Authority in country i and year t.
AI_USE_{it}: The intensity of the extent of artificial intelligence use in country i in year t.
MED_AUTOM_{it}: Medical Automation Index in country i at year t.
HUM_EXP_{it}: The rate of doctors per 1,000 population (country i in year t).
GDP_HEALTH_{it}: contribution to the GDP of *country* ii in year t.
E_{it}: The random error term.

In an academic format, the definition of each variable utilized in the study, its type, mode of measurement and the source of each, is detailed in the table below:

Variable Name	Variable Type	Measurement Method	Source
DOC_VISITS_PC (Doctor visits per capita)	Dependent	Average number of doctor visits per individual per year	World Health Organization (WHO)
ICT_INDEX (ICT Infrastructure Index)		Composite index including: number of internet subscriptions, international bandwidth, number of internet users, fixed and mobile line subscriptions; values range from 0 to 10	International Telecommunication Union (ITU)
AI_READINESS (AI Readiness of the State)	Independent	Composite index based on three dimensions: government, infrastructure, and sectors; measured on a scale from 0 to 100, where higher scores indicate greater readiness; analyzes data from over 30 sub-indicators such as: digital policy, R&D, skills, open data, cybersecurity, etc.	Oxford Insights – Government AI Readiness Index
GDP_PER_CAPITA (Gross Domestic Product per capita)		Measured in US dollars (market prices, real or nominal depending on the year)	World Bank
HEALTH_EXP_GDP% (Health expenditure as a percentage of GDP)	Control	Percentage of GDP allocated to health expenditure	World Health Organization (WHO)
HUM_EXP (Human capital – Physicians per 1,000 people)		Number of practicing physicians per 1,000 population	World Bank
LIFE_EXP (Life expectancy)		Average number of years an individual is expected to live from birth	World Bank

Table 1. Measurement of variables

Source: Prepared by the researcher based on WHO, ITU, Oxford Insights, World Bank.

Results and discussion

Descriptive Statistics

	Median	min	max	Std. Dev.	Skewness	kurtosis
DOC VISITS PC	7	3	14.000	3.721	.599	2.098
ICT INDEX	6.5	3	8.000	1.823	-.629	1.935
AI READINESS	85	35	85.000	18.689	-1.209	2.73
log GDP PER CAPITA	10.597	7.824	10.597	.972	-1.166	2.929
HEALTH EXP GDP	8	4	10.000	2.123	-.411	1.845
LIFE EXP	81	69	84.000	4.246	-1.119	3.462

Table 2. Descriptive Statistics Table

Source: Stata Output

The set of structural characteristics of care systems in G20 economies as in 2015-2022 are identified in the descriptive statistics presented in the table. There was a moderate utilization of healthcare services as the median amount of doctor visits per capita was 7 per year. The relatively large standard deviation (3.72) and positive skewness (0.599) however, show a considerable degree of variation across countries, where some countries registered visit rates way above the means. The ICT index, however, has negative skeweness (-.629) in data, implying that the majority of countries lie in the high digits of digital infrastructure, meaning that health technology absorption may be promoted. AI Readiness is also greatly skewed negatively (-1.209), and the highest value can be seen to be that of the median (85), demonstrating that many countries are very well prepared to adopt AI in the healthcare sector.

This is also affirmed by the variable of GDP per capita (logarithmically) that was defined by a high negative skewness (-1.166) and low standard deviation (0.972), showing that the countries landed in the bracket of high income. Measures of health spending as a percentage of GDP (median = 8%) and life expectancy (median = 81 years) also point at the fact that health systems perform better. It is also observed that a majority of the variables depict low kurtosis (below 3), i.e. the values do not function to be large outliers (Djerfi & Chaalal, 2025). All these data signify the high technological preparedness, the convergence of health investing, and a high level of health outcomes, hence a fitting situation to discuss the effects of artificial intelligence and medical automation adoption on the changing balance of power in professional workforce in contemporary health systems.

Statistical Analysis and Interpretation of Results

DOC_VISITS_PC	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
ICT_INDEX	-2.429	.696	-3.49	.001	-3.819	-1.04	***
AI_READINESS	.291	.08	3.66	.001	.132	.45	***
GDP_PER_CAPITA	0	0	3.61	.001	0	.001	***
HEALTH_EXP_GDP	-2.83	.541	-5.23	0	-3.91	-1.75	***
LIFE_EXP	.281	.208	1.35	.182	-.135	.697	
Constant	-9.509	14.627	-0.65	.518	-38.712	19.695	

Mean dependent var	7.111	SD dependent var	3.721
R-squared	0.630	Number of obs	72
F-test	22.498	Prob > F	0.000
Akaike crit. (AIC)	332.909	Bayesian crit. (BIC)	346.569

**** p<.01, ** p<.05, * p<.1*

Table 3. Regression Table

Source: Stata Output

This study used the Ordinary least squares (OLS) model because it is efficient and gives unbiased estimates, which is the Gauss-Markov theorem with regard to the classical linear regression assumptions. Diagnostic tests, including checks for multicollinearity and homoscedasticity, confirmed the absence of significant violations, reinforcing the appropriateness of OLS for analyzing.

The findings of the regression model reveal the evident shift in the effects of the expository variables on the number of doctor visits per capita, which concurs with the high level of intricacy of the relationship between technological infrastructure, digital readiness, economic and health considerations on the one hand, and healthcare utilization behaviors on the other. Artificial Intelligence Readiness (AI_READINESS) positively and significantly contributed, implying that higher readiness to adopt AI is not associated with reduced authority of physicians

DOI: 10.2478/eras-2025-0009

as proposed in H1, but potentially will lead to more efficient health systems and medical care demand. On the other hand, Information and Communication Technology Index (ICT_INDEX) produced a negative significant difference, which means that more sophisticated ICT infrastructure could allow digital option to the more conventional care that will limit face to face visit to the doctors.

Gross Domestic Product per Capita (GDP_PER_CAPITA) had a positive relationship with the number of doctor visits implying that countries that are richer have more capacity to be able to access and make use of health services. Conversely, the proportion of Health Expenditure Percent of GDP (HEALTH_EXP_GDP) showed an enormous negative impact, which may indicate a tendency toward preventive care or allocation efficiency in those kinds of systems. Lastly, Life Expectancy (LIFE_EXP) was not found to have significant relationship, which implies further study in appreciating its influences on healthcare utilization. All in all, the results indicate that the interaction between AI and healthcare behavior is multidimensional and therefore, future studies need to employ more sophisticated models to analyze the situation.

Conclusions

According to the results of this research, the ties between the use of artificial intelligence (AI) and professional control by physicians are not simple and linear, but are defined by the sophisticated interactions of technological, economic, and social aspects. Unlike the first hypothesis, the effect of AI readiness was statistically significant and positive on the number of doctor visits per capita indicating that the emergence of AI might not slow down the demand of the old ways of medical care services, but might improve the efficiency of the given healthcare system. Conversely, the Information and Communication Technology (ICT) Index exhibited a substantial adverse impact, but it could be because of the increased dependence on digital replacements like telemedicine, thus changing conventional methods of interaction among the physicians and the patients.

A sociological interpretation of these findings would be that it shows a reconfiguration of professional authority but not its loss. The doctor ceased to be the only source of decisions in the clinical process and is now incorporated into a more extensive system involving AI tools, digital platforms, and algorithmic decision-making. The shift does not destroy the professional authority it changes it within the new frameworks of technologies and institutions that necessitate adjustable digital and interpersonal skills. Also, the results indicate that the prevalence of structural inequalities, the income and a healthcare spending play a very crucial role in determining the access and use of health care services echoing the unity of engaging the power of the physician into the framework of the socioeconomic and cultural conditions.

Study Recommendations

According to the findings of this study, it is possible to suggest the following recommendations:

• Expand Measurement Indicators: Qualitative measures of greater relevance to physicians in terms of their professional control over practice and judgment should be added into the future research such as patient/professional satisfaction, level of AI integration into the decision process, and autonomy to make decisions in the future.

• Employ Multi-Level Analytical Models: It is advisable to adopt mixed-method, that is quantitative models and qualitative field research like interviews or a case study analysis in form of an ethnography study should be adopted to address the social phenomenon altering the medical practice.

• Research Cultural and Institutional Context: Different countries have different norms and health system organizations that need to be considered when comparing how different countries will adopt AI and the changing discipline of physicians in various countries.

• Consider Ethical and Professional Aspects: One should pay more attention to the ethical aspects of AI in medical care- specifically the issue with privacy, accountability, and technological impact on the human connection between a doctor and a patient.

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