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THE EVOLUTION OF THE OLD-AGE DEPENDENCY RATIO OVER TIME AND ITS CHALLENGES IN MATO GROSSO – BRAZIL

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ABSTRACT

Foundation: The world population is undergoing profound changes in its age distribution, impacting the labor market and health policies for the elderly. *Goal*: To analyze the aging trend in Mato Grosso, from 1980 to 2020 and its challenges in the labor market. ***Method:*** Time-series ecological study of the following indicators on aging in Mato Grosso: Population aging index (IEP) and Old-age dependency ratio (RDI). The source of demographic information was the Brazilian Institute of Geography and Statistics (IBGE). The *Joinpoint* regression method was used to analyze the temporal trend, adopting the calendar year as the regression variable. ***Results:*** The elderly population (60 years and over) in Mato Grosso grew by 182.54%, while the IEP remained stable. The RDI in both sexes significantly increased. ***Conclusion:*** Population aging in Mato Grosso happened in a similar way to other Brazilian states and European countries. However, the increase in the period's RDI indicates the need to implement public policies through tax incentives to maintain jobs for the elderly, train them, and ensure good health conditions and quality of life, given the implementation of new technologies in the state, especially in agribusiness.

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INTRODUCTION

The world population is undergoing profound changes in its age distribution, recognizing the need for more attention to the specific problems that affect the elderly and the promotion of human rights and dignity of these people, with this population growth being reflected in the labor and financial market (United Nations, 2019), which is why the United Nations declared the Decade of Healthy Aging (2021-2030) (United Nations, 2015). In 2015, Brazil was considered 56th in the quality of life of its elderly, behind Bolivia (55th), Peru (48th), Ecuador (44th), Argentina (31st), Uruguay (27th), Chile (21st), with Switzerland offering the best quality of life for its elderly (Helpage international, 2022), demonstrating that policies to protect the elderly in the labor market can be improved. Every year in Brazil, 650,000 new elderly people are added to the population, most of them with chronic diseases and some with functional limitations. In less than 40 years, Brazil has gone from a mortality scenario typical of a young population to a scenario of complex and costly diseases, typical of long-lived countries, characterized by chronic and multiple diseases that last for years, requiring constant care, continuous medication, and periodic exams (Veras, 2009). In this scenario, a series of social and economic changes are projected in health and social security policy demands and the availability of labor (Oliveira, 2019), given the association between health and work that is already documented in developed countries (Giattil, 2003). According to the WHO, by 2025 Brazil will be the sixth country in the world in terms of the number of elderly people, although there is a considerable lack of information about the health of the elderly and the particularities and challenges of population aging for public health, there is a worldwide increasing recognition of the need to support the active and productive contribution that older people can and do make in formal work, as industries will be able to meet the needs of their older consumers with the expertise of their employees (WHO, 2008), whose aging has been ongoing since 1950 and with a tendency to increase until 2050, including for several Brazilian states(Closs,

2012). In 2010, Mato Grosso was the 17th oldest Brazilian state with an aging trend, since 1970 (Closs, 2012), whose population aging occurs differently in its territory (SEPLAG, 2018), with upward economic growth, due to the primacy of agribusiness (IMEA, 2022) which uses a high degree of technology (Moraes, 2021). Studies on the evolution of the old-age dependency ratio provide knowledge of how much demographic changes can impact economic growth. The time series of aging indicators provide elements to explain the cause, helping in the planning of health, social security, and labor market policies (Queiroz, 2010). In this sense, the present study aimed to analyze the aging trend in Mato Grosso, from 1980 to 2020 and its challenges in the labor market.

METHODS

This is a time-series ecological study, using historical information on aging based on a few indicators about the elderly in Mato Grosso, from 1980 to 2020. The state of Mato Grosso is located in the Midwest region of the country. It had an estimated population of 3,567,234 inhabitants, in 2021. It isthe third-largest state in the country, with a population density of 3.94 inhabitants per $km^{2,}$ agross birth rate of 16.07/1,000 inhabitants and a Life Expectancy at Birth of 75.39 years, a Human Development Index of 0.725, and a nominal monthly household income per capita of R$ 1,362.00.Mato Grossoismadeup of 141 municipalities, heterogeneously distributed throughout its space, and onlyfive of these have a population greater than 100,000inhabitants. Cuiabá, the capital of the state, is the largest of them, with 618,124 inhabitants. The state's economy is based on the production of agricultural commodities for export, such as soy, cotton, sugar cane, and corn, through the agribusiness production model (IMEA, 2022; IBGE, 2022). The Elderly was considered as individual aged from 65 years in developed countries and from 60 years old in underdeveloped countries (WHO, 2005), and both ages were used to calculate the indicators to allow comparison with international and Brazilian findings, which is a developing country. The indicators for the aging analysis were considered according to the United Nations (UN, 2020), as shown in table 1. Population data were collected at the IBGE according to the 1980, 1991, 2000, and 2010 Census and population estimates for inter-census years (IBGE, 2022) by sex. Dispersion and the percentage Delta of the indicators (ΔI%) were calculated for the description of the indicators, using the equation $\Delta\%I = 100 \times ((I_{2020} / I_{1980}) - 1$, using Excel 2010 software (Microsoft Corp., United States).

Joinpoint regression analysis was used to analyze the trend of aging indicators, gauging a few points if there were changes in the observed trend pattern (National Cancer Institute, 2021). With this, the Annual Percent Change (APC) is the direction and magnitude of the trend results and Average Annual Percent Change (AAPC), which is estimated by calculating the weighted geometric average of the different APCs with weight equal to the segment size for each time interval, were calculated by modeling using the Joinpoint method, using the calendar year as the regressor variable (Kim, 2000; Clegg, 2009). Joinpoint regression analysis is used to find the best model that tests whether multiple line fragments explain a trend over time better than a single line (dependent variable: the logarithmic transformation of the rate). Monte Carlo permutation tests are used to compare the various models (with 0, 1,... or 5 joinpoints - depending on the size of the time series) (Kim, 2006).

When the model is defined, the PCA or AAPC, for each segment is calculated and used to describe, quantify the trend, and assess whether this trend is statistically significant. In this situation, the null hypothesis is APC or AAPC = 0, i.e., the rates are neither increasing nor decreasing, therefore, stable and their respective 95% confidence intervals (95% CI) are presented (Clegg, 2009). The statistical analyses were performed with the *Joinpoint Regression Program® software,* version 8.3.6.1 (National Cancer Institute, 2021), which allows the adjustment of data from a series from the smallest number of inflection points (junction points), the values can go from the least infinite to the most infinite, where negative numbers indicate decreasing trends and positive, increasing trend, and the value zero indicates no trend (Kim, 2009). The study met the ethical precepts of research, in terms of art. 13 of Law 13.709/2018 - General Personal Data Protection Law (LGPD), and there was no need for submission to the Ethics Council, under the terms of Resolution 510/2016, of the National Health Council, art. 1, II and III, which indicates the unnecessary need in cases of information of public access, anonymization and public domain.

RESULTS

The state of Mato Grosso counted 6,744,127 elderly people in the period from 1980 to 2020 with 52.3% being men and 47.7% women. There was a considerable increase in people aged 60 years and over, 65 years and over during this period, IEP 60 years, IEP 65 years, RDI 60 years, and RDI 65 years (Table 1 and Figure 1). The percentage of people who were 65 years and older was 7.3% in 2020, and the Old-age dependency ratio of the elderly 60 years and older went from 7 elderly for every 100 persons aged 15 to 59 years in the year 1980 to approximately 17 elderlies for the year 2020, an increase of 127.4% (Figure 1, Table 1). Figure 1 shows oscillations in the growth of the elderly population and its indicators. An increase is perceived as of 1996, but this increase is more apparent from 2006, especially in IEP60, RDI60, and RDI65. When analyzing the trend by joinpoints of the aging indicators selected for women, we found an increase throughout the period, Average Annual Percentage Change (AAPC) was statistically significant ($p<0.05$). The Annual Percentage Change (APC) of the IEP60 in the period 2005-2008 increased by 16.4%, however, without statistical significance (95%CI:(-9.8;50.2). The RDI 60 years in the period 1980-1993 and RDI 65 years period 1980-1998 increased, but without statistical significance (Table 2). For men, the % of people 60 years and older, % of people 65 years and older, and RDI 60 and RDI 65 had a statistically significant (AAPC) average annual growth ($p<0.05$). The IEP 60 years, for males, in the joinpoints of 1992-1995, indicated a decrease of the elderly population by 11.9% per year, and the smallest growth of 1.4% in the period 1980-1992, both periods without statistical significance (Table 3). There was an increase in the average annual percentage change (AAPC) per year, for all genders, in all indicators, studied (% 60 years and over, % 65 years and over, IEP 60 years, IEP 65 years, RDI 60 years, and RDI 65 years) with statistical significance ($p<0.05$) throughout the period (Table 4).

DISCUSSION

The study found rapid aging of the Mato Grosso population in these 40 years, with a 3-fold increase for the percentage 60 years and older. The growing IEPs demonstrate an accelerated demographic transition process with very evident characteristics: an increase in life expectancy at birth, a reduction in birth rates, fertility, and mortality (Siegel, 2004; SEPLAG, 2018; IBGE, 2022). The speed at which the population aged was greater than in France, where the proportion of elderly above 65 doubled in 115 years, and in Brazil, it occurred in only 21 years (Ogura, 2018) and 27 years in China (WHO, 2005). The increase of this elderly population (65 years or older) in Mato Grosso, which was 7.3% in 2020, indicates the aging of the population, which is considered elderly above 10.0%[18], with parameters similar to Eastern European countries: the Czech Republic, Slovakia, and Poland considering the estimated increase in the average of 10 points for European countries, except for the population of Slovakia that will increase 22.0% by 2080 (Leszko, 2017). The growth of the elderly population occurred more among women, materializing the feminization of aging in Mato Grosso, which is consistent with findings in Brazil and worldwide (WHO, 2005). This phenomenon regards the higher proportion of women compared to men in the elderly population, especially at more advanced ages (UN, 2020), a result of health promotion and early preventive care that produced a longer life span (WHO, 2005). Another aspect worth mentioning is that the immigration process in Mato Grosso throughout the period influenced demographic growth as well as the aging indicators (SEPLAG, 2018; Farias, 2022).

Table 1. Descriptive analysis of aging indicators, Mato Grosso.1980 to 2020

Indicators	Indicator Method of Calculation	Minimum	Mean	Standard deviation	Median	Maximum	Δ% (1980-2020)
Percentage of 60 years and over	$\frac{\text{population 60 years or older}}{\text{total population}} \times 100$	3,9	6,1	2,2	5,6	11,2	182,5
Percentage of 65 years and over	$\frac{\text{population 65 years or older}}{\text{total population}} \times 100$	2,4	3,9	1,5	3,5	7,3	196,8
Population aging index for age 60 and over - IEP 60	$\frac{\text{population 60 years or older}}{\text{population under 15 years old}} \times 100$	9,2	22,4	10,8	17,6	48,0	423,6
Population aging index for age 65 and over - IEP 65	$\frac{\text{population 65 years or older}}{\text{população under 15 years old}} \times 100$	5,7	14,3	7,2	11,1	31,3	450,0
Old-Age Dependency Ratio for 60 years and over – RDI 60	$\frac{\text{population 60 years or older}}{\text{population between 15 and 59 years old}} \times 100$	7,3	9,9	2,9	8,9	17,0	127,4
Old-Age Dependency Ratio for 65 years and over – RDI 65	$\frac{\text{population 65 years or older}}{\text{população between 20 and 64 anos years old}} \times 100$	5,5	7,2	1,9	6,6	11,8	105,0

IEP=Population Aging Index; RDI=Old-Age Dependency RatioΔI%= Delta percentage of indicators

Table 2. Aging trend by demographic indicators on the elderly, according to women, Mato Grosso-Brazil (1980 to 2020)

Indicators	Period	APC (CI 95%)	AAPC (CI 95%)	Trend
Female				
60 years old or more	1980 - 2004	2,1*(1,6;2,6)	3,2*(2,8;3,5)	Increase
	2004 - 2020	4,8*(4,2;5,4)		
65 years old or more	1980 - 1998	1,5*(0,5;2,4)	3,1*(2,6;3,6)	Increase
	1998 - 2020	4,4*(4,0;4,9)		
IEP 60 years old	1980 - 2005	0,8*(0,3;1,4)	3,3*(1,4;5,3)	Increase
	2005 - 2008	16,4(-9,8;50,2)		
	2008 - 2020	5,5*(4,4;6,7)		
IEP 65 years old	1980 - 2005	0,9*(0,3;1,5)	3,5*(1,5;5,4)	Increase
	2005 - 2008	17,7(-8,4;51,3)		
	2008 - 2020	5,5*(4,4;6,6)		
RDI 60 years old	1980 - 1993	0,3(-0,5;1,2)	2,4*(2,0;2,8)	Increase
	1993 - 2005	2,1*(1,2;3,0)		
RDI 65 years old	1980 - 1998	0,3(-0,3;0,9)	2,0*(1,7;2,3)	Increase
	1998 - 2020	3,4*(3,1;3,8)		

* Statistically significant APC or AAPC (p<0.05); CI 95% = Confidence Interval with 95%

Table 3. Aging trend by demographic indicators on the elderly, according to men, Mato Grosso-Brazil (1980 to 2020)

Indicators	Period	APC (CI 95%)	AAPC (CI 95%)	Trend
Male				
60 years old or more	1980 - 2004	1,6*(1,3;2,0)	2,6*(2,3;2,9)	Increase
	2004 - 2020	4,0*(3,5;4,5)		
65 years old or more	1980 - 2005	1,7*(1,4;1,9)	2,6*(1,9;3,2)	Increase
	2005 - 2008	8,1(-0,2;17,2)		
	2008 - 2020	3,2*(2,5;3,9)		
IEP 60 years old	1980 - 1992	1,4(-0,4;3,2)	2,8(-1,4;7,2)	Stability
	1992 - 1995	-11,9(-50,2;55,7)		
	1995 - 2020	5,4*(4,9;5,9)		
IEP 65 years old	1980 - 2005	0,4(-0,1;1,0)	2,7*(0,7;4,7)	Increase
	2005 - 2008	15,7(-11,0;50,4)		
	2008 - 2020	4,6*(3,4;5,7)		
RDI 60 years old	1980 - 2004	1,0*(0,7;1,2)	2,0*(1,8;2,3)	Increase
	2004 - 2020	3,6*(3,2;4,1)		
RDI 65 years old	1980 - 2004	1,0*(0,7;1,3)	1,9*(1,6;2,1)	Increase
	2004 - 2020	3,2*(2,7;3,8)		

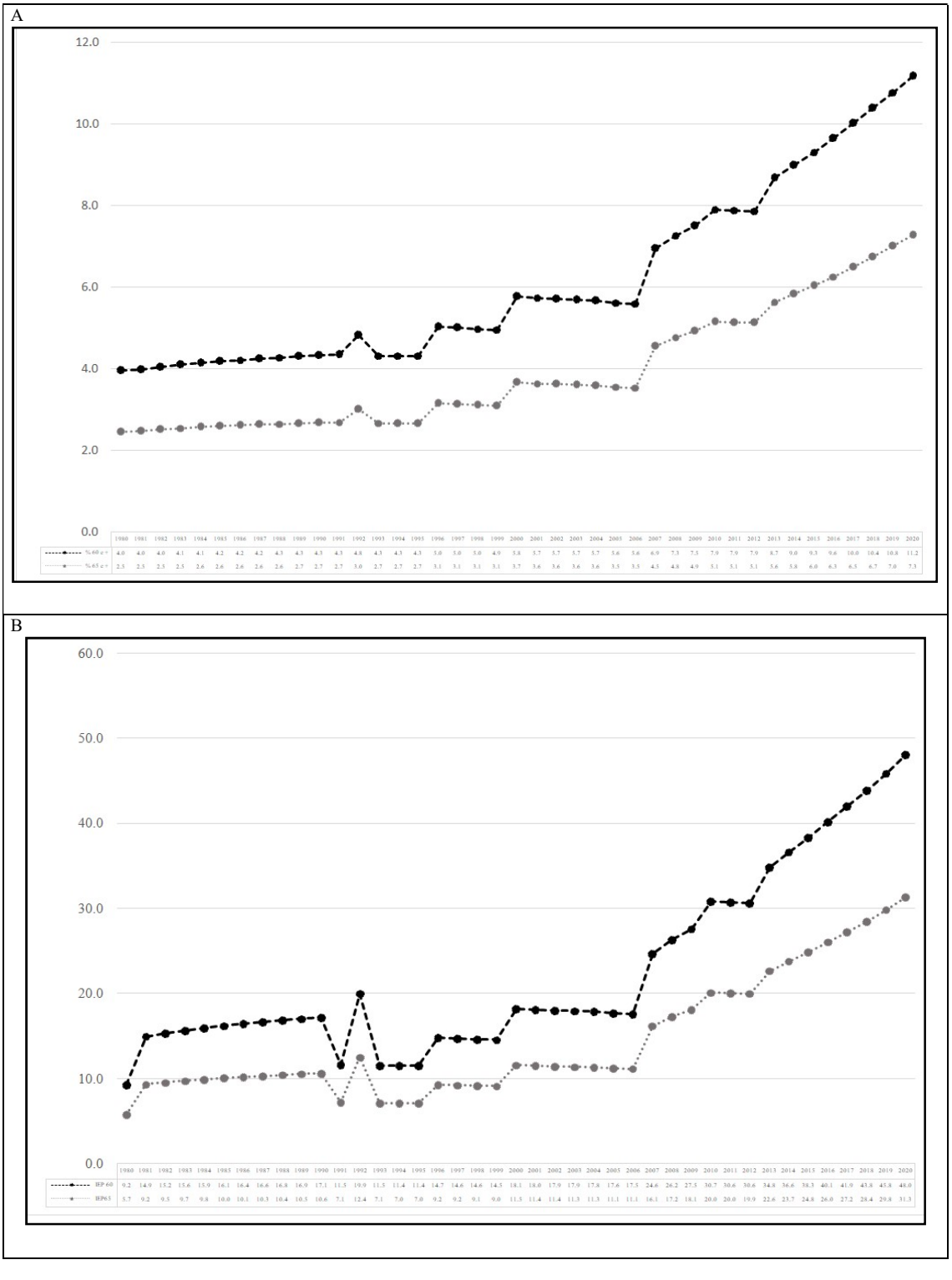
* Statistically significant APC or AAPC (p<0.05); CI 95% = Confidence Interval with 95%

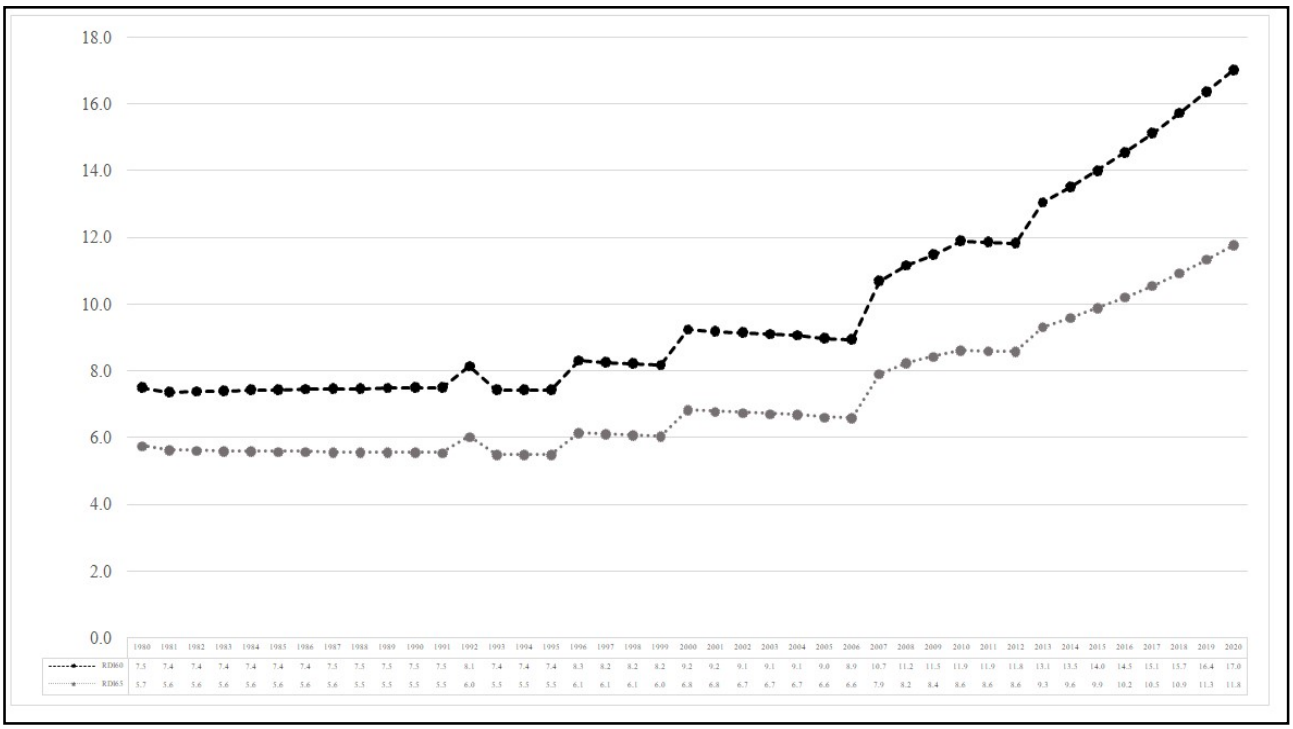
This explains the stability of the IEP for men, as well as the trend to increase 60 years or older, 65 years or older, the RDI 60 years, RDI 65 years, IEP 65 years, in women, given the immigration of male workers who worked in the opening of the agribusiness borders in Mato Grosso, whose low-skilled labor was not absorbed permanently, causing emigration to other Brazilian states (Farias, 2022), as well as emigration of young adults (SEPLAG, 2018). These characteristics of aging in Mato Grosso impacted the demographic structure and the economy, given that the RDI's shown in the study indicate the opportunities for economic growth in the state of Mato Grosso, given that most of the population is still economically active (Queiroz, 2010). With the aging of the labor force, the RDI, as the old-age dependency rate, brings an increase in social security costs and higher taxes to support economic, social, and welfare policies, impacting negatively on the sustainability of these policies, with labor shortages and changes in the composition of the labor force (Leszko, 2017). The increasing RDI trend in Mato Grosso was also found in the Czech Republic, Slovakia, and Poland, which are smaller compared to other European countries. However, projections show that by 2050, Slovakia and Poland will experience the largest increase in the old-

Table 4. Aging trend by demographic indicators on the elderly, according to both sexes, Mato Grosso-Brazil (1980 to 2020)

Indicators	Period	APC (CI 95%)	AAPC (CI 95%)	Trend
Total				
60 years old or more	1980 - 2004	1,8*(1,4;2,2)	2,8*(2,5;3,2)	Increase
	2004 - 2020	4,4*(3,8;4,9)		
65 years old or more	1980 - 2005	1,8*(1,5;2,1)	2,8*(2,2;3,5)	Increase
	2005 - 2008	8,8(-0,1;18,5)		
	2008 - 2020	3,6*(2,9;4,3)		
IEP 60 years old	1980 - 2005	0,5(-0,0;1,1)	2,9*(1,0;4,9)	Increase
	2005 - 2008	15,4(-11,0;49,7)		
	2008 - 2020	5,1*(4,0;6,3)		
IEP 65 years old	1980 - 2005	0,6*(0,1;1,2)	3,1*(1,1;5,1)	Increase
	2005 - 2008	16,7(-9,7;50,8)		
	2008 - 2020	5,0*(3,9;6,1)		
RDI 60 years old	1980 - 2004	1,1*(0,8;1,4)	2,3*(2,0;2,5)	Increase
	2004 - 2020	4,0*(3,6;4,5)		
RDI 65 years old	1980 - 1998	0,4(-0,2;0,9)	1,8*(1,5;2,1)	Increase
	1998 - 2020	3,1*(2,7;3,4)		

* Statistically significant APC or AAPC (p<0.05); CI 95% = Confidence Interval with 95%





Source: IBGE

age dependency ratio ranging from 35 to 50.0% (Leszko, 2017), as well as in other European countries, the United States and Canada (Fialová, 2016). In the period studied in Mato Grosso, the RDI 65 averaged 7.1 and increased by 105.0%, reflecting the same trend as in Europe (Jakovljevic, 2015), Greece, and Cyprus (Lamnisos, 2021). Similar to Mato Grosso, the RDI in the Midwest between 1991 and 2000 also increased from 9.0 to 10.7 (Stampe, 2020), with the same happening in Brazil with the RDI of 60 that in 2010 corresponded to 9.9%, and will reach 19.9% in 2030, 36.6% in 2050 and 61.9% in 2100. This last figure is higher than the one forecast for France and slightly lower than the one expected for Spain. Similarly, the Brazilian IEP, which in 2010 was much lower than those of the other two countries, will reach 239.3% in 2100, representing almost the same value as Spain and being higher than that of France (Amaro, 2018). The trend of aging indicators in Mato Grosso indicates the need to reform the social and health policy agenda to address the demographic transition to population aging, such as specific measures of fertility incentives, prevention, diagnosis and treatment of infertility, family policies such as baby bonuses, family allowances, maternal, paternal and parental leave, tax incentives and flexible working hours. France directly pays families for child care and adopts strategies such as (a) increased child care facilities (day care centers) and better financial support for them, (b) increased benefits to provide partial coverage of the cost of child care by registered nannies, and (c) paid parental leave for a parent who withdraws, partially or fully, from the labor market (Stampe, 2020).

The findings of French policies indicate greater effectiveness in protecting the aging population, because, in addition to protecting the elderly, it also encourages the rejuvenation of the population with the protection of motherhood and fertility, meeting the gender policies, given the feminization of aging. Population aging challenges public policies on work and health, besides social assistance and social security (WHO, 2005), given the association between health and work already documented in developed countries, because elderly people who are active in the labor market have fewer chronic diseases (Giattil, 2003), which directly favors the labor market to give more security to the entrepreneur in maintaining and creating new jobs for the elderly population, given the better health conditions. The profile of these elderly workers is discussed in the context of employability. In France, three profiles of older workers have been defined: *i*) the frail one who performs a laborious activity and demands a progressive retirement policy; *ii*) the outdated one is occupied mainly in the service sector, with skills weakened by technological advancement, requiring continued education; and *iii*) the expert one is a specialist in his field of work, handles high-tech instruments, and demands incentives for competence transmission and funding to undertake entrepreneurship (Felix, 2016). This distinction is important for Mato Grosso, which depends on specialized labor for the development of agribusiness and the development of public policies, even more so because of the emigration of young adults (SEPLAG, 2018). In Latin America and the Caribbean, population aging began in the 1970s in Cuba, Argentina, Uruguay, the Netherlands Antilles, Barbados, Guadalupe, Martinique, and Puerto Rico, distinguished by its greater speed in comparison with European countries (Bayarre, 2018), whose reality is similar in Mato Grosso. As a result of these changes, the proportion of the population aged 60 or over has increased by 10.0% in Cuba, 4.2% in Latin America, and 10.3% in developed countries. By 2030, the number of older people in Cuba and other Latin countries is expected to increase. This proportion will continue to increase until at least 2050. In 2010, Cuba and some Latin American countries had more than 15.0% of the population aged 60 years or older, which is considered advanced aging, generating a challenge that society and public health will have to deal with in the coming years (Bayarre, 2018), as well as the maintenance and creation of jobs to this differentiated population because population aging in Brazil and Mato Grosso is faster than it happened in developed countries. The discussion on the composition of the workforce is related to the increased prevalence of chronic diseases, dependency of the elderly and its influence on the family and community, and increased demand for health care, among others. These elements make aging a generator of social and health problems that make it a striking challenge for developing countries, because there is a lack of resources and preparation, including for the speed at which it is occurring (Bayarre, 2018). Since the 1940s, it is in the Brazilian elderly population that the highest rates of population growth are observed, generating a series of changes in society related to the economic sector, the labor market, health systems and services, and family relations (Oliveira, 2019; Closs, 2012), with more and more elderly people expected in the working-age population - PIA, requiring work programs to absorb this population in the labor market, given the growing trend of participation of the elderly in the labor market, in 1977, 4.9%, in 1998, this number rose to 9% and the expectation is that in 2020, 13.0% of the employed population in the country (Sato, 2020; Moura, 2006), even more, with the pension reform that set the minimum age of 62 for women and 65 for men to

retire (Barros, 2021). Since 1990, despite the accelerated pace of population aging, there has been a drop in the proportional participation of the elderly in the labor market. From 1992 to 2002, the economically active population (EAP) grew by 24.1%, and from 2002 to 2012, by 14.1%. The elderly EAP increased by 23.2% in the first period, and by 32.8% in the second. This rate of growth is explained by the aging of the population and its permanence in the labor market after retirement. These percentages are lower than the total growth of the elderly population, of 40.6% and 51.8%, for the same periods (Felix, 2019; Fialho, 2019; Amorim, 2018). The mature worker (over 55 years old) or the elderly retiree is returned to the market in a precarious labor situation, because they are willing to work by accepting "low labor guarantees", under the justification of reduced productivity or cuts in production costs, by firing employees with higher salaries, or they return as self-employed workers (Felix, 2016). As a way of ensuring the employability of older people, the European Union (EU) has encouraged older workers to remain employed through welfare reforms such as raising the retirement age and labor market policies. In 2000, the EU launched the Lisbon Strategy, to increase the EU average employment rate among older women and men aged 55 to 64 to 50 percent by 2010, but the goal was only achieved in six countries: Cyprus, Denmark, Estonia, Portugal, Sweden and the United Kingdom (Leszko, 2017). In Poland, one finds incentives to hire individuals over the age of 50, a ban on dismissal when the worker is four years away from retirement, improved safety conditions for older workers, and training for new skills in the face of labor market innovations and incentives to increase employment opportunities for the elderly, with differentiated work hours (Leszko, 2017). In addition to investments in education and health conditions, they increase the longevity of the elderly in the labor market (Giattil, 2003; Castro, 2019; Pazzos, 2020), adding that the experience of the elderly is also an attribute that helps intellectual production (Sato, 2020; Morato, 2020). Offering flexible working hours; adequate ergonomic conditions, requiring less physical effort and with less wear on their health; management of intergenerational groups; and the creation of strategies to deal with ageism in companies are the main conclusions in studies conducted in the Netherlands, United Kingdom, USA, Norway, Denmark, and Canada, to keep the elderly in the labor market (Batista, 2021) and the promotion of gender equality strategies for the elderly woman (UN, 2019). The Brazilian agribusiness scenario is in a significant technological evolution in its means of production, called Agribusiness 4.0, considered the fourth industrial revolution, and is the joining of the digital evolution with automation of activities in the field, requiring more qualified workers, reducing the number of people employed, since 2002, overcoming the adaptation capacity of individuals (Moraes, 2021; Renzcherchen, 2021).

In Mato Grosso, precision agriculture uses communication and information technologies - ICT in agricultural equipment, requiring fewer workers with increasing qualifications (Farias, 2022). Although technological innovations have brought continuous changes, it does not prevent the training of workers aged 50 years or older, who can learn new ICT, ensuring personal satisfaction, including with the completion of training, despite the possible difficulty in the learning process for training and retraining of the elderly, even in the use of ICT (Sato, 2020; Raymundo, 2019). It is observed that not only are guidelines necessary to qualify the health service, fight prejudice against the elderly, and re-adaptation to the labor market, under the Statute of the Elderly (Mato Grosso, 2003) but actions to ensure conditions for them to remain in the labor market, through public policies (Sato, 2020), including inspection, as a form of active aging (WHO, 2002), because findings indicate that elderly people who work have more satisfaction in life, compared to those who stopped. (Castro, 2019; Pazzos, 2020; Amorin, 2018; Batista, 2021). Public policies help fight inequality in the job supply for people over 50 years old, given the reconfiguration of work modes due to technologies in work activities, when young people master these new technologies better (Barros and Raymundo, 2021), including with the flexibilization of the labor market, aiming, for example, to increase the participation of women and the elderly in the employed population (Stampe et al, 2010) ensuring social participation in these discussions (Pazzos, 2020). The better the public health and employment policies for the elderly, the fewer chronic diseases, the fewer expenses with treatment and medical assistance, and with more the quality of life (WHO, 2005; Amorim et al, 2018). As the technical progress in agribusiness reduces the capacity to absorb unskilled labor (Farias, 2022), the state of Mato Grosso can implement policies to improve the health and training of the elderly to remain in the labor market, including incentives for entrepreneurship in the supply of jobs and working conditions, given the technological needs of agribusiness, in attention to Article 14 of State Complementary Law 131/2003, which deals with the stimulation of the elderly in the labor market and the re-adaptation of the elderly in the productive process (Mato Grosso, 2003). The need for new governance models to meet the needs of the elderly population in the labor market in addition to the new social security and labor protection policies already in place in Europe, Brazil, and Mato Grosso, is observed (OCDE, 2022) because demographic changes can favor economic growth when appropriate policies are implemented (Queiroz, 2010). Among the limitations of the study is the use of secondary data, which depends on the quality of the records, and the difficulty of comparing the results with those from other locations, due to methodological differences related to the period of analysis, and age limit, among others. As a potentiality, the need to implement policies to ensure the employability of the elderly and active aging is indicated.

Final considerations

The aging indicators studied (60 years or older, 65 years or older, IEP 60 years, IEP 65 years, RDI 60 years, and RDI 65 years) materialize growth opportunities in Mato Grosso, given the economically active population, which is still young, with a tendency for the elderly population to grow. This shows the challenge faced by public policies for the maintenance of the elderly in the job market and the creation of new jobs, including for women, reducing the burden of social security, as an incentive to schooling, health care, adapting roles given eventual physical limitations, making the work day more flexible, training for new technologies used in agribusiness and incentives for entrepreneurship, as a way to improve the quality of life, ensuring active aging, with monitoring to inhibit the creation and maintenance of underemployment. Social and health policies are also needed to face the demographic transition to maintain the economically active population, with policies to encourage birth rates, child care, and the protection of women, including flexible working hours for parents, as was found in France. The implementation of these policies and their enforcement may occur, including through tax incentives at the state level, because keeping the elderly in the labor market implies more income, as a way to ensure economic development and active aging.

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REFERENCES

UN - United Nations. Department of Economic and Social Affairs, Population Division (2020). World Population Ageing 2019 (Disponível em: https://www.un.org/en/development/desa/population/publications/pdf/ageing/WorldPopulationAgeing2019-Report.pdf Acessado setembro 16, 2021.

UN - United Nations. United Nations Decade of Healthy Ageing (2021-2030) (Disponível em: https://undocs.org/en/A/RES/75/131 Acessado novembro 04,2021.

Helpage international. Global AgeWatch. Index 2015. Global rankings table. 2015 (Disponível em: https://www. helpage. org/global-agewatch/population-ageing-data/global-rankings-table/Acessado fevereiro 28, 2022.

Veras R. Envelhecimento populacional contemporâneo: demandas, desafios e inovações. Rev. Saúde Pública (Internet). 2009;43(3):548-554.

Oliveira HN, Silva CAM, Oliveira ATR. Imigração internacional: uma alternativa para os impactos das mudanças demográficas no Brasil?. Revista Brasileira de Estudos de População (online). 2019;36.

Giattil L, Barreto SM. Saúde, trabalho e envelhecimento no Brasil. Cadernos de Saúde Pública (online). 2003;19(3):759-771.

WHO - World Health Organization. Envelhecimento ativo: uma política de saúde. Brasília: Organização Pan-Americana da Saúde; 2005.

Closs VE, Schwanke CHA. A evolução do índice de envelhecimento no Brasil, nas suas regiões e unidades federativas no período de 1970 a 2010. Revista Brasileira de Geriatria e Gerontologia (online). 2012;15(3):443-458.

SEPLAG - Secretaria de Estado de Planejamento do Estado de Mato Grosso. Caderno de Indicadores Demográficos Mato Grosso. 2018 (Disponível em: http://www.seplan.mt.gov.br/documents/363424/5931254/Caderno+Indicadores+Demogr%C3%A1ficos_+2018.pdf/6bc0f6e9-0e31-0edd-157b-289ddf0b7b43 Acessado outubro, 29, 2021.

IMEA - Instituto Matogrossense de economia agropecuária. Mapa das macrorregiões do IMEA; 2017 (Disponível em: https://www.imea.com.br/imea-site/view/uploads/metodologia/justificativamapa.pdfAcessado março 01, 2022.

Moraes PM, Costa JA, Cunha LSB, Mascarenhas AW. Aplicação de tecnologia da Informação no agronegócio da macrorregião sudeste do Estado De Mato Grosso. Research, Society and Development. 2021;10(1).

Queiroz BL, Turra, CM. Window of opportunity: socioeconomic consequences of demographic changes in Brazil. Washington, DC: NTA; 2010.

IBGE - Instituto Brasileiro de Geografia e Estatística. Municípios; 2022 (acesso em 14 mar 2022). Disponível em https://www.ibge.gov.br/cidades-e-estados/mt/

National Cancer Institute, Surveillance, Epidemiology and end Results. Join Point Regression Program. Version 8.3.6.1. Bethesda: SEER; 2020 (Disponível em: https://seer.cancer. gov/ seerstat/Acessado outubro 30, 2021.

Kim HJ, Fay MP, Feuer EJ, Midthune DN. Permutation tests for joinpoint regression with application to cancer rates. Stat Med. 2000;19:335-51.

Clegg LX, Hankey BF, Tiwari R, Feuer EJ, Edwards BK. Estimating average annual percent change in trend analysis. Stat Med. 2009;28(29):3670-82.

Ogura S, Jakovljevic MM. Editorial: Global Population Aging - Health Care, Social and Economic Consequences. Frontiers in Public Health. 2018;6.

Siegel JS; Swanson DA. The Methods and Materials of Demography. 2. ed. San Diego, Califórnia: Elsevier Academic Press; 2004.

Leszko M, Bugajska B. The Evaluation of Employment Policies for Older Adults in the Czech Republic, Poland, and Slovakia. In Tomczyk L, Klimczuk A, coordenadores, Selected Contemporary Challenges of Ageing Policy. Kraków: 2017, Uniwersytet Pedagogiczny w Krakowie. p. 69-87.

Farias LFFC. Metamorfoses do trabalho no estado do Mato Grosso - Brasil. Revista Tamoios. 2022;18(Supl l).

Fialová D, Desplenter F. Aging of the Population, Clinical Pharmacy Services, and Interdisciplinary Cooperation in the Optimization of Pharmacotherapy in Older Patients. Drugs Aging. 2016;33(3):163-7.

Jakovljevic M. The aging of Europe. The unexplored potential. Farmeconomia Health Econ Therapeutic Pathways. 2015;16(4):89-92.

Lamnisos D, Giannakou K, Jakovljevic M. Demographic forecasting of population aging in Greece and Cyprus: one big challenge for the Mediterranean health and social system long-term sustainability. Health Res Policy Sys. 2021;19(21).

Stampe MZ, Pozzobon F, Niquito TW. Impactos da estrutura etária sobre o desempenho econômico das regiões do Brasil entre 1991 e 2010. Revista Brasileira de Estudos de População (online). 2020;37.

Amaro LC, Afonso LE. Quais são os efeitos do envelhecimento populacional nos sistemas previdenciários de Brasil, Espanha e França?. Revista Brasileira de Estudos de População. 2018;35(2)(Supl 1):S1–29.

Felix J. O idoso e o mercado de trabalho. In Alcantara AO, Camarano AA, Giacomin KCG. Política nacional do idoso: velhas e novas questões. Rio de Janeiro: Ipea; 2016.

(Bayarre VEA, Héctor D, Lauzarique MEA, Piñero JSP, Rodríguez KA, Cabrera AR, et al. Enfoques, evolución y afrontamiento del envejecimiento demográfico en Cuba. Rev Panam Salud Publica. 2018;42(e21).

Fialho AAB, Mafra SCT, Pio ES, Silva AAP, Zanancio SV. A pessoa idosa e o mercado de trabalho: uma análise a partir da ped 2014 da região metropolitana de Belo Horizonte. Estud. interdiscipl. envelhec. 2019;24(1):9-29.

Castro CMS, Costa MFL, César CC, Neves JAB; Sampaio RF. Influência da escolaridade e das condições de saúde no trabalho remunerado de idosos brasileiros. Ciência & Saúde Coletiva (online). 2019;24(11):4153-4162.

Pazzos PFB, Bonfatti RJ. Velhice, trabalho e saúde do trabalhador no Brasil: uma revisão integrativa. Revista Brasileira de Geriatria e Gerontologia (online). 2020;23(6).

Sato AT, Lancman S. Public policies and the insertion of old people in the labor market in Brazil. Revista Brasileira de Geriatria e Gerontologia (online). 2020;23(06).

Moura JEA, Paiva MJG. Inserção de idosos no mercado de trabalho formal brasileiro em 1996, 2006 e 2016. Revista Direitos, trabalho e política social. 2019;5(8):100-113.

Barros L, Raymundo TM. Envelhecimento, trabalho e tecnologia: motorista de aplicativos como possibilidade laboral para a população 50+. Cadernos Brasileiros de Terapia Ocupacional(online). 2021;29:1-20.

Amorim JSC, Mesas AE, Trelha CS. Fatores associados à ótima capacidade para o trabalho em servidores idosos de uma universidade no Sul do Brasil. Revista Brasileira de Saúde Ocupacional (online). 2018;43:e15:1-12.

Morato LZ, Ferreira HG. O mercado de trabalho para idosos: a consultoria como possibilidade de atuação. Rev. Psicol., Organ. Trab. 2020;20(3):1097-1104.

Batista RL, Teixeira KMD. O cenário do mercado de trabalho para idosos e a violência sofrida. Revista Brasileira de Geriatria e Gerontologia (online). 2021;24(6):1-10.

Renzcherchen SK, Siatkowski A, Marcowicz T, Castro M. Desenvolvimento do agronegócio 4.0 e seu impacto no mercado de trabalho rural. Revista de Estudos em Organizações e Controladoria. 2021;1(2):98-118.

Raymundo TM, Castro CSS. Analysis of a training program for older workers in the use of technology: difficulties and satisfaction. Revista Brasileira de Geriatria e Gerontologia (online). 2019;22(05).

MT - Mato Grosso. Lei complementar nº 131, de 17 de julho de 2003. Institui o Estatuto da Pessoa Idosa no Estado de Mato Grosso e dá outras providências. Promulgada em 05 de outubro de 1989. Diário Oficial do Estado – DOE de 17.07.2003.

OCDE - Organization for Economic Co-operation and Development. Maintaining Prosperity in an Ageing Society. Paris: Organização para Cooperação e Desenvolvimento Econômico; 1998 (Disponível em: https://www.oecd.org/els/public-pensions/2429430.pdfAcessado fevereiro 28, 2022.

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