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Impact of macroeconomic factors on inclusiveness in outpatient service use in Vietnam in the period 2008-2022

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Abstract: This study analyzes the impact of factors on the inclusiveness of outpatient service use in Vietnam from 2008 to 2022 based on data from 63 provinces and cities nationwide. The study applies the social opportunity function method to measure the level of inclusiveness in health service use in Vietnam and analyzes the impact of economic factors, macroeconomic policies, and public spending based on provincial data. Using fixed effects, random effects, and FGLS (Feasible Generalized Least Squares) estimation methods, the study considers economic, social, and health policy factors to assess their influence on people's access to and use of health services. The study results indicate that factors such as inclusive growth, health budgets, and appropriate allocation of health resources play an important role in expanding and improving access to health services, especially outpatient services. However, the study also found that current health support policies have not been as effective as expected, possibly due to lack of coordination between government levels or failure to meet the actual needs of the people.

Keywords: *Access to healthcare services, healthcare inequality, healthcare resource allocation, healthcare system, inclusivity index, public healthcare expenditure, socio-economic factors.*

1. Introduction

Inclusiveness in health is a key element in ensuring that all people, regardless of socioeconomic class, geographic location, or personal circumstances, can access and benefit from essential health services. Inclusiveness thereby contributes to promoting equity, reducing healthcare inequalities, and preventing financial burdens that can lead to "health poverty traps" [1]. The need for inclusiveness is further emphasized in the context of many low- and middle-income countries struggling to achieve universal health coverage (UHC). Although efforts to improve health policies, increase health insurance coverage, and provide financial support to the poor have shown positive signs, there are still many challenges in ensuring that all people have equal and timely access to health services [2, 3].

Globally, reports from the World Health Organization (WHO) and the World Bank show that nearly half of the world's population 3.5 billion people do not have access to basic health services when they need them [2]. More worryingly, each year, about 100 million people fall into extreme poverty due to the cost of treatment and health care. Many families are forced to choose between paying for health care and other essential needs such as food, education, or housing, thereby increasing the likelihood of developing diseases due to lack of regular medical check-ups. This negative interaction creates a vicious cycle of disease and poverty, leaving the poor even more disadvantaged and vulnerable [1].

In Vietnam, the goal of universal health coverage has been specified by the government through many policies, including expanding health insurance coverage, investing in building health infrastructure, training, and allocating health workers to disadvantaged areas. As a low-middle-income country (LMIC), Vietnam has achieved certain milestones: health insurance coverage has increased significantly, the

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system of district and commune health facilities has been strengthened; at the same time, a number of programs to support the poor, children under 6 years old, and ethnic minorities have also been implemented. However, inequality in access to health services still exists, clearly demonstrated by the differences between regions, between rich and poor groups, as well as between ethnic minorities and the Kinh [4]. In many cases, poor or near-poor households still face financial and geographical barriers when needing health care, leading to missing the "best treatment" time, reducing treatment effectiveness, and increasing the risk of complications.

One of the core causes of this disparity stems from the uneven distribution of health resources, including facilities, medical equipment, and medical staff. Additionally, limitations in transportation infrastructure in remote areas prolong travel time to health facilities, increasing opportunity costs, especially for the poor. Furthermore, health care awareness, language barriers, and cultural and psychological factors also influence the decision to use health services. Vulnerable groups such as poor households, the elderly, and ethnic minorities often face greater difficulties in accessing subsidized programs, insurance, or free medical care. Addressing these issues requires a coordinated approach that focuses on both coverage and equity in the distribution of health services [5].

Academically, research on inclusiveness in health service utilization has typically focused on two main dimensions. The first is coverage, which reflects the extent to which health services are accessible to the widest possible population [6-9]. The second is equity, particularly horizontal equity, which emphasizes the distribution of service opportunities that are not influenced by income status, social status, or geographic location [5]. In Vietnam, some empirical works [4] initially analyzed separately the coverage or inequality aspects in health access. However, integrating these two aspects into a composite "inclusion" index, thereby providing a more comprehensive picture, is still a new and less deeply studied concern.

Therefore, measuring the inclusiveness of health care services and exploring the influencing factors including macroeconomic factors, public policies, and social conditions will provide useful scientific evidence for planners. The analysis results help identify which groups of people are being "left behind," which are the main barriers to health care service use, as well as the effectiveness of support programs [5]. More importantly, this information can lead to systemic policy recommendations, creating the foundation for the process of building a health system that is both universally covered and equitable in resource distribution.

Using provincial-level data from approximately 2008 to 2022, the study aims to analyze the impact of policy factors, socio-economic conditions, and health resources on the inclusiveness of health care services. We chose outpatient services as the research object because this is one of the important health services, reflecting the level of access to primary health care of the population. This service can be influenced by many factors such as health insurance policies, people's ability to pay, the distribution of health facilities, and the quality of services provided. Additionally, from an economic perspective, outpatient services can have the characteristics of both private goods because they can apply user fees, and public goods when the government supports costs through health insurance to ensure wide access for the entire population. Therefore, studying outpatient services helps clarify the level of coverage of health policies as well as equity in health care. The approach from a macro and policy perspective promises to provide a more comprehensive view, complementing studies at the household and individual levels, which are quite common but often lack correlation with the overall policy context. In the period when Vietnam continues to integrate into the international economy and faces many changes, the findings from this study are expected to contribute significantly to the process of developing a sustainable health strategy, aiming at inclusion and ensuring that no one is left behind.

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2. Overview of Research on Factors Affecting Inclusiveness In Health Service Use

2.1. The concept of inclusiveness in the use of health services

Inclusiveness in health derives from the concept of "inclusive growth," which emphasizes that all individuals, including disadvantaged groups, have the opportunity to access and utilize appropriate health services. In the WHO report on people with disabilities, the concept of "inclusive health" was introduced, indicating that health systems must be effective, equitable, and affordable for everyone including people with disabilities and the poor to access. This view is reinforced by Yeravdekar et al. [10], who argued that "inclusiveness" is about expanding health care opportunities to the entire population, even when the number is up to billions of people like in India. To realize this goal, not only basic health services but also, if possible, secondary health services should be widely provided.

The African Development Bank report [11] shows that health inclusion can be assessed through three pillars: quantity (scale of services), quality (ensuring effective and sustainable treatment) and accessibility (services reach all people, especially vulnerable groups). A similar research direction is also supported by Hashemi et al. [12], emphasizing ensuring non-discriminatory access to health services, contributing to improving the quality of life and increasing the participation of vulnerable groups in the community. From a policy perspective, it is pointed out that ensuring the availability of public services and improving social welfare are at the core of "inclusiveness" in health, especially in challenging regions such as sub-Saharan Africa.

Inclusiveness in health care can thus be understood as the fact that all people regardless of income, social status, or geographical location have access to and benefit from health services that meet their needs, in an equitable manner. At the same time, inclusiveness prioritizes protecting vulnerable groups, helping them receive timely care at reasonable costs. This approach requires a health system that focuses on equity, the ability to meet diverse needs, as well as preventing financial consequences from illness.

2.2. Studies On Inclusiveness in Access to Health Services

Although the concept of "inclusive growth" has been widely discussed, defining "inclusiveness" by sector, especially in the health sector, is still relatively new [11]. Most of the current research focuses on measuring the level of equity, diversity, and coverage of health services for all. Some works point out that insufficient public spending on health leads to a "health poverty trap," in which the poor have difficulty escaping the vicious cycle of illness and poverty [1] also emphasize the role of social welfare, life expectancy, education, and income in measuring human development. However, aggregate measures such as HDI or IDI sometimes do not specifically reflect a public policy area, typically health [10].

In terms of practical implementation, Yeravdekar et al. [10] argued that to achieve "inclusive health care," countries should prioritize providing health infrastructure, improving sanitation, clean water, and especially investing in primary health care. This requirement is also illustrated by the research of Sandholdt et al. [13] emphasizing that "human-centered" design can improve the experience and quality of life for older adults, thereby enhancing the inclusiveness of health services. In addition, Enders et al. [14] noted that inequalities related to racism and discrimination create significant barriers to diversity and equity in health care access.

In sub-Saharan Africa, a case study by Kociemska and Cichon [15] calculated an "Inclusive Health Index (IHI)" based on data from 47 countries. Contrary to popular belief, health expenditure or government quality do not always significantly influence the level of inclusiveness. Instead, policies that emphasize access to services for all, along with stratification according to specific needs of each group, play an important role. Overall, most research on this topic remains limited, especially when it comes to comprehensively identifying the factors that influence "inclusiveness" in health.

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2.3. Factors Affecting Access to Health Services

Healthcare accessibility is considered an important factor for public health, affecting the efficiency and sustainability of the health system. Researchers often rely on the behavioral theory model of Aday and Andersen [16], which has been developed through many versions [17]. This model emphasizes three groups of factors: (1) demographic & social factors, (2) enabling factors such as income, insurance, health infrastructure, and (3) needs factors, including health status and personal perception. The idea of "access as use" [16] suggests that the actual level of health service use reflects the ability to access. Later studies, Penchansky and Thomas [18], extended to the macro level, addressing the political, economic, and cultural environment and the role of policy.

From the supply side, variables such as the number of hospital beds, medical facilities, geographical barriers, and medical human resources (doctors, nurses) are identified as important factors. Wang and Luo [19] and Wing and Reynolds [20] emphasize the role of "demand factors" (actual health), "medical resources" (availability of hospital beds, facilities, doctors), and "geographic barriers" (distance, transportation infrastructure). For example, equitable distribution of medical resources between poor and non-poor areas helps reduce inequality [21]. In addition, socio-economic factors such as growth rate, employment opportunities, or market prices also influence the decision to use medical services [8].

Health financing is another area that has received considerable attention. Drabo and Ebeke [22] found that remittances, health aid, and public spending are all important for access in developing countries. However, Berthélemy and Seban [23] did not find convincing evidence of the decisive role of public spending on health, partly because the endogeneity of public spending was not fully addressed. Similarly, research in Africa [24] highlighted the fact that public spending tends to favor high-income groups, leaving the poor less benefited, thereby affecting inclusiveness.

2.4. Studies On Inequality in the Use of Health Services

The theoretical framework of Peters et al. [25] studies the relationship between poverty and equity in access to health services, focusing on four criteria: geographic accessibility, availability, affordability, and user acceptance. Each criterion is influenced by supply (service availability) and demand (affordability, culture, psychology) factors. In fact, income inequality or socio-economic factors are the main drivers of disparities in health care utilization [26, 27].

At the household level, factors such as income, educational status, employment status, insurance coverage, or place of residence (urban-rural) decisively influence access to services [25, 28]. Although government support in the form of subsidies or public spending is expected to reduce inequality, research still shows that the allocation of health resources can favor the rich [29-31]. However, some positive evidence [32, 33] shows that appropriate public finance policies can improve access for the poor, especially to primary health care and maternal and child care.

Many analyses of health care inequality focus on income distribution as a key factor [34, 35]. High income facilitates access to private services, specialist services, or areas with modern health facilities, while the poor often face cost barriers, lack of insurance, or live in areas with poor infrastructure [36]. In addition, health needs [37] are considered more rational in directing resources. That is, in theory, the health system should allocate more to groups with high needs; however, this is not always the case due to financial and policy constraints.

3. Factors Determining Inclusiveness in Access to Health Services

Inclusiveness in access to health services is governed by many factors on both the supply and demand sides of the health system. Based on two main theoretical frameworks, the health service utilization behavior model of Aday and Andersen [16] and the research framework on health inequality of Peters et al. [25], along with related experiments, it can be seen that ensuring inclusiveness requires the

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simultaneous consideration of socio-economic characteristics, health policies, as well as the quality and distribution of health resources.

3.1. Theoretical Framework Integration

The health service utilization behavior model of Aday and Andersen [16] classifies the decision to use health services into three groups: (i) predisposing factors such as demographics and awareness; (ii) enabling factors, including finance, insurance, facilities, and policies; (iii) need factors, reflecting health status as well as the necessity of medical examination and treatment. In the context of research on inclusiveness, the group of supporting factors is often focused on more because they regulate the actual accessibility of people, especially vulnerable groups [16].

Complementing the above approach, Peters et al. [25] emphasized four important aspects: (i) affordability, (ii) availability of health services, (iii) policy factors, and (iv) macro-environmental factors. These are all factors that can facilitate or become barriers to equity in health access. In reality, many poor or remote populations do not have access to services because of high costs or inadequate health facilities [38, 39].

By integrating both theoretical frameworks, the study can better address aspects related to service use decisions (individual and household perspectives) and health inequality issues at the macro level (resource allocation and national policy perspectives). From there, a comprehensive solution can be proposed to improve inclusiveness.

3.2. Impact of Socio-Economic Factors

3.2.1. Income and Inequality

Income inequality is considered one of the leading causes of inequality in access to health services [40, 41]. When income is low, households are more vulnerable to health care costs, especially out-of-pocket (OOP) costs, which can lead to "catastrophic health spending" and push households into poverty. Research by Bonfrer et al. [42] in 18 sub-Saharan African countries found that income was the most important factor leading to inequality in access to health care services in the majority of the sample.

3.2.2. Poverty and Accessibility

Many studies confirm that the poverty rate has a significant impact on the ability to access health services. Poor households are often hesitant or lack sufficient resources to seek medical treatment, despite support policies [43]. Although implementing health insurance support for the poor, many non-financial barriers such as travel costs, time off work, and service quality also make them less accessible to health facilities [43].

3.2.3. Urbanization and Population Density

Urbanization can promote investment in health infrastructure, thereby improving accessibility [44]. Urban areas often have a high density of doctors and health facilities, and a wide range of services. However, rural and mountainous areas lack transport infrastructure, medical equipment, and specialists [26]. This makes the gap between rich and poor areas become more serious; people have to travel long distances or incur high costs for medical examinations and treatment [39, 43].

3.2.4. Education and Employment

Education level is associated with health awareness and health-seeking behavior [45]. People with higher education tend to be proactive in disease prevention and treatment, and are more likely to participate in health insurance [36]. Employment opportunities, especially formal employment, also affect access to health care: workers with stable contracts often enjoy insurance from their employers, reducing

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the financial burden [46]. In contrast, self-employed or informal workers are at higher risk of health care costs.

3.3. Impact of Health Policy and Public Spending

3.3.1. Health Insurance and Financial Support

Universal Health Coverage (UHC) is an important tool for reducing financial barriers to healthcare access [47, 48]. In Vietnam, despite increasing health insurance coverage, overcrowding at upper-level hospitals and uneven quality of lower-level services still make it difficult for low-income people [43].

3.3.2. Public Spending on Health

Public investment in health systems is expected to increase inclusiveness, especially for disadvantaged groups [30, 49]. In theory, increased public spending can expand basic health services, improve infrastructure and human resources, and reduce costs for the poor [50]. However, many studies have shown that the unreasonable allocation of public spending leads to benefits skewed towards the better-off [24, 51]. When the majority of the budget is spent on higher-level hospitals or expensive techniques, the poor at lower levels benefit less. Roemer and Trannoy [52] emphasize that public health spending often does not reach the groups that really need it due to management problems and lack of distributional equity.

In addition, some studies confirm the positive effects of public spending if it focuses on basic services and preventive health care. Sandholdt et al. [13] found that investing in primary health care can narrow the gap between rich and poor. In addition, combining public spending with health subsidies or universal health insurance can increase equity and accessibility [25].

3.4. Provision of Medical Services

The provision of health resources includes facilities, equipment, medicines and health workers World Health Organization [53] and Zhou et al. [9]. Castel et al. [43] pointed out that reducing the disparity in resource allocation between poor and non-poor areas is a key condition for narrowing inequality. However, a common shortcoming is the "over-concentration" in urban areas, leading to a lack of doctors and equipment in remote areas [10, 54]. Many low-income people have to travel long distances, wasting time and travel costs, sometimes giving up or delaying medical examination and treatment [15].

In addition, when primary health care facilities lack quality services, patients are forced to go to higher levels or choose the private sector, where costs are often high [43]. This situation exacerbates inequality, as the rich have easy access to expensive services, while the poor face financial barriers. To promote inclusiveness, rational distribution of health facilities, improving quality, and developing community health networks are important directions [55].

3.5. Proposed Research Framework

Based on theoretical and empirical foundations, this study develops an analytical framework for factors affecting the inclusiveness of access to health services in Vietnam. The focus is on socio-economic factors (income, poverty, urbanization, education, employment) combined with health policies (insurance, public spending) and supply capacity (allocation of facilities, health human resources). These factors interact with each other, creating an overall picture of the level of access to health services, especially for groups that are vulnerable to being left behind.

Accordingly, the proposed research model focuses on testing:
i. The impact of income, poverty, and socio-economic conditions on the ability to use health services.
ii. Whether health insurance policies and public spending reduce financial barriers and narrow inequality gaps.

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iii. How supply capacity (facilities, human resources) creates conditions to improve quality and coverage for all population groups.

Theoretical and empirical studies have shown the important role of socio-economic factors such as income, poverty, urbanization, and education, along with health policy, public expenditure, and provision capacity in determining the inclusiveness of health services. In developing countries, financial constraints and resource allocation are often the biggest barriers, while the effectiveness of health policies depends largely on the ability to manage and adjust to local needs. The design of the integrated research framework based on the models of Aday and Andersen [16] and Peters et al. [25] allows for a deeper identification of both micro factors (needs, household financial capacity) and macro factors (policies, expenditure, resource allocation). Thereby, the research results can provide useful evidence for policymakers to expand coverage while ensuring equitable distribution of health services for everyone, especially vulnerable groups.

4. Research methods

4.1. Research model

Based on previous empirical studies, the authors have developed a research framework to assess the impact of factors on inclusiveness in health service use in Vietnam. The proposed research model is as follows:

The overall regression model has the following form:

$$Y_{it} = \alpha_{it} + \beta_{it} X_{it} + u_{it} \quad (1)$$

In there:

Dependent variable (Y): Outpatient service coverage index. The study applied the social opportunity function method to calculate the coverage index in health service utilization across provinces (i) and each survey year (t).

Independent variable group X: Set of factors affecting the comprehensiveness of outpatient service use, including three groups of factors: socio-economic factors, health financing, and health service provision.

α:is the blocking coefficient

β: estimated regression coefficient

u: is the noise part of the model

i, t: are the indices for province i and year t, respectively.

4.2. Research Data

The data analyzed in this study is panel data, covering 63 provinces and cities nationwide from 2008 to 2022.

The study employs a set of dependent variables representing the inclusiveness of health service use, including the opportunity index for outpatient services. These indexes are derived from the Vietnam Household Living Standards Survey (VHLSS) dataset, conducted biennially in even-numbered years by the General Statistics Office of Vietnam (GSO). The measurement of the inclusiveness index follows the social opportunity function methodology. The index is calculated for each province from 2008 to 2022. However, since the survey occurs only every two years, the temporal observation is limited, which may pose challenges in monitoring and analyzing long-term trends. To address this, the study calculates the inclusive index over an 8-year span from 2008 to 2022, covering all 63 provinces and cities nationwide.

The group of independent variables includes:

(1) Socio-economic factors: (i) income inclusion index *(ystarTN_01)*, is calculated based on the social mobility function method of Anand et al. [56] using the VHLSS dataset, this method is similar to the social opportunity function method, in which the average income is also converted to the actual value compared in 2010. Then, the study performed Min-Max standardization to the same scale as the

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dependent variable. (ii) The poverty rate (hn) is calculated as the ratio of the number of poor households to the total population of the province; (iii) The population density index, taking the logarithm (lnmdds), is calculated as the ratio between the total population and the area by province. These two indexes are taken from the General Statistics Office. (iv) The educational opportunity index (*ystargiaoduc*) reflects the educational level of the people; (v) The employment opportunity index (*ystarVieclam*) reflects the opportunity to access employment. These two indexes are both calculated from the VHLSS dataset and are based on the social opportunity function method.

(2) *Health policy:* Includes the following variables: (i) the health insurance access opportunity index *(ystarBHYT)* reflects the coverage level as well as the equity in accessing health insurance. This index is calculated based on the social opportunity function method of Ali and Son [57] based on the VHLSS dataset, in which the access opportunity is coded as 1 if the person has health insurance for 12 months, and 0 otherwise. (ii) Percentage of poor households supported to buy free health insurance; supported to free medical examination and treatment. To reduce multicollinearity, the study uses the PCA method to extract factors and standardize the index using the Min-Max method. (iii) Public expenditure on health *(ln(TongCNS))*. This index is calculated based on actual values compared to the base year 2010 and taking the logarithm, based on actual expenditure data publicly available on the Ministry of Finance portal and on the statistical yearbooks of provinces and cities from 2008-2022.

(3) *Health service provision:* Study to calculate *health resource allocation index* (HRDI) based on data sourced from the General Statistics Office. Using the density index method to calculate each component of the resource, including the number of doctors, hospital beds, and medical facilities, to measure the level of medical resource allocation. Next, applying the PCA method to extract factors to address the phenomenon of multicollinearity, which occurs due to the high linear correlation among variables such as doctors, hospital beds, and medical facilities. The index is then standardized using the Min-Max method.

Details of variable names and collection sources are presented in Table 1.

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Table 1.
Description of study variables.

Variable group	Symbol	Variable	Description and units of measurement	Source	Expected sign.
Dependent variable					
	ystarngoaitru	Outpatient service utilization coverage index	Social opportunity function method to calculate the opportunity index of outpatient service use by province, from 2008 to 2022.	VHLSS	
Independent variable					
Social economics	ystarTN_01	Standardized Income Inclusion Index	The social mobility function method calculates the income inclusion index for each year from 2008 to 2022, then normalizes the index using the Min-Max method.	VHLSS	+
	hn	Poverty rate by locality	Poverty rate/provincial population	General Statistics Office	-
	lnmdds	Population density	Total population divided by total area, with the unit People/km². Take the logarithm to standardize the data to the same scale.	General Statistics Office	-
	ystareducation	Access to education index	Social opportunity function method, calculating education access opportunity index by province in the period 2008-2022.	General Statistics Office	+
	ystarvieclam	Employment Opportunity Index	Social opportunity function method, calculating employment access opportunity index by province in the period 2008-2022.	TCTK	+
Health Finance	ln(TotalCNS)	Total health budget expenditure	Total local health budget expenditure, logarithm	Provincial statistical yearbook	+
	ystarBHYT	Health insurance coverage index	The social opportunity function method calculates the health insurance access opportunity index, which is computed by province from 2008 to 2022.	VHLSS	+
	Health care system	Medical support policy	Rate of poor households supported to buy free health insurance; rate of poor households supported to buy free medical examination and treatment / total number of households in the province. Next, use the PCA method to extract factors and standardize the index using the Min-Max method.	VHLSS	+
Medical resources	HRDI	Health resource density index	Use the density index method to calculate each resource component, including the number of doctors, hospital beds, and the number of medical facilities. Next, apply the PCA method to extract factors and standardize the index using the Min-Max method.	Health statistical yearbook	+

Source: Compiled documents of the author group.

4.3. Describe the Method of Calculating the Indices

4.3.1. Coverage Index

To measure the coverage index of health service use, the study employs the social opportunity function method. Accordingly, the coverage index is assessed through two aspects: (i) coverage, which reflects the expansion of access to health services on average for the entire population, and (ii) equity, which indicates the fair distribution of service use opportunities for all, especially disadvantaged groups. The social opportunity function shares the same concept as the social welfare function, assigning greater

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weight to the poor group. This weighting mechanism ensures that opportunities created for the poor are more significant than those for the rich. Specifically, if the opportunities enjoyed by one person are transferred to a poorer individual in society, the social opportunity function increases, thereby raising the coverage index. The access opportunity indices are calculated by iterating through provinces year by year, based on data from the Vietnam Household Living Standards Survey (VHLSS).

The formula for calculating the opportunity index is expressed as follows:

$$\bar{y}^* = \int_0^1 \bar{y}_p \, dp \tag{2}$$

In which: $\bar{y}^*$is the Opportunity Index (OI). The $\bar{y}^*$larger it is, the greater the opportunity for the entire population.

$\bar{y}_p$ is the average opportunity enjoyed by the lowest p percent of households.

Formula for calculating resource allocation density index

The health resource density index (HRDI) is used to assess the level of health resource allocation, including the number of doctors, hospital beds, and health facilities. This index is calculated by averaging the product of population and geography to objectively reflect the allocation of resources while minimizing bias in the assessment.

HRDI is calculated based on the arithmetic average of two indicators: the number of health resources per 1,000 people and the number of health resources per km².

Specifically, the calculation formula is as follows:

$$HRDI = \sqrt{\frac{HR_i}{P_i} * \frac{HR_i}{A_i}} \tag{3}$$

Where: $HR_i$is the number of health resources in province i, $P_i$is the population of province i and $A_i$is the area of province i, $HRDI$is the health resource density index. This formula helps adjust the impact of population size and geographical area, thereby more accurately reflecting the availability and access to health resources in each locality.

Principal component analysis (PCA)

To minimize multicollinearity, the study applied the principal component analysis (PCA) method. This method allows the creation of composite variables from multiple indicators while retaining the maximum amount of important information. This technique is widely recognized for its effectiveness in summarizing data in multivariate analysis.

The principal component model is described as follows:

$$HTYT = w'_1 \times htbhyt + w'_2 \times htkcb \tag{4}$$

$$HRDI = w''_1 \times hrdicsyt + w''_2 \times hrdibs + w''_3 \times hrdigiuong \tag{5}$$

In which, the study applied PCA analysis to two groups of variables:

HTYT: Composite index of state health support, extracted from the variables htbhyt and htkcb.

HRDI: Health Resource Density Index, extracted from the variables hdicsyt, hrdibs, and hrdigiuong.

After applying PCA, the final composite indices will be standardized to ensure uniformity of scale and facilitate analysis and comparison.

The weight coefficients w_1, w_2, w_3; w'_1, w'_2 and w''_1, w''_2, w''_3 are the results of PCA analysis. This method helps reduce the dimensionality of data by combining strongly correlated variables into composite indices that represent most of the variation in the data. After applying PCA, the final composite indices are standardized to ensure uniformity of scale and facilitate analysis and comparison.

$$A_{norm} = \frac{A_i - A_{min}}{A_{max} - A_{min}} \tag{6}$$

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$A_{norm}$is the normalized A index (in the range [0; 1]).

A_i is the computed value of A for the ith observation before normalization.

A_{max} and A_{min} are the maximum and minimum values of the A index computed over all observations.

By applying this formula, the A values are scaled in the range [0, 1], ensuring a standardized representation of the digitization levels, which simplifies the interpretation and comparison between different observations. This normalization process is important in studies involving multiple indicators, where the units of measurement are different. As Han et al. [58] min-max normalization is one of the most common methods for preparing data for analysis in statistical analysis.

4.4. Model estimation method

The data used in the study is panel data, which combines time series and cross-sectional data. Due to the small time dimension of panel data, the study employs two basic estimation methods for static panel data: the fixed effect estimation method (FEM, Fixed Effect Model) and the random effect method (REM, Random Effects Model). Subsequently, the Hausman test is utilized to determine whether to choose the fixed effect model (FE) or the random effect model (RE). To assess the presence of multicollinearity, the variance inflation factor (VIF) is calculated. The Wald test is applied to examine heteroscedasticity, while the Wooldridge test is used to detect autocorrelation. Finally, to address issues related to heteroscedasticity and autocorrelation, the study adopts the Feasible Generalized Least Squares (FGLS) method.

5. Experimental Research Results

5.1. Descriptive Statistics

Based on data from 63 provinces and cities during the period from 2008 to 2022, estimating factors affecting inclusiveness in people's use of health services with a total of 504 observations, the descriptive statistics table (Table 2) is presented as follows:

Table 2.
Descriptive statistics of variables.

Variable name	Number of observations	Average value	Standard deviation	Minimum value	Maximum value
ystarngoaitru	504	0.687	0.145	0.299	0.988
ystarTN	504	763.56	394.564	146.733	2278.131
ystarTN_01	504	0.307	0.191	0	1
hn	504	11.423	10.021	0	53.7
mdds	504	491.454	613.563	37	4481
lnmdds	504	5.686	0.995	3.611	8.408
ystareducation	504	0.73	0.14	0.415	1.296
ystarVieclam	504	0.582	0.071	0.332	0.82
lnTongCNS	504	12.709	0.703	11,118	15.023
ystarBHYT	504	0.735	0.147	0.317	0.998
Health care system	504	0.251	0.218	0	1
HRDI	504	0.123	0.132	0	1

Note: ystarngoaitru (outpatient service access opportunity index), ystarTN (unstandardized income inclusion index), ystarTN_01 (standardized income inclusion index), hn (poverty rate), mdds (population density), lnmdds (logarithm of population density), ystargiaoduc (education inclusion index), ystarVieclam (employment access opportunity index), lnTongCNS (logarithm of total health budget expenditure), ystarBHYT (health insurance inclusion index), HRDI (health resource allocation).

Based on the descriptive statistics (Table 2) and the research variables presented in the document, it can be seen that the coverage level in the use of health services in Vietnam shows significant differences between provinces and cities, especially between outpatient and inpatient services. Specifically, the coverage index for outpatient services (ystarngoaitru) has an average value of 0.687, indicating a fairly high coverage level, but there remains a gap to achieve comprehensive coverage (the highest value is

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0.988). Meanwhile, the coverage index for inpatient services (ystarnoitru) has a much lower average value of only 0.265, reflecting limited access to inpatient services. This may be due to factors such as high costs, limited facilities, or geographical distance.

Regarding socio-economic factors, the poverty rate (hn) has an average value of 11.423%, with a fairly high standard deviation (10.021), indicating a large difference in poverty levels between provinces. This can negatively affect people's access to health services, especially in rural and mountainous areas. The urbanization rate (dth) also has significant differences between provinces, with an average value of 27.736% and a standard deviation of 16.876. Provinces with high urbanization rates often have better socio-economic conditions, thereby improving access to health services. Population density (mdds) is also an important factor, with an average value of 491.454 people/km², but a very high standard deviation (613.563), reflecting uneven population distribution between provinces. This can lead to a shortage of health resources in areas with low population density.

Regarding health financing, the total health budget expenditure (ln(TongCNS)) has an average value of 12.709 (logarithm), with a standard deviation of 0.703, indicating that the level of health budget investment is relatively stable among provinces. However, the health insurance coverage index (ystarBHYT) has an average value of 0.735, indicating that although the health insurance coverage level is quite high, there is still a gap to achieve comprehensive coverage (the largest value is 0.998). Health support programs (HTYT) also have a low average value of only 0.251, reflecting the limited and uneven rate of households receiving health support among provinces.

Regarding health resources, the health resources index (HRI) has a mean value of 0.123, with a standard deviation of 0.132, indicating that health resources (including the number of doctors, hospital beds, and health facilities) are limited and unevenly distributed among provinces. This situation is especially serious in provinces with low population density or remote areas, where access to health services is difficult.

These results are an important basis for selecting appropriate models and analysis methods, contributing to explaining model results.

5.2. Regression Model Results For Outpatient Medical Services

After analyzing descriptive statistics, the study estimated and tested the model according to the following process:

- Model estimation using FEM, REM methods
- Use Hausman test to choose between FEM and REM model.
- Defect verification of selected model
- Fix model defects.

The Hausman test results confirmed that the FEM model was suitable in the general scope and all hospital levels (P-value = 0.000). The Wald test showed that there was heteroscedasticity (P-value = 0). The Lagrange multiplier test confirmed that the model had autocorrelation (P-value = 0.000). To address the model's shortcomings, the study used the feasible generalized least squares (FGLS) method, in which the panels(h)corr(ar1) option was used for models with both heteroscedasticity and autocorrelation, or the panels(h) option was used only for models with heteroscedasticity but no autocorrelation. The summary of the model estimation results is presented in Table 3.

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Table 3.
Summary of the regression results for the inclusive model of outpatient service use.

	(1)	(2)	(3)	(4)	(5)	(6)
	ystarngoaitru	**ystarngoaitru Tuyentw**	**ystarngoaitru Tuyentinh**	**ystarngoaitru Tuyenhuyen**	**ystarngoaitru Tuyenxa**	**ystarngoaitru BVtunhan**
ystarTN_01	0.184***	0.00460***	0.00713**	0.00341	-0.0334***	0.00492***
	[4.51]	[3.69]	[2.41]	[0.70]	[-5.05]	[3.59]
hn	-0.000331	-0.0000461	-0.000732***	-0.00142***	0.00353***	0.0000187
	[-0.35]	[-0.46]	[-3.03]	[-3.00]	[4.06]	[0.18]
lnmdds	0.0102	0.00348***	0.00471	0.00227	0.00999	0.00108
	[1.10]	[2.72]	[1.59]	[0.42]	[1.32]	[0.93]
ystareducation	0.305***	0.0377***	0.0736***	0.137***	-0.0740**	0.0300***
	[7.76]	[7.21]	[6.47]	[6.66]	[-2.55]	[5.90]
ystarVieclam	0.0921	0.000444	-0.0127	0.0966**	0.279***	-0.0176*
	[1.20]	[0.05]	[-0.62]	[2.40]	[4.78]	[-1.88]
lnTongCNS	0.0867***	0.00618***	0.00751***	0.0168***	0.0126*	0.00845***
	[10.02]	[5.05]	[2.88]	[3.46]	[1.88]	[6.79]
ystarBHYT	0.102***	-0.00731	-0.000929	0.00145	0.179***	0.000434
	[2.81]	[-1.47]	[-0.08]	[0.07]	[5.87]	[0.09]
Health care system	-0.0711***	0.000119	-0.00982	-0.0141	0.0297	-0.00142
	[-2.68]	[0.04]	[-1.55]	[-1.15]	[1.56]	[-0.48]
HRDI	-0.228***	-0.0311***	-0.0345*	0.0952***	-0.00444	-0.0244***
	[-4.65]	[-3.41]	[-1.79]	[2.62]	[-0.11]	[-2.59]
_cons	-0.822***	-0.100***	-0.0946**	-0.241***	-0.274***	-0.109***
	[-6.88]	[-6.04]	[-2.57]	[-3.54]	[-2.83]	[-6.37]
N	504	504	504	504	504	504
R^2						

Note: (1) The symbols ***/** /* indicate that the estimated parameters are statistically significant at the significance levels of 1%, 5% and 10%, respectively. The values in [·] are the corresponding T ratio values. (2) variables in the model: ystarngoaitru (index of opportunities to use general outpatient services), ystarngoaitruTuyentw (index of opportunities to use central outpatient services), ystarngoaitruTuyentinh (index of opportunities to use provincial outpatient services), ystarngoaitruTuyenhuyen (index of opportunities to use district outpatient services, ystarngoaitruTuyenxa (index of opportunities to use commune outpatient services), ystarngoaitruBVtunhan (index of opportunities to use private outpatient services), ystarTN_01 (index of standardized income coverage), hn (poverty rate), lnmdds (population density taken as logarithm), ystargiaoduc (index of education coverage), ystarVieclam (index of opportunities to access jobs), lnTongCNS (logarithm of total health budget expenditure), ystarBHYT (inclusion index) Health Insurance (HI), HRDI (health resource allocation).

Table 3 presents a summary of the regression results from all three estimation methods FEM, REM, and FGLS for outpatient services, ranging from the general scope to hospital levels. The regression results indicate that the findings are generally consistent in the direction of impact across the general scope and each hospital level. However, some variables exhibit inconsistent results. The study emphasizes analyzing the regression outcomes after addressing the model's deficiencies using the FGLS method, leading to the following main conclusions:

5.3. Impact of Socio-Economic Factors

Impact of inclusive growth: Our analysis shows that among the factors tested, the income inclusion index (ystarTN) exhibits the strongest explanatory power, with a positive and statistically significant impact on the inclusion index of outpatient services (regression coefficient $\beta = 0.184^{***}$). This result is consistent with previous findings, suggesting that individuals with higher incomes tend to have better access to health care services, especially outpatient services, and have higher health awareness. This highlights the importance of improving economic conditions and health access for low-income groups to promote inclusion in outpatient services. However, when analyzing at hospital levels, specifically at the commune level, the impact tends to be negative (negative coefficient -0.0334*** at 1% statistical significance), while at the district level, the impact is not clearly shown. This indicates that when economic conditions

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improve, people tend to seek better quality medical facilities, usually higher-level hospitals instead of using services at the primary health care level. This change also poses challenges to the health system, especially at the primary health care level. Although primary health care plays an important role in providing primary care services and reducing the burden on higher-level hospitals, if the quality of service does not meet people's expectations, they will tend to ignore this health care level. This can increase pressure on higher-level hospitals, leading to overload, long waiting times, and higher medical examination and treatment costs.

Poverty rate (HN): The regression results show that the poverty rate does not have a clear impact on the overall opportunity to use outpatient services. However, when analyzed by health level, this impact exhibits a significant difference in the direction of impact. Specifically, the poverty rate has a negative impact at the provincial and district levels but a positive impact at the commune level.

This reflects the reality in Vietnam, where commune health stations play an important role in providing primary health care. Due to financial constraints, even with health insurance, low-income people still face additional out-of-pocket costs such as medicines, tests, or hospital fees, making it difficult for them to access higher-level health facilities. In addition, in areas with high poverty rates, the health system is often underdeveloped, leading to people relying mainly on commune health stations to access primary health care services.

The impact of population density (lnmdds) has a positive effect on the opportunity to utilize outpatient services, regardless of the general scope or hospital level. However, this effect is only clearly evident at the central hospital level and is not as apparent at other levels.

This suggests that as population density increases, demand for health care increases, leading to the expansion and development of health facilities, which improves access to services, but this does not mean that all population groups have equal access to health services. Overcrowding in hospitals, especially at higher levels, can reduce access for low-income groups due to higher service costs, longer waiting times, and pressure from overcrowding that affects service quality.

Education coverage index (ystargiaoduc): The opportunity to use health services also depends significantly on the education level of the people. The regression results show that the impact of the education coverage index has a positive effect on the opportunity to access outpatient services in both the general scope and hospital levels, except for commune health care. This indicates that when people's education level improves, they often have better awareness of health and promote the behavior of using health services more frequently, especially outpatient services for periodic health check-ups. People with higher education are more likely to maintain positive health care habits, leading to them proactively seeking health services when necessary. This increase in education level also contributes to reducing inequality in access to and use of health services, promoting greater fairness in the health care system.

The employment inclusion index (ystarvieclam), although not having a clear impact on the opportunity to use outpatient services in general as well as at the central and provincial levels, has a positive impact on the opportunity to use outpatient services at the district and commune levels. This reflects that when this index increases, it indicates improved employment opportunities for people, especially the poor, who consequently have better access to jobs. This helps narrow the income gap, improve living standards, and increase the ability to pay for essential needs, including health services. Stable employment not only ensures income but also raises health awareness, creating more favorable conditions for accessing health services. In particular, low-income workers often benefit from welfare policies such as health insurance, which helps reduce the burden of medical examination and treatment costs, encouraging them to use health services more frequently, thereby contributing to narrowing inequality in access to health care.

5.4. The Impact of Health Financing and Health Policies

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Impact of total budget expenditure (lnTongCNS): The estimated results show that total budget expenditure has a positive impact on access to outpatient services in general as well as at all hospital levels, with statistical significance at the 1% level. This indicates that increasing budget expenditure for health has been effective in improving access to outpatient services, helping people, especially in disadvantaged areas and low-income groups, to easily access basic health services, such as periodic medical examinations, health consultations, or preventive health checks. This contributes to reducing financial barriers for people, particularly those with low incomes or without full health insurance.

The health insurance coverage index (ystarBHYT) reflects the coverage level and distribution of access to health insurance in the population. The results show that this index has a positive impact on the opportunity to use outpatient services in general and at the commune level. However, at the remaining health levels, the impact of this factor is not entirely clear. One possible explanation is that people tend to use health insurance mainly for inpatient services because these services often require higher costs and involve complex medical interventions. Additionally, factors such as insurance payment procedures, service quality, and long waiting times may make people less likely to use health insurance for outpatient services. However, at the commune level, health insurance plays a more significant role in supporting primary health care services, especially for the elderly who often need follow-up examinations, periodic medication, general health check-ups, and medical consultation services, which are common outpatient services at the commune level. Furthermore, people in rural areas, where incomes are low and access to high-quality health facilities is limited, tend to rely on commune health stations for basic health care. Low costs, close geographical proximity, and health insurance support policies facilitate easier access to health services for this group. Conversely, at higher levels (district, provincial, central), the use of health insurance for outpatient care is less common, partly because the quality of services at public hospitals may not meet expectations, waiting times are long, and people tend to opt for private examinations or pay for outpatient services themselves. The results partly reflect previous results found in studies by Orjingene et al. [47] and Steele et al. [48] that health insurance is an important tool that has a positive impact on reducing the burden of medical costs for patients.

5.5. Health Support Policy (HSP)

The regression results show that the impact of the health support program after factor extraction analysis on outpatient services is not as expected (estimated regression coefficient is -0.0549***). This result coincides with the findings of previous international studies that have confirmed that government health support programs often do not benefit the poor. This may stem from the fact that poor people in these areas have few opportunities to use outpatient services due to long distances, limited facilities, and lack of specialists. This leads to some areas, especially remote areas, having difficulty accessing health services, even though they are supported by health insurance. The lack of health infrastructure in these areas reduces policy effectiveness and does not contribute to increasing inclusiveness in outpatient service use.

5.6. The Impact of Health Resource Allocation

Allocation of health resources (HRDI) has a negative and statistically insignificant impact (-0.0816), indicating that the allocation of health resources has not significantly improved the opportunity to use outpatient services. The reason may be due to the lack of high-quality health resources, leading to overload at specialized facilities, which reduces the effectiveness of access to outpatient services. This demonstrates that there are still many challenges in the allocation of health resources. Limited resources, an uneven distribution of health facilities, and the lack of skilled doctors have diminished the effectiveness of access to services, especially outpatient services. This situation not only causes overload at specialized facilities but also results in inadequacies in ensuring comprehensive health coverage. Therefore, it is

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necessary to improve the allocation system and enhance the quality of health resources to better meet the needs of people in all regions.

6. Conclusion

Our analysis of the impact of macroeconomic factors on the inclusiveness of outpatient services in Vietnam during 2018-2020 shows significant regional differences. Inclusiveness reflects not only access to services but also the level of equity in the distribution and enjoyment of services among population groups. The results show that outpatient services are more commonly used in developed urban areas with prosperous economies, while coverage remains limited in rural areas, where people face more barriers to accessing and using health services. Socioeconomic and demographic factors play an important role in narrowing this gap, with personal income and urbanization rates being the strongest drivers of outpatient service inclusiveness.

In particular, the study highlights the role of inclusive growth in improving equity in access to health services. The positive impact of the income inclusion index on outpatient service utilization, especially at higher-level and private hospitals, suggests that as economic conditions improve, people tend to access higher-quality services. However, this shift may widen the gap between income groups, posing a challenge in ensuring sustainable inclusiveness, especially when primary health care is not meeting demand and the higher-level hospital system is at risk of being overloaded.

In addition, the analysis also shows that health financing policies play an important role in promoting inclusiveness, not only by expanding access but also by enabling disadvantaged groups to benefit equitably from the health system. In particular, the level of state budget expenditure on health has a clear impact on the level of outpatient service coverage, highlighting the need to maintain and expand financial support programs, especially in low-income areas. Similarly, the level of educational coverage is also closely related to the use of outpatient services, reflected in increased health awareness and the tendency to proactively access health services among more educated groups.

These findings confirm that to promote inclusiveness in outpatient service use, health policies need to aim not only at expanding access but also at ensuring equity and sustainability in the health system. This requires investment in improving the quality of primary health care, enhancing health infrastructure in less developed areas, and maintaining financial support programs to narrow gaps between population groups and ensure that all people have equal access to health services.

Transparency:

The authors confirm that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.

Copyright:

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