

The relationship between demographic dynamics and health resources in
Algeria

العلاقة بين الديناميكية الديموغرافية والموارد الصحية
في الجزائر

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Abstract:

المخلص:

This research aims to examine the extent to which health resources in Algeria respond to population dynamics by estimating the relationship between the population size and various health resources (both material and human) during the period from 2000 to 2023.

For this purpose, ready-made data from the Ministry of Health and Population as well as the National Office of Statistics were utilized.

The study found that there is a health strategy that responds to population growth. However, some shortcomings remain, including a decline in the number of hospitals, a shortage of public-sector dentists, and an imbalance between the population size and the Ministry of Health's budget.

يهدف هذه البحث إلى معرفة مدى إستجابة الموارد الصحية في الجزائر للديناميكية السكان، وهذا من خلال قياس العلاقة بين عدد السكان ومختلف الموارد الصحية (المادية والبشرية) خلال الفترة الممتدة من سنة 2000 إلى سنة 2023.

تم العمل على معطيات جاهزة لوزارة الصحة والسكان وكذا الديوان الوطني للإحصائيات.

توصلت الدراسة إلى أن هناك إستراتيجية صحية تستجيب للنمو السكاني لكن تبقى بعض النقائص منها تراجع عدد المستشفيات ونقص في عدد أطباء الأسنان في القطاع العام واختلال التوازن بين عدد السكان وميزانية وزارة الصحة.

الكلمات المفتاحية: عدد السكان القطاع الصحي، معامل الارتباط، الموارد الصحية، الانتقال الديموغرافي.

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1- Introduction:

Providing healthcare is the only way to achieve the third Sustainable Development Goal, which is "Good Health and Well-being for All." However, this may be difficult given the rapid demographic growth and the neglect of planning to identify the health needs of society. Algeria, like many developing countries, has undergone profound demographic changes that have affected various sectors, particularly the health sector, where changes in the population structure are a key factor that directly influences the extent to which health services are provided to the population. In this context, the extent to which the Algerian health system has responded to various rapid demographic changes is noteworthy. This study therefore aims to describe the relationship between health capabilities and demographic shifts in Algeria, starting with a review of the evolution of certain demographic and health indicators over the past 20 years (2000-2020). Then calculating the statistical relationship between population size and various available health capacities using correlation coefficients. Finally, we conclude by proposing recommendations to improve the situation. Before all this, we begin by addressing the most important definitions of the terms used in this work.

2- Basic Concepts:

2-1- Definition of Health Capabilities:

Health capabilities are defined as: the totality of human, material, and organizational resources possessed by the health system, which are harnessed to provide health services and achieve health policy objectives. They include treatment facilities, medical equipment, health personnel, and financial resources, which are used to ensure the provision of health services and improve the health status of the population (Abdelkader, 2016, pp. 88-112).

In another definition, health capabilities are defined as: the totality of health resources available within the health system, including infrastructure, equipment, human and organizational frameworks, which are harnessed to ensure the provision of preventive, curative and rehabilitative health services to the community (Alkhatib, 2014, p. 95).

Al-Saadi defines health capacity as the operational capacity of health institutions through their hospitals, care centers, doctors, nurses, equipment and technologies, in addition to the financial and organizational capacity

that ensures the continuity and quality of health services (ALsaad, 2017, p. 134).

The United Nations definition that we will adopt in our study states: Health capacity refers to the total availability of human, physical, financial and organizational resources within the health system, including hospitals, medical equipment, health professionals and administrative structures, which are mobilized to provide preventive and curative health services to the population (WHO, 2010, p. 8).

2-2-Definition of Demographic Transitions:

The concept of demographic transitions refers to profound changes in population size and structure resulting from shifts in birth and death rates, leading to a transition from a population system characterized by high fertility and mortality to one with low fertility and mortality (Abdelkader, 2016, p. 45).

Demographic transitions are also defined as the gradual transition of societies from a phase of high population growth, associated with high birth and death rates, to a phase of population stability characterized by lower rates and changes in the age structure of the population (Chesnaïs, 1992, p. 22). Demographic transition is a long-term change in population dynamics, beginning with a decline in mortality followed by a decline in births, leading to an ageing society and a change in age structure (Vallin, 2024, p. 78). Demographic transitions are also defined as the shift of societies from a traditional to a modern demographic pattern through changes in marriage patterns, fertility, migration, and the accompanying social and economic effects (Tabutin & B, 2010, p. 56).

Based on the above, demographic shifts in our study refer to: all changes in demographic indicators (births, deaths, population pyramid) that reflect Algeria's transition to a different stage from the previous one, characterized by lower mortality and birth rates and a change in the population structure with an increase in the proportion of elderly people. Theoretically, this definition refers to one of the stages of the demographic transition theory, which is one of the most important theories in demography and explains demographic shifts. We summarize it as follows:

2-3-Definition Of The Theory Of Demographic Transition:

The theory of demographic transition describes the historical transition of societies from high levels of birth and death rates to low levels, as a result

of economic and social development and improvements in health and education (Notestein, 1945, p. 40).

The theory of demographic transition also represents the historical process by which societies move from high fertility and mortality to low fertility and mortality through four successive stages:

Stage 1: High birth and death rates lead to weak growth.

Stage 2: Declining mortality and continuing high birth rates lead to rapid population growth.

Stage 3: A gradual decline in births leads to a slowdown in population growth.

Stage 4: Stabilization of births and deaths at low levels leads to weak or stable growth.

The theory of demographic transition also provides a framework for understanding long-term changes in population dynamics, from a traditional society with high growth to a modern society characterized by low fertility and mortality (Chesnais, 1992, p. 18).

3-Methodology and Methodological Procedures Adopted In the Research:

Our work relied on an analytical approach, based on processing data in a systematic manner with the aim of revealing the links within the phenomenon by analyzing its elements and interpreting the relationships between variables in order to arrive at practical results that contribute to a deeper understanding of the subject (al-qadi.A, 2016, p. 55)

The following methodological procedures were followed: First, we asked whether there could be a statistical relationship between population growth and various health resources in Algeria. We then obtained data from the Ministry of Health and Population in a document entitled 'demographic and health situation (2000-2024)' and from the National Statistics Office (ONS) publication No. 1030. These two documents contain all the variables to be tested (population, number of health facilities, human resources in the health sector, etc.).

After defining the most important concepts used in the study, we examined the evolution of various demographic and health indicators that describe the health status of the Algerian population during the observation period. In the next stage, we entered the data into tables using SPSS software, then estimated Pearson's correlation coefficient between the population size and various indicators describing health resources (number

of hospitals, number of specialist doctors, number of pharmacists, etc.). We then compared the correlation coefficients and identified the variables that had a strong relationship with the population. We drew conclusions and made recommendations for the health sector in Algeria in order to improve health services in the country.

4-Evolution Of The Demographic Situation In Algeria:

Measuring the relationship between population size and health needs cannot be done without a database covering a period of time or a time series of population growth. Below, we will examine the evolution of the most important indicators describing the demographic situation in Algeria during the period 2000-2024.

4-1-Population Growth in Algeria:

Algeria's population has grown by 17 million in 24 years, from 30.1 million in 2000 to 47.3 million in 2024 (Table 1). This development was the result of many economic, health and social factors.

Table 1: Population growth in Algeria by gender in millions during the period 2000-2024:

Years	Population in Algeria (in millions)			Gender ratio*	Years	Population in Algeria (in millions)			Gender ratio*
	Male	Females	Total			Males	Females	Total	
2000	15.2	14.9	30.1	102	2013	19.4	18.9	38.8	103
2001	15.6	15.2	30.8	103	2014	19.8	19.3	39.1	103
2002	15.8	15.5	31.3	102	2015	20.0	19.5	39.5	103
2003	16.1	15.7	31.8	103	2016	20.7	20.1	40.8	103
2004	16.3	16.0	32.3	102	2017	21.2	20.5	41.7	103
2005	16.6	16.3	32.9	102	2018	21.6	21.0	42.6	103
2006	16.9	16.5	33.4	102	2019	22.0	21.4	43.4	103
2007	17.3	16.8	34.1	103	2020	22.4	21.9	44.3	102
2008	17.5	17.1	34.6	102	2021	22.8	22.2	45.0	103
2009	17.9	17.4	35.3	103	2022	23.2	22.6	45.8	103
2010	18.2	17.8	36.0	102	2023	23.6	23.0	45.6	103
2011	18.6	18.1	36.7	103	2024	24.0	23.3	47.3	103
2012	18.9	18.5	37.4	102					
Source: (ministry of health, 2024)					Years: 2021/2022/2023 Ministry of Health estimates				
* Prepared by the researcher.									

The data in the table shows that Algeria's population is growing steadily and at a regular pace. It can also be seen that the second decade of the 21st century saw a greater increase than the previous one, with the population rising by around 6 million in the first decade (2000-2010). During the second decade (2010-2020), the population increased by about 8 million people.

This can be explained by several factors, the most important of which is the high fertility rates. There may also be an impact of the health situation, especially during the corona virus pandemic and the quarantine measures that the population experienced for a considerable period of time (from 22 March 2020 to 2021). This remains to be confirmed by field studies describing the impact of the corona virus pandemic on reproductive behavior.

As for statistics by gender, the sex ratio confirms that there is a balance between the number of females and males in Algeria in all years of observation, with a slight predominance of males not exceeding 1%.

4-2- Demographic Shift:

The population pyramid is one of the most important demographic techniques, summarizing a wealth of information in a graph that describes the distribution of the population by age and gender in a given society over a specific period of time. It also enables us to identify the age structure of the community (young, elderly) and helps us to understand various demographic shifts. It is commonly used in planning health, education and social policies. The following table shows the evolution of age groups (under 15 years old), (15-59 years old) and (60 years old and above) as derived from population pyramids for the period 2000-2024.

Table 2 : Evolution of population structure from 2000 to 2024.

Years	Age groups			Years	Age groups		
	Under 15	15-59	60 years and over		Under 15	15-59	60 years and over
2000	34	59.3	6.7	2013	28.1	63.6	8.3
2001	32.8	60.4	6.9	2014	28.2	63.3	8.5
2002	31.8	61.3	6.9	2015	28.3	62.9	8.8
2003	30.7	62.2	7.1	2016	28.8	62.5	8.7
2004	29.8	63.1	7.2	2017	29.7	61.1	9.1
2005	28.9	63.9	7.3	2018	30.1	60.6	9.3
2006	28.4	64.3	7.3	2019	30.1	60.6	9.3
2007	27.8	64.8	7.4	2020	30.7	59.6	9.8
2008	28.1	64.5	7.4	2021	30.6	59.4	10.0
2009	28.2	64.4	7.4	2022	30.6	59.6	9.8
2010	27.8	64.5	7.7	2023	30.4	59.0	10.6
2011	27.7	64.4	7.9	2024	30.2	58.9	10.9
2012	27.9	64.0	8.1	Percentage change*	12.58	0.67	62.68

Source: (ministry of health, 2024) Years 2021/2022/2023 Ministry of Health estimates
*Prepared by the researcher

The results in the table reveal important observations about the changing demographic structure in Algeria, which we will address based on three age groups that differ according to the specific characteristics of each stage: The under-15 age group, which is the generation renewal group and represents the future population; the 15-59 age group, which is the working and productive breadwinner group; and finally, the 60+ age group, which represents the elderly and the "social burden". Observing the development of these categories during the observation period (2000-2024) shows us the following:

The under-15 age group: The data in the table show that this group has experienced the greatest decline in size, as confirmed by the rate of change, which is estimated at around 12.58% between 2000 and 2024. This indicates that Algeria is entering a new phase of demographic transition as a result of declining birth and death rates.

The 15-59 age group: This group has not been affected by the various changes that have taken place in society and has remained the same size, with a change rate estimated at -0.67%, which will keep the size of the

working-age population unchanged and unemployment rates stable. However, the burden on this group has increased due to the growth in the size of the elderly population, as confirmed by the statistics for this age group.

The 60+ age group: The evolution of the proportions of this group shows a doubling of the size of the elderly population in Algeria, as confirmed by the rate of change, which exceeded 62.68%. This will affect the economic and social conditions of the country, from increased health and social care spending and pressure on the pension system to the impact on economic growth.

The results of this table clearly show us the profound changes that have taken place in Algeria's population structure, which call for the adoption of a new population policy to restore balance to the country's demographic structure.

4-3-Evolution of the Natural Population Growth Rate in Algeria From 2000 To 2023:

The natural growth rate is one of the most important demographic indicators reflecting the dynamics of change in the size and structure of the population. It forms the basis for the planning and evaluation of demographic and economic policies. In Algeria, it has fluctuated at different levels, as summarized in the following table.

Table 3: Evolution of the natural growth rate in Algeria from 2000 to 2023:

Years	Natural growth Rate (%)	Years	Natural growth Rate (%)
2000	1.48	2012	2.16
2001	1.55	2013	2.07
2002	1.53	2014	2.15
2003	1.58	2015	2.15
2004	1.63	2016	2.17
2005	1.69	2017	2.09
2006	1.78	2018	1.99
2007	1.86	2019	1.93
2008	1.92	2020	1.69
2009	1.96	2021	1.54
2010	2.03	2022	1.56
2011	2.04	2023	1.52

Source: (ministry of health, 2024)
2020/2021/ 2022/2023 Based on data from (ONS, 2024, p. 20).

The table shows that during the first period (2000-2009), the natural growth rate in Algeria fluctuated but generally tended to rise. In 2010, the natural growth rate exceeded 1% and reached 2.03%, and the rate of increase continued until it reached its highest level during this period in 2016, at an estimated 2.17%. A year later, the rates began to decline again, reaching their lowest level in 2023, at an estimated 1.52%. These observations confirm what we have already concluded, namely that Algeria has entered a new phase of demographic transition characterized by a simultaneous decline in birth and death rates, which calls for an adjustment of demographic and health policies to meet future challenges.

5-The Health Situation In Algeria:

The description of the health situation can include many demographic and health indicators.

Below, we will discuss some of the demographic indicators that accurately reflect the evolution of the health situation in Algeria, including infant mortality rates, maternal mortality rates, and life expectancy at birth during the period from 2000 to 2022.

5-1-Evolution of Under-One Mortality Rates in Algeria (2000-2023):

This is one of the most important demographic indicators reflecting the quality of healthcare and the effectiveness of health programmers. A rise in this rate indicates poor maternal and child healthcare, while a decline indicates improvement. It is also an indicator of a country's level of economic development and improvement in living conditions. Below, we will discuss the changes in this rate in Algeria during the period from 2000 to 2023.

Table 4: Evolution of the under-five mortality rate in Algeria from 2000 to 2023:

Years	Infant mortality rate per thousand			Years	Infant mortality rate per thousand		
	Males	Females	Total		Males	Females	Total
2000	38.4	35.3	36.9	2012	23.9	21.2	22.6
2001	38.9	35.9	37.5	2013	23.6	21.2	22.4
2002	36.1	33.3	34.7	2014	23.5	20.4	22.0
2003	34.6	30.3	32.5	2015	23.7	20.7	22.3
2004	32.2	28.5	30.4	2016	22.4	19.3	20.9
2005	32.4	28.2	30.4	2017	22.6	19.3	21.0
2006	28.3	25.3	26.9	2018	22.5	19.5	21.0
2007	27.9	24.4	26.2	2019	22.5	19.4	21.0
2008	26.9	23.9	25.5	2020	21.2	16.5	18.9
2009	26.6	22.9	24.8	2021	22.1	17.8	20.0
2010	25.2	22.2	23.7	2022	22.0	17.2	19.7
2011	24.6	21.6	23.1	2023	21.9	17.8	19.9

Source: (ministry of health, 2024, p. 10).

2020/2021/ 2022/2023 Based on data from (ONS, 2024, p. 20).

The data in the table show that the infant mortality rate for children under one year of age over the years observed (2000-2023) shows a general trend towards a gradual decline, for both males and females, from 36 deaths per 1,000 live births in 2000 to 19 deaths per 1,000 live births in 2023. The mortality rates for male children remain higher than those for female children, from 38 deaths per 1,000 live births of males in 2000 to 19 deaths per 1,000 live births. We also note that the decline in 2020 to 18.9 deaths per 1,000 live births was the result of the spread of the corona virus pandemic (quarantine), which indirectly affected the number of infant deaths. These data reflect a clear improvement in the level of healthcare provided to mothers and children. The continuation of this decline is an indicator of the

improvement in the country's health and economic conditions and reflects the level of human development and the quality of the healthcare system in Algeria.

However, more efforts are needed to reach the level of developed countries that have achieved low mortality rates, such as 5.6 deaths per 1,000 live births in 2023 in the United States and 4.3 deaths per 1,000 live births in Canada and 1.8 deaths per 1,000 live births in Japan (CDCP, 2023, p. 10). This requires improving living standards and striving to reduce regional disparities in the distribution of health services among all segments of society.

5-2-Evolution Of The Maternal Mortality Rate In Algeria (1999-2019):

It refers to the death of a mother during pregnancy or within 42 days of the end of pregnancy for any reason related to pregnancy or its complications. It is one of the most important health indicators used to measure the quality of healthcare provided to mothers during pregnancy, childbirth and afterwards. It is also considered a tool for assessing the effectiveness of the health system and a means of guiding countries' health policies. A high maternal mortality rate reflects a weak health system, low levels of education, poverty and gender inequality. The following table shows the evolution of the maternal mortality rate per 100,000 live births in Algeria during the period 1999- 2019.

Table 5: Evolution of the maternal mortality rate in Algeria from 2000 to 2023

Years	Maternal mortality rate (per 100,000 live births)	Years	Maternal mortality rate (per 100,000 live births)
1999	117.1	2012	70.3
2001	113.8	2013	66.9
2004	99.5	2014	63.6
2007	88.9	2015	60.5
2009	81.4	2016	57.7
2011	73.9	2019	48.5

Source: (ministry of health, 2024, p. 13).

In line with child mortality rates, maternal mortality rates have fallen significantly, from 117 deaths per 100,000 live births in 1999 to 48 deaths per 100,000 live births in 2019. These statistics reflect the efforts made in Algeria to improve health services and confirm the conclusions we reached

earlier. However, work must continue in order to reach the levels of developed countries such as the Scandinavian countries, which have achieved the lowest rates, with Norway recording approximately 2 deaths per 100,000 live births and Finland approximately 3 deaths (World Health Organization, 2024, p. 15).

This can be achieved through raising health awareness, good nutrition and close medical monitoring of mothers and children.

5-3 -Evolution of the Probability of Survival at Birth in Algeria (2000-2023):

Life expectancy at birth is one of the most accurate demographic indicators describing the health status and economic and social quality of life in a country. The higher the average life expectancy, the more successful the health and social policies are, and the better the quality of life and well-being in society. Below, we will discuss the evolution of this indicator in Algeria during the period (2000-2023).

Table 6: Evolution of life expectancy at birth in Algeria from 2000 to 2023

Years	Probability of survival at birth E_0 (in years)			Years	Probability of survival at birth E_0 (in years)		
	Males	Females	Total		Males	Females	Total
2000	71.5	73.4	72.5	2012	75.8	77.1	76.4
2001	71.9	73.6	72.9	2013	76.5	77.6	77.0
2002	72.5	74.4	73.4	2014	76.6	77.8	77.2
2003	72.9	74.9	73.9	2015	76.4	77.8	77.1
2004	73.9	75.8	74.8	2016	77.1	78.2	77.6
2005	73.6	75.6	74.6	2017	76.9	78.2	77.6
2006	74.6	76.7	75.7	2018	77.1	78.4	77.7
2007	74.7	76.8	75.7	2019	77.2	78.6	77.8
2008	74.8	76.4	75.6	2020	74.2	77.9	75.9
2009	74.7	76.3	75.5	2021	74.4	77.2	75.7
2010	75.6	77.0	76.3	2022	77.0	80.0	78.5
2011	75.6	77.4	76.5	2023	78.2	81.0	79.6

Source: (ministry of health, 2024).

Years: 2020/2021/2022/2023 Based on data from (ONS, 2024)

The data in the table show a steady and continuous increase in the average probability of survival at birth throughout the observation period

(2000-2023) for both sexes, with a slight advantage for females. We also note that the only decline recorded was in 2020 and 2021 as a result of the corona virus pandemic and its repercussions, which affected males in particular, where the average probability of survival fell to 74.2 years, while females were not greatly affected, with an average life expectancy of around 77 years. The total $E_{(0)}$ was estimated at around 72 years in 2000 and reached 78 years in 2023, while for females, after being 73 years in 2000, it reached 79 years in 2023.

The difference between males and females remains in favor of females, with an estimated 80 years for females in 2023 compared to 78 years for males. The data in this table confirms the remarkable improvement achieved by the health sector in Algeria as a result of efforts to improve health services, reduce rates of infectious and chronic diseases, and improve living conditions.

However, challenges remain for the health sector, particularly with the increase in the number of elderly people, which will put pressure on the pension fund and increase healthcare costs. This calls for the provision of adequate infrastructure to cover the deficit caused by the increase in average life expectancy, as well as the adoption of policies from countries that have already passed this stage without their economic situations being affected. According to the latest World Health Organization report for 2024, the highest average life expectancy in the world is recorded in Japan, where it is around 85 years (83 years for males and 87 years for females), followed by Switzerland and Singapore (84.4 years and 84.0 years respectively). This is a result of the quality of the health system, preventive care, low poverty rates, the adoption of a healthy lifestyle (balanced diet and physical activity), advances in medical technology, and the adoption of strong social systems for the elderly (World health organization, 2024, p. 20).

6-Testing the Relationship between Demographic Reality and Health Status in Algeria (2000-2022):

The aim of studying the relationship between population growth and health resources is to assess the health system's capacity to respond to increasing population growth in order to meet future challenges, particularly in light of the changes in Algeria's demographic composition, and to develop effective policies that ensure sustainable health development for the population. It is customary to describe the adequacy of health resources in relation to the population by using the

The indicator "Coverage ratio of health practitioners." declined during the period under review (2000-2022), with a coverage ratio of one doctor (private, public, dentist, pharmacist) per 440 inhabitants in 2022, down from 786 in 2000. These statistics reflect the efforts made in the sector to ensure equity and balance in the provision of health services. To gain a deeper understanding and diagnose shortcomings, and to discover the extent of parity between population size and health resources, we calculated the Pearson correlation coefficient between the variables of population size and health resources (number of hospitals, number of doctors) during the time series (2000-2022) using SPSS software and arrived at the following:

Table 7: Results of estimating the correlation coefficient between population and various health resources in Algeria during the period 2000-2022.

Health resources (infrastructure and human resources)	Correlation coefficient	Health resources (infrastructure and human resources)	Coefficient Correlation
University hospitals (CHU)	0.954	Private dentists	0.979
Specialised hospitals (EHS)	0.962	Total dentists	0.993
Public hospitals and health institutions (EPH) (EH)	-0.45	Pharmacists in the public sector	0.98
Polyclinics	0.85	Pharmacists in the private sector	0.972
Treatment room (treatment room)	0.964	Total pharmacists	0.990
Specialist doctors in the public sector	0.992	Total number of health practitioners in the public sector	0.976
Specialist doctors in the private sector	0.961	Total number of health practitioners in the private sector	0.993
Total number of specialist doctors	0.991	Total number of health practitioners	0.996
General practitioners in the public sector	0.954	Paramedical sector State certification	0.907
General practitioners in the private sector	0.917	Paramedical sector Assistants	0.942
Total doctors	0.981	Total number of paramedical personnel	0.977
Dentists in the public sector	0.823	Ministry of Health budget	0.871

Source: prepared by the researcher

The results in the table reveal several observations. We note that most correlation coefficients show that the majority of health resources, whether

infrastructure or human resources, are positively and strongly correlated with population growth during the period under review (2000-2022). This is reflected in the high correlation coefficients, which are close to or exceed 0.95 for most indicators, indicating a strong positive relationship: as the population increases, so does the volume of health resources of various types.

We find that human health resources (doctors, dentists, pharmacists, paramedics) have the highest correlation levels, with values ranging between 0.90 and 0.99, reflecting the state's efforts to expand training and recruitment to keep pace with the growing health demand of the population.

As for infrastructure (CHUs, EHSs, polyclinics, treatment rooms), there is also a strong correlation, most notably in university hospitals (0.954) and treatment rooms (0.964), indicating a significant expansion of healthcare facilities across the country.

However, we note a shortage of public hospitals (EPH/EH), which have a negative correlation value (-0.45), which is unusual compared to the rest of the data. This may be explained either by the stability of the number of these institutions or their relative decline despite the increase in population, or by changes in the administrative classification of these institutions during the period. The same observation applies to the number of polyclinics in relation to population size, with a correlation coefficient of approximately 0.856. As for human resources, we note a shortage of dentists in the public sector (0.823) and in the paramedical sector with state certificates (0.907).

As for the Ministry of Health's budget, the correlation coefficient was estimated at 0.871, indicating a positive but less strong relationship compared to human resources, which may reflect the impact of other factors on the budget, such as the country's overall economic situation, and not just demographic growth. The size of the financial deficit suffered by the sector and the fact that the budget responds relatively to population pressures prevent the improvement of the quality of health services provided to the population in Algeria.

Overall, the results reveal an almost complete correlation between population growth and the expansion of health resources in Algeria during the period 2000–2022, with a few discrepancies that require institutional or administrative explanation. Overall, the trend indicates a gradual response by the health sector to the demands of demographic growth, particularly in

terms of human resources, which show the highest levels of correlation. This indicates that the Algerian state has adopted a general health policy that responds to population growth and demographic transition in Algeria. This policy has achieved many gains in the health sector during this period (2000-2022) by providing the various resources necessary to deliver health services to the population, including infrastructure and human resources that are very close to the level of universal coverage.

-General conclusions and recommendations:

During the period 2000-2023, Algeria experienced a change in its demographic composition and structure. By observing the dynamics of various demographic indicators (population size, population pyramid, natural growth rate), we can confirm that Algeria has entered a new phase of demographic transition, characterized by a decline in both mortality and fertility rates, which has led to a doubling of the size of the elderly population. This calls for the development of a new health strategy that responds to the needs of this vulnerable group.

On the other hand, most of the indicators that measure the quality of the health sector have shown significant improvement despite Algeria's vast geographical area. Life expectancy has exceeded 79 years, the infant mortality rate has not exceeded 19%, and the maternal mortality rate is 48 per 100,000 live births.

Many health facilities have been built, and the coverage of health practitioners is estimated at approximately one doctor per 440 inhabitants in 2022. However, despite all these indicators, a health strategy must be prepared with resources commensurate with the growing population, as we have noted an imbalance between the population size and the size of the health sector budget (correlation coefficient 0.871). To achieve quality health services and an effective health system, we propose the following:

- Establishing health infrastructure (hospitals, multi-service clinics) according to population density, i.e. using demographic indicators to determine health maps.
- Increasing the number of doctors (dentists in the public sector) and distributing them fairly, especially in remote rural areas and areas with high population density, to prevent geographical disparities from achieving equity in the distribution of health resources.
- Continuous training for all health sector workers, especially

administrators, and improvement of working conditions.

- Continue to implement the policy of digitizing the health sector by computerizing medical records and developing health information systems to improve case follow-up and decision-making.
- Increase financial resources for investment in disease prevention by raising health awareness among all segments of society, organizing vaccination campaigns, combating chronic diseases and behavior that pose a risk to health, such as addiction and unhealthy diets. Prevention is better than cure.
- Rely on accurate demographic and health statistics when making decisions and developing health policies.
- Leveraging the expertise of advanced countries in the health field and various international bodies to develop strategies.
- Work to implement governance by organizing periodic monitoring, transparent management, qualified competencies and, consequently, combating corruption.
- To achieve sustainable healthcare, a sufficient budget must be allocated to the health sector in Algeria and the value of resources invested in health innovation (medical research and studies) must be increased in order to reduce the brain drain.

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