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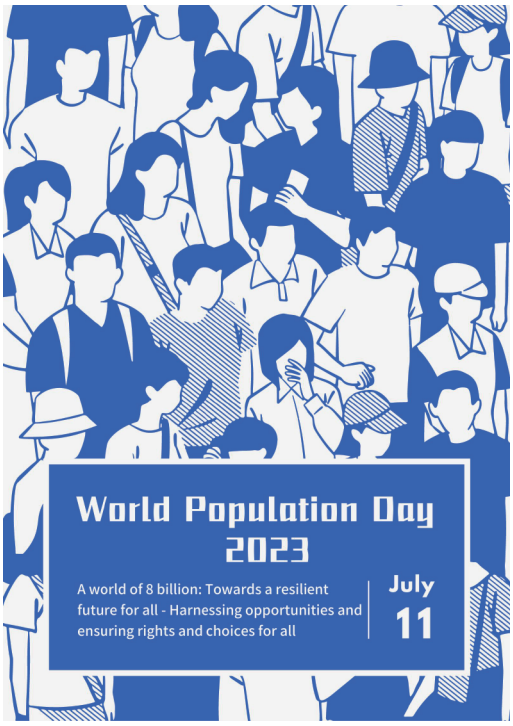

WORLD POPULATION DAY ISSUE

Preplanned Studies

Perspectives

ISSN 2096-7071

Cover Image: poster of World Population Day, redesigned by Meng Wang, China CDC Weekly.
This week's issue was organized by Guest Editor Xiaoying Zheng.

Preplanned Studies

Activities of Daily Living-Related Functional Impairment Among Population Aged 65 and Older — China, 2011–2050

Binbin Su[1,&]; Panliang Zhong[2,&]; Chen Chen[2]; Yu Wu[2]; Xiaoying Zheng[2,#]

Summary

What is already known about this topic?

The elevated prevalence of functional impairment among elderly individuals in China contributes to an increased burden of care.

What is added by this report?

This report presents a comprehensive evaluation of trends in functional impairment related to activities of daily living (ADL) among the elderly population in China. Furthermore, it offers insights for future projections of these trends in this demographic group.

What are the implications for public health practice?

Addressing the care needs and functional impairment issues among the aging population in China necessitates interdepartmental collaboration.

Aging is often accompanied by diminished physical health, increased prevalence of chronic diseases, and a higher incidence of functional impairment (*1*). China, home to the world's largest geriatric population, experienced a 4.63% increase in the demographic aged 65 and above between 2010 and 2020 (*2*). The rapidly growing elderly population is exacerbating the disability issue. In 2015, China reported 40.63 million geriatric individuals with functional impairment, of whom 64.5% were rural residents (*3*). Utilizing data from the Chinese Longitudinal Healthy Longevity Survey (CLHLS), this research examines the factors contributing to functional impairment in China's geriatric population and makes projections for future changes in dependency among the elderly from 2019 to 2050. This study reveals that the standardized prevalence of functional impairment among Chinese adults aged 65 and above declined from 2011 to 2018 and will continue to decrease from 2018 to 2035. However, it is projected to increase after 2035, with the population of elderly individuals reaching 42.18 million by 2050. Proactive measures are needed to address the anticipated rise in the number of disabled elderly individuals.

The study utilized data from three CLHLS waves collected between 2011 and 2018, focusing on individuals aged 65 and older. Functional impairment assessment was based on activities of daily living (ADL) (*4*), which include six essential activities. Each ADL was categorized into three levels of dependency: mild impairment (having one or more ADL activities with "partial independence" but none of the six ADL activities with "complete dependence on others"), moderate impairment (having one to two ADL activities with "complete dependence on others"), and severe impairment (having three or more ADL activities with "complete dependence on others"). Moreover, the functional impairment rate was estimated using age-standardization techniques.

A binomial generalized linear mixed model, which accounted for the cluster effect of years, was employed to analyze the social and economic factors influencing functional impairment. To identify the key factors associated with shifts in functional dependency between 2011 and 2018, a linear probability model was developed. Future changes in dependency among older adults from 2019 to 2050 were projected based on the estimated coefficients from the linear probability model. All statistical analyses were conducted using R (version 4.2.2; R Core Team, 2022, R Foundation for Statistical Computing, Vienna, Austria).

This study included a total of 31,114 participants. Across all waves of data collection, more than half of the participants were aged over 85 years, and the samples predominantly comprised women, individuals from rural areas, and those who had never attended school. Significantly, approximately half of the participants resided in the eastern region of China (Table 1). The standardized prevalence of functional impairment among Chinese adults aged 65 years or older exhibited a slight decline from 13.10% in 2011

TABLE 1. Basic demographic information for the three waves of the study population.

Subgroup	2011	2014	2018
	N=9,385	*N*=6,719	*N*=15,010
Functional impairment, *n* (%)	2,500 (26.6)	1,654 (24.6)	3,980 (26.5)
Male, *n* (%)	4,216 (44.9)	3,080 (45.8)	6,561 (43.7)
Rural, *n* (%)	4,903 (52.2)	3,619 (53.9)	6,710 (44.7)
Age group, *n* (%)			
65–74 years	1,882 (20.1)	1,107 (16.5)	3,116 (20.8)
75–84 years	2,476 (26.4)	2,152 (32.0)	4,069 (27.1)
85+ years	5,027 (53.6)	3,460 (51.5)	7,825 (52.1)
Attended school, *n* (%)	3,911 (41.8)	2,887 (43.3)	6,415 (49.8)
Regions, *n* (%)			
Eastern	4,484 (47.8)	3,223 (48.0)	7,414 (49.4)
Central	2,592 (27.6)	1,960 (29.2)	3,875 (25.8)
Western	2,309 (24.6)	1,536 (22.9)	3,721 (24.8)
Household-income, *n* (%)			
Low-income	1,446 (20.0)	1,184 (22.3)	2,308 (20.5)
Low-middle-income	1,641 (22.7)	1,095 (20.6)	2,336 (20.7)
Middle-income	1,246 (17.3)	1,235 (23.3)	2,195 (19.5)
Middle-high-income	1,439 (19.9)	680 (12.8)	2,385 (21.2)
High-income	1,449 (20.1)	1,114 (21.0)	2,051 (18.2)
Married, *n* (%)	3,540 (37.8)	2,633 (39.6)	6,075 (40.9)
Living alone, *n* (%)	1,582 (17.0)	1,247 (18.7)	2,359 (15.9)
Having medical insurance, *n* (%)	1,446 (20.0)	1,184 (22.3)	2,308 (20.5)

to 10.91% in 2018. As age increased, the prevalence of functional impairment in the elderly demonstrated an exponential growth trend. In 2018, the impairment rate was 3.78% for the 65–74 age group, 9.74% for the 75–84 age group, and 42.28% for the 85 and older group. Notably, the prevalence of functional impairment among elderly women was significantly higher than among elderly men, and the urban elderly population displayed a higher prevalence than their rural counterparts (Table 2).

Upon examining specific contributing factors, the results of the regression analysis revealed that being male [0.86, 95% confidence interval (*CI*): 0.79, 0.93], attending school (0.79, 95% *CI*: 0.72, 0.86), having a high-income level (0.83, 95% *CI*: 0.73, 0.93), being married (0.58, 95% *CI*: 0.53, 0.63), and being covered by medical insurance (0.72, 95% *CI*: 0.65, 0.80) all serve as protective factors mitigating the risk of functional impairment in older adults (Figure 1).

This study utilized regression models to provide preliminary predictions on the elderly functional impairment rate and population size in China from 2020 to 2050. The findings indicate that between 2020 and 2035, the functional impairment rate among the elderly in China will display a declining trend, decreasing from 10.91% in 2018 to 9.10% in 2035. However, after 2035, the functional impairment rate among the elderly will gradually increase. Additionally, based on the data estimated in this study, the population of elderly individuals aged 65 and above with ADL disabilities in China was approximately 17.75 million in 2018. By the years 2025 and 2035, the population of elderly individuals aged 65 and above with disabilities will reach approximately 20.76 million and 28.69 million, respectively. Furthermore, by the year 2050, the population of elderly individuals with disabilities will reach 42.18 million (Figure 2).

DISCUSSION

This study focuses on analyzing the changing trends and factors influencing functional impairment among the elderly population in China over the past decade. Additionally, it projects the prevalence and magnitude of functional impairment in the elderly population

TABLE 2. Prevalence of functional impairment across three levels: comparisons by sex, residential region, and age group.

Subgroup	2011	2014	2018	Average annual growth rate (%)
Overall functional impairment (%)	13.10	13.46	10.91	−0.0257
Urban	14.40	15.91	11.79	−0.0281
Rural	11.66	11.23	9.98	−0.0220
Male	12.09	12.11	9.47	−0.0342
Female	14.31	15.10	12.49	−0.0193
65–74 years	6.30	5.97	3.78	−0.0705
75–84 years	13.28	13.61	9.74	−0.0432
85+ years	39.59	36.16	42.28	0.0095
Mild impairment (%)	4.29	4.33	3.01	−0.0496
Urban	4.29	4.87	3.20	−0.0410
Rural	4.30	3.84	2.80	−0.0593
Male	4.14	3.75	2.81	−0.0537
Female	4.48	5.04	3.22	−0.0462
65–74 years	2.93	2.52	1.24	−0.1149
75–84 years	4.59	5.00	3.60	−0.0341
85+ years	8.92	7.96	8.80	−0.0018
Moderate impairment (%)	6.49	6.33	5.72	−0.0177
Urban	7.46	7.65	6.32	−0.0235
Rural	5.41	5.13	5.10	−0.0085
Male	5.76	5.86	5.04	−0.0191
Female	7.35	6.90	6.48	−0.0180
65–74 years	2.73	2.28	1.95	−0.0473
75–84 years	6.53	6.19	4.74	−0.0448
85+ years	21.25	19.28	23.13	0.0122
Severe impairment (%)	2.32	2.80	2.18	−0.0087
Urban	2.65	3.39	2.28	−0.0216
Rural	1.95	2.26	2.08	0.0093
Male	2.19	2.50	1.63	−0.0417
Female	2.47	3.16	2.79	0.0174
65–74 years	0.64	1.18	0.58	−0.0132
75–84 years	2.15	2.41	1.40	−0.0595
85+ years	9.42	8.93	10.35	0.0135

Note: mild impairment was defined as having 1 or more activities of daily living (ADL) activities with “partial independence” but none of the 6 ADL activities with “complete dependence on others”; moderate impairment was defined as having 1 to 2 ADL activities with “complete dependence on others”; severe impairment was defined as experiencing “complete dependence on others” for three or more ADL activities.

from 2020 to 2050. The findings suggest a decreasing trend in the level of functional impairment among the elderly in recent years. Factors such as gender, age, residential area, access to medical insurance, and availability of medical resources play a significant role in affecting functional impairment among the elderly population.

According to the analysis and predictions in this study, the rate of functional impairment among the elderly population in China demonstrates a temporal trend, initially characterized by a decline, followed by a subsequent increase. Notably, a consistent downward trajectory was observed in the functional impairment rate from 2020 to 2035. This finding aligns with previous pertinent investigations and supports the consensus established by prior national surveys (*5*). The decline could be attributable to factors such as improved healthcare (*6*), heightened awareness of

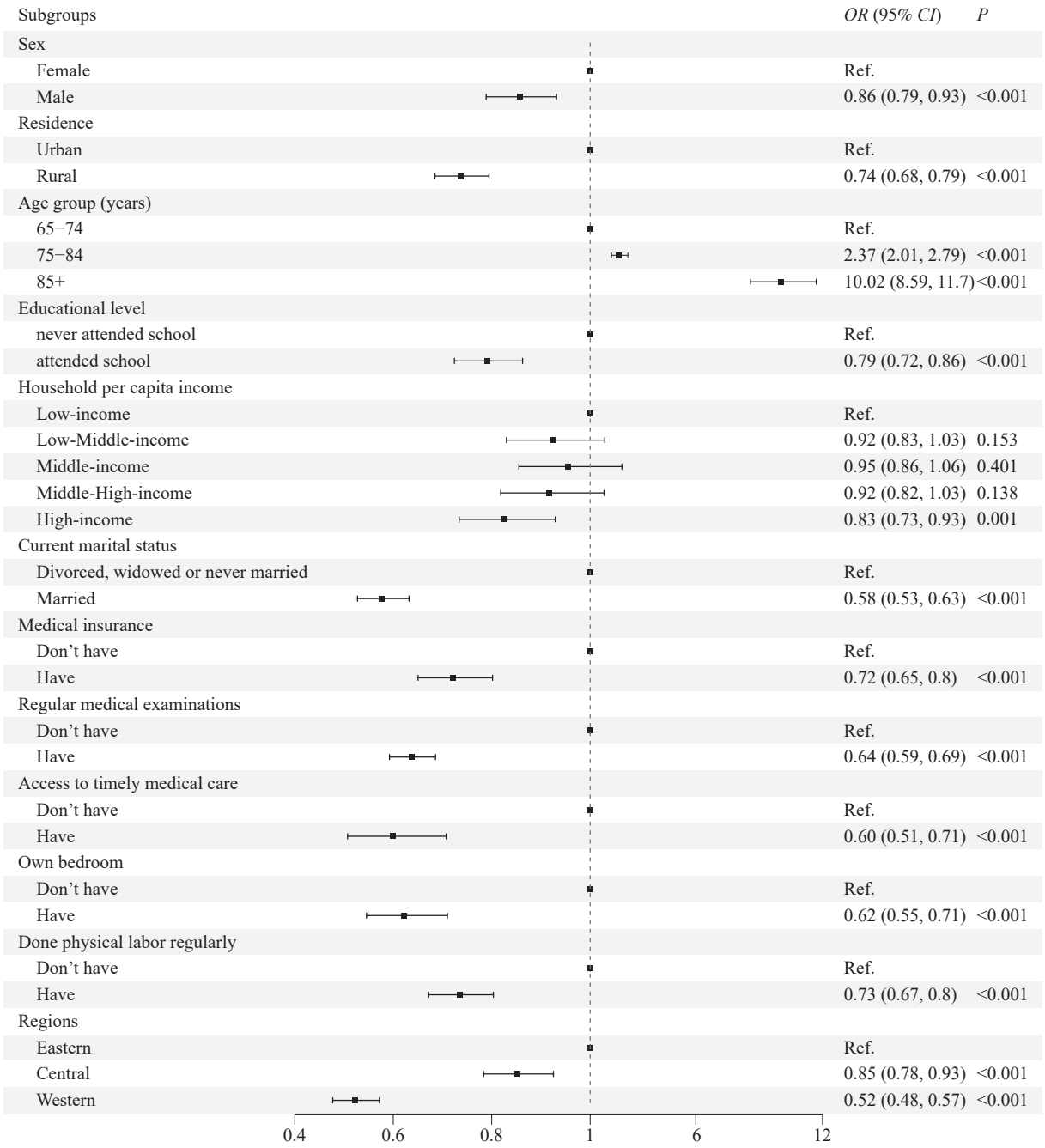

FIGURE 1. Demographic and socioeconomic influencing factors on functional impairment among older adults in China.

lifestyle-related diseases (*7*), and advances in medical technology (*8*). While these factors likely contribute to a decreased incidence of disability, they also result in extended lifespans, thereby increasing the size of the elderly population who may eventually experience disabilities. However, from 2035 to 2050, the functional impairment rate among elderly individuals will display an increasing trend. The primary reason for this is the substantial growth in the older adult population, as the negative effects of population aging outweigh the positive impact of improved external conditions.

The magnitude of functional impairment among the elderly population in China is steadily increasing. Projections estimate that the number of elderly individuals with disabilities will rise to 28.69 million by 2035 and further to 42.18 million by 2050. Moreover, the growing issue of functional impairment among the aging population in China demands attention. The findings of this study reveal a rising

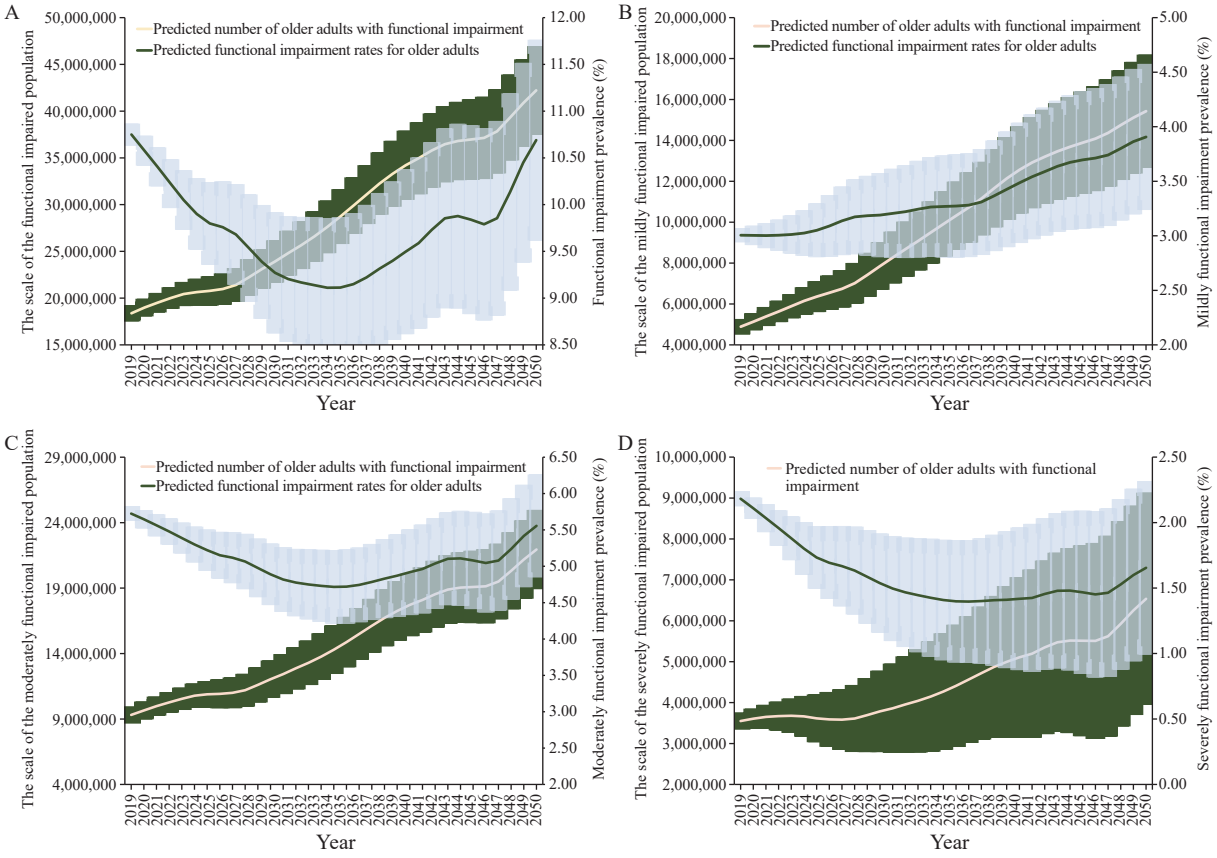

FIGURE 2. Projected functional impairment rates and the scale of functionally impaired older adults in China from 2019 to 2050. (A) total functional impairment rates and scale; (B) mild impairment rate and scale; (C) moderate impairment rate and scale; (D) severe impairment rate and scale.

trend in functional impairment rates among individuals aged 85 and above, particularly among women and elderly populations residing in rural areas. The increased prevalence of disability among women and the rural elderly population could be attributed to deeply ingrained gender roles and socioeconomic disparities that affect access to quality healthcare (*9*).

This study presents several limitations. First, the data on functional impairment were primarily gathered and evaluated through self-report or proxy report, which may introduce some discrepancies with the actual situation (*10*). Second, as noted earlier, the findings may not adequately represent older adults in the western region, considering that eight provinces in this area were not included in the CLHLS. Finally, certain potential factors contributing to the decline in dependency rates, such as the expansion of long-term care pilot projects and enhancements in health literacy, were not examined in our study due to the unavailability of relevant data.

In conclusion, this study highlights that despite general trends indicating a decrease in functional impairment rates among older adults, the mounting concerns related to an increasing number of disabled elderly individuals and the growing functional impairment rates among specific subgroups should not be overshadowed. As a result, policy responses and interventions must adopt a comprehensive approach that not only aims at reducing functional impairment rates, but also addresses diverse health needs, taking into account age, gender, and regional disparities. A more targeted and robust medical and social insurance system is necessary to manage the anticipated rise in the number of disabled elderly individuals. Consequently, the Chinese government must implement proactive measures to address the substantial caregiving burden caused by the forthcoming aging population.

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Perspectives

The Impact of Low Fertility Rates on Labor Demand and Socioeconomic Development in China

Yutong Wu[1]; Binbin Su[2,#]; Jun Li[3]

The World Population Prospects report, published by the United Nations in 2022, revealed a decline in the global population growth rate (PGR) to less than 1% — the lowest recorded rate since 1950. Predictions suggest a further decrease to 0.5% by 2050, culminating in negative growth in more than 60 countries and intensifying the issue of population aging (*1*). China, a highly populous nation, is encountering even more acute challenges. By the conclusion of 2022, China's population totaled approximately 1.412 billion, reflecting a decline of 850,000 from the prior year and a natural PGR of –0.06% (*2*). This negative growth, China's first since the 1960s, indicates that the peak of China's population was reached in 2021, with a slide into negative growth from 2022 onward. Examining the population structure between 2010 to 2022, there was a decrease in China's working-age population (ages 15–64) from 74.5% to 68.2% and an increase in the over-65 demographic from 8.87% to 14.9%, whereas the under-15 age group experienced only negligible change. This scenario underscores the escalating trend of aging in China, propelled by persistently low fertility rates.

China's negative population growth poses challenges and opportunities for its socio-economic development. Firstly, changes in population size and structure will bring about major alterations in family dynamics and societal systems, significantly impacting social demands and resource allocation strategies. Additionally, the decline in the working-age population, being central to economic development, will notably curtail economic growth potential. Conversely, a reduced population size will increase per capita resource allocation in sectors like education and healthcare, presenting an opportunity to enhance the quality of life. These demographic changes can also spur a new wave of industrial revolution, creating novel development prospects.

Decelerating or Negative Population Growth is Common in Advanced Economies

The evidence from developed countries suggests that as economic development reaches a specific threshold, it is usual to observe a decrease in population growth, which can even become negative (*3*). The demographic transition theory (*4*), alongside the dual economic development theory (*5*), provides a deeper understanding of the inherent relationship between economic progress and population transitions. In the early phases of societal development, a shortage of resources and inadequate sanitation conditions contribute to high birth and death rates. As socioeconomic conditions advance, enhancements in living standards, technology, and healthcare lead to a decrease in mortality rates, eliciting a swift population growth. With the amelioration of women's social status and shifts in fertility perspectives, birth rates begin to drop, and overall population growth progressively slows down. Consequently, as the per capita gross domestic product (GDP) continues to increase, birth and death rates globally transition from an initial high plateau to a final low equilibrium.

Figure 1 shows that high-income countries have seen a decline in birth rates (from 4‰ to 2‰) and death rates (from 10‰ to under 8‰) since 1960, resulting in a near-zero net population growth rate. Simultaneously, the per capita GDP has consistently grown, reaching approximately 50,000 United States dollars (USD) by 2020. Figure 2 portrays the dynamic patterns in China's population and economic growth. Since its establishment, China has experienced rapid growth in per capita GDP while the net PGR has reduced to –0.6‰. Although the decline in net PGR mimics that of developed countries, the per capita GDP level is strikingly different. This is attributed to the long-term prosperity of developed countries, enabling wealth accumulation and extensive distribution systems. These factors have led to slower population transitions and higher average GDP. Despite China's substantial economic strides, a significant disparity remains compared to developed nations. Concurrently, the swift demographic transition from high to low growth highlights an escalating aging problem before achieving comparable development levels. However, the onset of negative population growth in China should not incite panic, as it is an inevitable milestone in economic progression

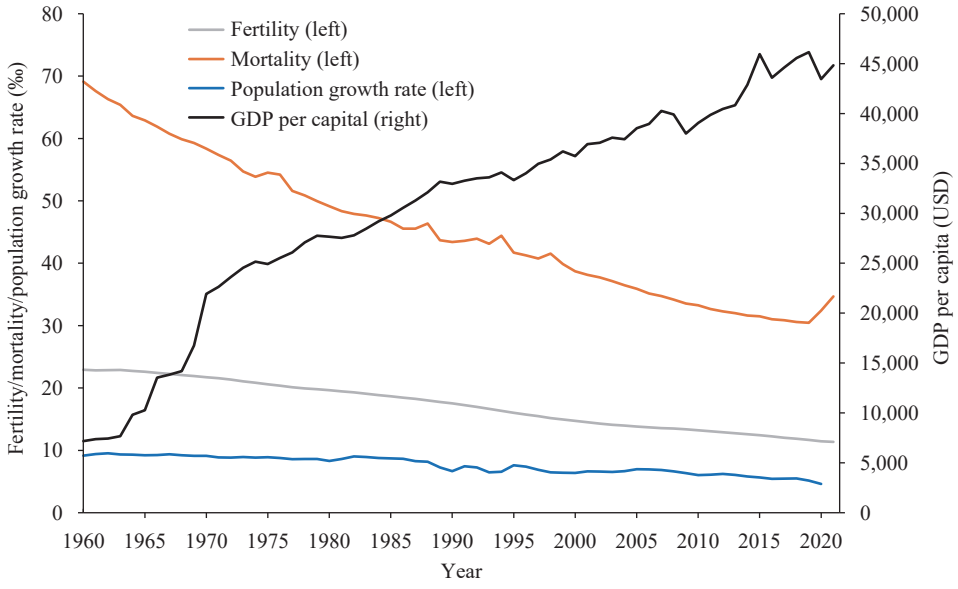

FIGURE 1. Correlation between per capita GDP and net population growth rate in high-income countries.
Note: Data depicted in the figure has been computed independently, utilizing information from the World Bank. All data has been weighted concerning each country's GDP scale and population size.
Abbreviation: GDP=gross domestic product; USD=United States dollars.

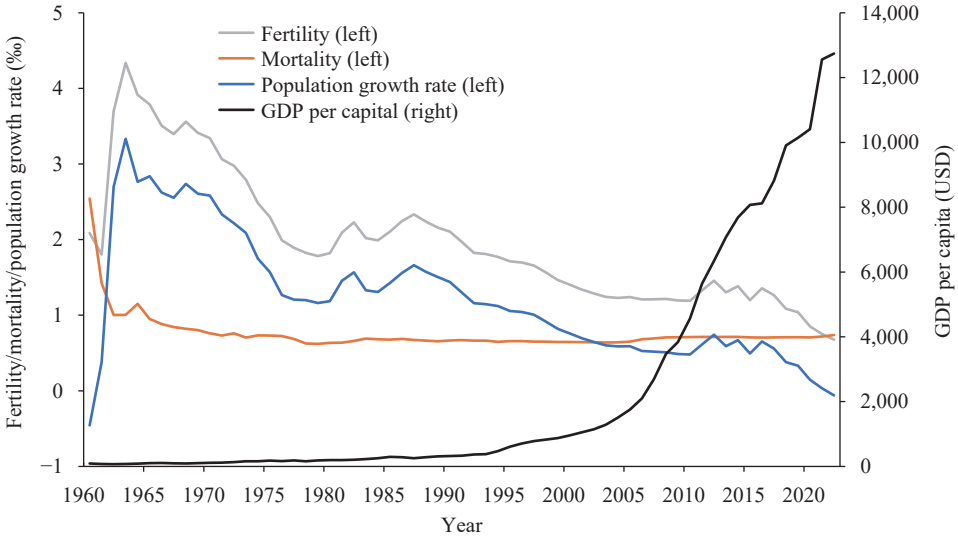

FIGURE 2. The relationship between per capita GDP and population trends in China.
Data source: National Bureau of Statistics.
Abbreviation: GDP=gross domestic product; USD=United States dollars.

and marks a new phase. Addressing this demographic landscape, the pertinent issues are formulating responses to challenges and capitalizing on opportunities for development.

The Profound Effects of Demographic Shifts on China's Socioeconomic Development

Changes in demographic trends and conditions present a host of societal challenges: In the short term, negative population growth could significantly impact industries like infant care and education due to declining demand. A lower birth rate is shrinking the infant care market and increasing competition, while a decreasing youth population risks oversupplying educational resources. Conversely, the expanding elderly population and demand for lifelong learning may cause a shortage of educational resources for seniors, necessitating structural changes in education to

align with demographic shifts.

In the long term, population structure changes could profoundly alter family structures and society. This could result in a continuous rise in the family dependency ratio, increasing family burdens without a commensurate income increase. The government might need to allocate more resources to elderly care, possibly at the expense of the younger workforce, reducing social resource allocation efficiency and threatening long-term societal and economic sustainability.

Population factors significantly affect the long-term potential output level of an economy: Each stage of the demographic transition presents varying impacts on both the demand and supply factors in the economy (*6*). When the size of the labor force is at its peak, it mainly influences the supply side of the economy, thereby determining the potential level of long-term growth. Conversely, at the peak of overall population size, the main economic impact manifests in demand, leading to an immediate decrease in total demand, consequently impinging on the potential output level. Over a longer duration, such a change promulgates a structural shift in demand and subsequently triggers industrial restructuring, introducing fresh opportunities and challenges for the market.

The Impact of the Current Population Situation on the Labor Market

Short-term impacts: Despite the onset of an aging society and the occurrence of negative population growth in China, its massive population size still stands strong. Current data indicates that the working-age population in China (those aged 16–59) achieved its zenith in 2011, and while it has gradually dropped since then, it remains substantial with an estimated 876 million in 2022 (*7*). In terms of structure, the contraction of the working-age population is principally attributed to older workers retiring from the economy. Evidence suggests that the fraction of retirees in relation to China's total population increased by 4.3 percentage points from 2011 to 2022. Furthermore, as urbanization catalyzes the transition of labor from rural to city regions, potential for labor supply expansion is inherent. Concurrently, technological progressions have precipitated a potent substitution effect on labor, with research demonstrating that with each standard deviation growth in robot utilization, the employment rate in China diminishes by 7.5% (*8*). Finally, the longstanding Chinese public education system has amassed a considerable pool of talent for economic escalation. The potential contribution of this human capital to the economy's growth remains untapped, offering substantial support for prospective industrial advancements.

Potential long-term consequences: Population reduction will inevitably alter societal expectations concerning the future, the signs of which will gradually become evident. This transition could be observable in the form of structural transformations, notably the conclusion of the high-growth period in the housing market, a reduction in the populace necessitating education, a decline in demand for infant commodities, and an escalation in the need for elderly care. These structural shifts have the potential to cause a significant change in labor market demand structure (*9*).

The Chinese employment market faces two main challenges. Firstly, structural shortages will intensify due to possible mismatches in supply and demand for skilled talents, with sectors like elderly care facing staff shortages. Secondly, as Figure 3 shows, the increasing proportion of older workers in the labor force may struggle to adapt to the fast-changing industrial landscape, which may lead to increased structural and frictional unemployment.

Understanding China's Population Size and Structure Issue Correctly

A moderate decrease in population has potential benefits for China's long-term economic development: This process could enhance the level of resources per capita and mitigate resource scarcity problems(*10*). Additionally, a reduction in population may stimulate the growth of per capita GDP, relieve saturation in the labor market, and foster increased labor productivity. Furthermore, a decrease in population suggests an associated increase in the per capita allocation of resources. This provides opportunities to further enhance the quality of the population, improving labor productivity.

The future structure of the population presents a significant challenge: As Figure 4 illustrates, changes in population structure are of particular importance in comparison to the overall decrease in population. The incidence of negative population growth in certain countries leads to a swift increase in the portion of the elderly population and a corresponding decline in the working-age and youthful populations. This dramatic

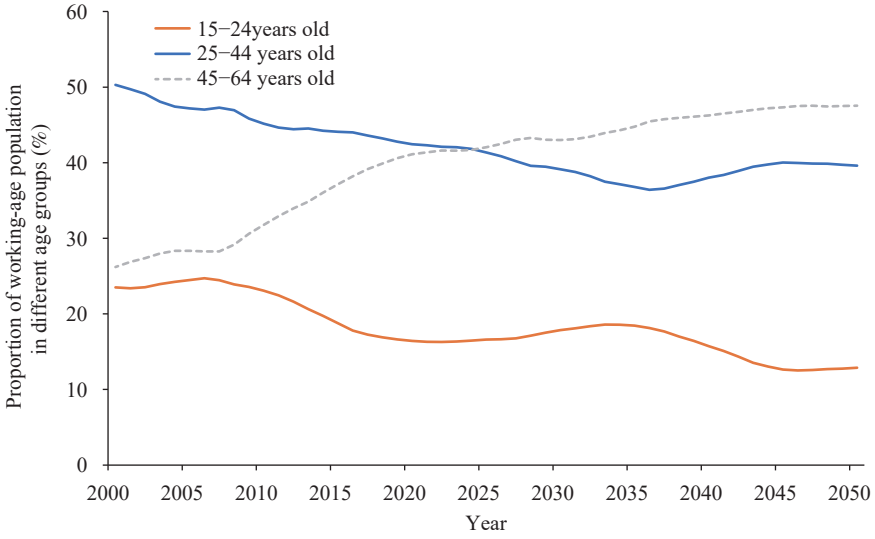

FIGURE 3. Alterations in the composition of the working-age population in China.
Note: Data was sourced from the United Nations' Department of Economic and Social Affairs Population Division's 2022 Revision of World Population Prospects.

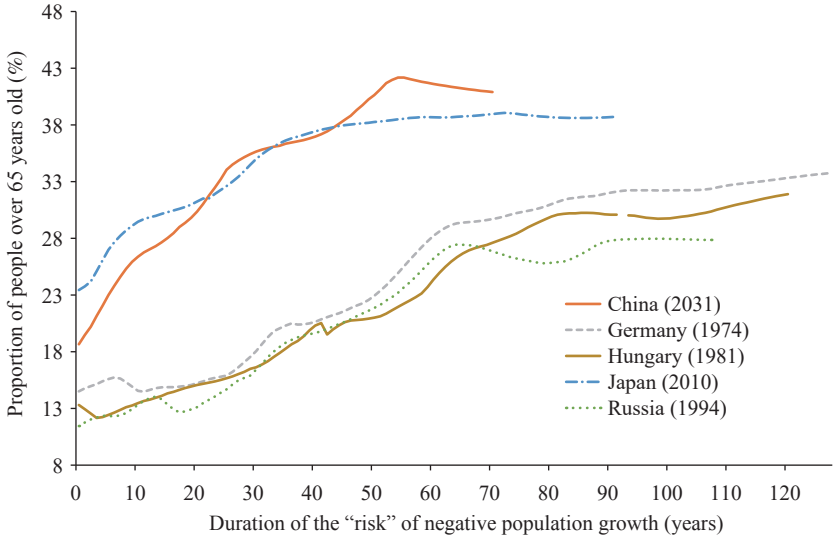

FIGURE 4. Trends in the proportion of aging population in China and selected countries with negative population growth.
Note: Data was sourced from the United Nations' Department of Economic and Social Affairs Population Division's 2022 Revision of World Population Prospects.

decrease in population can upset the balance between elderly individuals and the future younger population, thereby affecting socio-economic development. The dissolution of the demographic dividend exacerbates labor market discrepancies. Simultaneously, several factors, such as the enhancement rate of human capital, savings rate, capital return rate, and the efficiency of resource allocation, can curtail the potential for economic growth due to demographic changes.

Negative population growth in China offers novel opportunities for development in various sectors: Primarily, this shift prepares grounds for breakthroughs within the education and healthcare sectors. The spiral down in the number of compulsory-education students in the future implies that if the public education expenditure ratio to the GDP remains static, there will be a substantial improvement in the sufficiency of educational resources. This phase paves the way for China's third significant advancement, leading to the creation of a second demographic dividend (*11*). Second, the critical source of economic growth is the "population health

dividend," which comprises the workforce and elderly health (*12*). Lastly, negative population growth influences expectations surrounding family savings and the capital market in a way that promises more stabilized demand within the capital market. This transition also suggests new investment avenues for industries like healthcare, elderly care services, smart homes, and ecotourism.

Implications and Policy Recommendations

The transition of China into a phase of negative population growth marks a significant historical shift in its demographic landscape, indicating the onset of an unprecedented era in its population dynamics (*13*). Although this demographic transition presents challenges to the potential output level of the economy, it concurrently offers unique opportunities. As a result, a strategic policy response that includes a series of appropriate measures must be implemented to effectively address this transformative shift.

First, it is essential to develop and enforce supportive, flexible fertility policies that respect individual, family, and societal preferences. These policies should primarily seek to reduce the financial burden associated with childbearing. Second, it is imperative to leverage available opportunities to enhance the overall well-being and productivity of the population. This could involve improving national education and health levels by distributing educational resources equitably and investing heavily in the public health infrastructure. Third, it is crucial to address income distribution and diminish wealth disparities, particularly the prominent urban-rural divide and the limited size of the middle-income group. Fourth, we must promote urbanization and eliminate hindrances to population mobility to facilitate the efficient allocation of human resources and stimulate economic growth. Finally, establishing and strengthening a comprehensive social security system and corresponding institutional frameworks is key to mitigating the long-term adverse impacts of capital substitution on labor income shares.

In conclusion, China is experiencing significant changes in population structure and size, including slowing population growth, increased aging, and declining fertility rates. These shifts pose challenges to economic growth, the labor market, and the social security system. It also creates new opportunities for population quality improvement and industrial transformation. To tackle this demographic transition, it's imperative to enact strategic policies, including encouraging fertility, investing in education and technological innovation, and reforming the social security system. Through comprehensive and thoughtful policies, China can effectively address these challenges and pave the way for future socio-economic development.

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Perspectives

Examining the Influence of Fertility Policy Adjustments on Gender Equality in China During the Period of Exceptionally Slow Population Growth

Xueyan Yang[1,#]; Wanxin Li[1]; Rui Li[1]

The Chinese population is entering a new stage of development, marked by the fertility intentions of women of childbearing age continuing to decline and concerns over their consistently low fertility rates. The number of newborns has been decreasing annually, with 2022 figures falling below 10 million for the first time since the founding of the People's Republic of China, resulting in negative population growth (*1*). Currently, China's population over the age of 60 years is nearing 300 million and is projected to surpass 20% of the total population during the 14th Five-Year Plan period. Furthermore, the working-age population, estimated at 900 million in 2018, is expected to decline to approximately 830 million in 2030 and 700 million in 2050 (*2*).

In response to the new stage of population development in China, adjusting fertility policy has become a priority to stabilize fertility levels, alleviate the pressure of aging, and promote supply-side reforms in population and labor fields. On November 15, 2013, the Central Committee of the Communist Party of China launched a restricted two-child policy, marking the relaxation of the Chinese government's long-standing family planning policy, which was primarily focused on population control (*3*). On January 1, 2016, the Fifth Plenum of the 18th Central Committee of the Communist Party of China formally implemented the "universal two-child policy," signaling a shift in China's family planning policy from controlling population size to encouraging fertility intention and improving population quality (*4*). On May 31, 2021, the Political Bureau of the Communist Party of China Central Committee held a meeting to further optimize the fertility policy. This policy stipulates that a couple can have three children and outlines supporting measures, signifying the ongoing comprehensive adjustment and transformation of China's fertility policy (*5*).

Several scholars and practitioners have expressed concern about the potential impact of modifications to fertility policies on gender equality, as well as addressing the quantitative, structural, and qualitative challenges faced by population development. However, the underlying mechanisms of these challenges have not been sufficiently explored. In this study, we introduce the Dualistic Theory of Career-Family Life Cycle, examine the consequences of adjusting fertility policies on gender equality, and contend that the subsequent pressure will influence women's careers and families. This change may raise women's career thresholds, weaken women's career persistence, and exacerbate women's work-family conflicts. As a result, challenges to gender equality in China might arise, which could hinder the implementation of a three-child fertility policy.

DUALISTIC THEORY OF CAREER-FAMILY LIFE CYCLE

The ecological systems theory in developmental psychology posits that individual development is directly influenced by microecosystems. For infants, these microecosystems are primarily limited to their families. As infants transition into childhood and adolescence, their scope of activities broadens, and their microecosystems increasingly encompass kindergartens, schools, and peer relationships (*6*). Ultimately, as they enter adulthood, the home and workplace emerge as the most critical microecosystems impacting their personal development (*7*).

Typically, career and family life cycle theories are utilized independently to describe and analyze the stages of family and career development processes in relevant research. However, examining individual development from a gender perspective reveals the significance of women's development in both the family and the workplace due to traditional gender norms that dictate their reproductive and familial roles. Furthermore, the ramifications of fertility policy adjustments on women's development have

implications for both the family and workplace settings (*8*).

Based on this perspective, we propose the Dualistic Theory of Career-Family Life Cycle, which integrates the two theories of career and family life cycles. In this approach, specific challenges and important tasks must be addressed and fulfilled at each stage. Individuals should strive to take responsibility in each phase to successfully meet these demands (*8*–*9*). Moreover, career and family life cycles are interrelated. Gender role divisions within families influence gender equality in the workplace, while gender inequality in the workplace perpetuates traditional gender divisions within families. This framework is depicted in Figure 1.

IMPACTS AND CHALLENGES OF FERTILITY POLICY ADJUSTMENTS ON GENDER EQUALITY IN FAMILIE LIFE CYCLE

The revision of fertility policies will emphasize individual fertility events and take into account the various stages of the family life cycle as a temporal factor, ultimately generating a sequence of life event pressures that influence gender equality within households. Central to this issue is the gender-based division of labor inside the family.

Marital and Childbearing Stages

The modification of fertility policies can potentially result in unease and stress for women concerning marriage and childbearing decisions. These policy adjustments have removed factors that previously suppressed childbearing intentions. In Chinese society, the longstanding cultural belief that "having many children brings many blessings" places emphasis on women's reproductive roles, which may increase the probability of them encountering family pressures related to expectations regarding marriage and childbearing (*10*).

Child-Care and Child-Rearing Stages

The modification of fertility policy has the potential to cause unease and stress regarding childcare and child-rearing among women. Childcare encompasses the comprehensive care primarily given to toddlers aged 0–3 years, whereas child-rearing pertains to the education and upbringing typically provided to children aged 3 years and older. Due to established gender norms that define women's roles within the family, they often experience heightened pressure in relation to childcare and child-rearing (*11*).

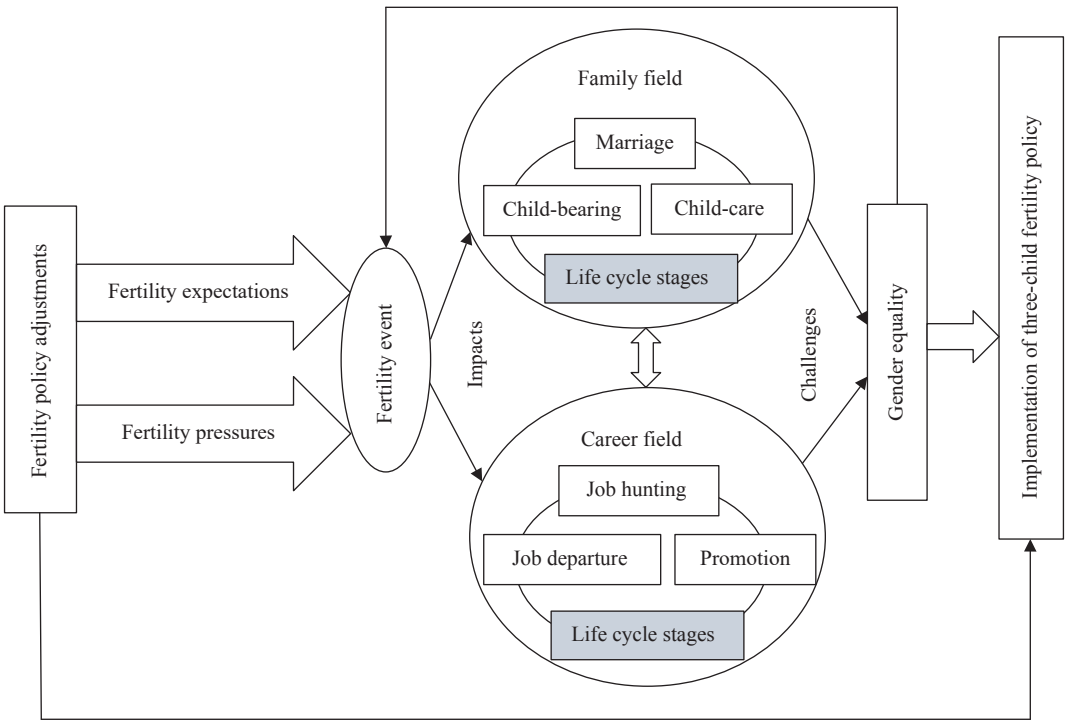

FIGURE 1. Framework for the influence of fertility policy adjustments on gender equality in China.

Consequently, an increase in the anticipated number of children resulting from adjustments in fertility policy will directly intensify this pressure (*12*).

IMPACTS OF FERTILITY POLICY ADJUSTMENTS ON GENDER EQUALITY IN CAREER LIFE CYCLE

The revision of fertility policy should be centered around fertility events while incorporating the career life cycle stage as the temporal dimension. This approach will address a series of life event stressors that influence gender equality in the workplace. The primary focus will be on women's work-family conflicts, which serve as the core issue in promoting workplace gender equality.

Job-Hunting Stage

The modification of fertility policies can potentially result in employment pressure due to heightened fertility expectations. As a consequence of such policy adjustments, employers may develop increased psychological expectations regarding women's childbearing, leading to gender discrimination and exclusion of women from the job market (*13*). Furthermore, these changes in fertility policies could diminish women's bargaining power in the labor market, thereby exacerbating the challenges in effectively protecting women's labor rights and interests (*14*).

Job-Promotion Stage

The modification of fertility policies may place a strain on the balance between fertility and career advancement. Making such decisions is challenging, and even women who smoothly return to their workplace after their first childbirth often face a choice between having a second or third child and pursuing job promotions. Typically, career-oriented women within childbearing age are also experiencing their professional growth phase. When confronted with workplace competition, increased childbearing coupled with childcare and child-rearing responsibilities often become significant obstacles to women's career development (*14*). The demands of childbearing, childcare, and child-rearing consume women's time and energy, frequently causing a considerable negative impact on their work performance. Additionally, subtle discrimination against women in the workplace undermines their opportunities for advancement (*13*).

Job-Departure Stage

Changes to fertility policies can potentially result in the exclusion of women from the workforce due to childbearing considerations. Moreover, these policy adjustments may present women with a significant challenge in balancing childbearing and career advancement (*13*). Existing research has demonstrated that employment stability for women diminishes as the rate of childbearing rises, and once a woman elects to leave her job for childbearing purposes, the probability of her re-entering the workforce and continuing her career declines (*15*).

DISCUSSION

According to worldwide examples, lower fertility rates are observed in societies with a relatively low level of gender equality in the public sector, predominantly due to a disparity between gender equality in public and private domains. Women are assuming increasingly significant roles in the public sector, such as the labor market, but continue to experience a relatively low degree of equality within the private sector, specifically within families. An increase in fertility rates occurs only when gender equality in the private sector improves (*16*). As an intrapersonal event, fertility events primarily impact the private sector, specifically the gendered distribution of labor within families. Nevertheless, gender inequality in the familial division of labor translates to the public sector—namely, the workplace—through women's labor force participation, thereby exerting pressure on women in both settings. This ultimately manifests in gender inequality within the public sector (*17–18*), which consequently influences family fertility intentions and behaviors, resulting in decreased fertility rates.

Central and local governments are currently examining fertility support policies, such as extending maternity leave, introducing paternity leave, enhancing childcare services, and relieving the burden on families during childbearing, childcare, and child-rearing, in an effort to encourage higher fertility rates. However, the development and execution of these policies have not adequately addressed gender issues, which ultimately impacts the effectiveness of the three-child policy. It is essential to design and establish a new fertility support policy system that incorporates gender equality perspectives.

First, the maternity leave policy should emphasize

the involvement of fathers in childcare, and a superior quality childcare services system should be developed to reduce women's burden in childcare and promote gender equality within families. Second, a more comprehensive security system with a higher compensation rate and broader coverage should be established, with a focus on balancing the responsibilities among the government, market, and families, as well as between husbands and wives. This revised fertility support policy system will foster gender equality within the family unit, leading to gender equality in the workplace and ultimately throughout society. As a result, this policy system will enhance the effective implementation of the three-child fertility policy.

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Perspectives

Challenges and Responses of Left-Behind Elderly and Children in Rural China Amid the New Population Development Stage

Dianqi Yuan[1,&]; Peisen Yang[2,&]; Hanbing Yang[1]; Huameng Tang[1]; Chao Guo[1,2,#]

The disparate economic growth in China has compelled numerous adults from rural areas to migrate to cities in search of more lucrative employment prospects (*1*). In the 7th National Census, it was reported that the floating population totaled 375,816,759, accounting for approximately 26.00% of the overall population. Such migratory patterns often result in leaving behind vulnerable groups, particularly children and older adults, in rural regions. Given the inadequately established care systems, these groups are particularly susceptible and have consistently been at the forefront of social security concerns in China (*2*).

The inadequate public pension benefits and health insurance systems result in older adults relying heavily on their offspring, generally their sons, for their overall well-being (*3*). Migration has led to the rise of a vulnerable group known as the "rural left-behind older adults", where older family members lack necessary support as their caretaker children move to urban areas. Simultaneously, the growth and well-being of children hinge on parental care, but employment constraints, limited financial resources, and rural residency restrictions often make it unfeasible for migrant workers to bring their children to the cities where they work (*4*). Consequently, these children are regularly left behind in their rural homes, becoming the "left-behind children in rural areas".

During the first meeting of the Financial and Economic Affairs Commission under the 20th Communist Party of China (CPC), Xi Jinping, General Secretary of the CPC Central Committee, accentuated that the country is entering a new stage of population development. This phase is characterized by declining birthrates, an aging population, and uneven population growth among regions. Additionally, the rural population characterized by an unbalanced age population structure, has been pronouncedly affected by the inconsistent economic development and these factors.

Status of Imbalanced Age Structure and Increasing Burdens

The 2020 Population Census reported that in China, the child-age dependency ratio was 26.24 per 100 working-age individuals, while the old-age dependency ratio was 19.74. Notably, rural areas displayed significantly higher dependency ratios in comparison to urban areas. In rural areas, the child-age dependency ratio was at 30.58 and the old-age dependency ratio was 28.13. Contrastingly, in urban areas, these ratios were 24.07 and 15.56, respectively. The heavily skewed age structure in rural areas has imposed a greater burden on the adult population due to these pronounced dependency ratios. Moreover, notable societal aging has been recorded in China, predicting a future transition from an aging society to an aged society, which may exacerbate the existing burdens.

Concerns over declining fertility rates and rising populations of older adults are not unique to China. According to the World Population Ageing 2020 report and the United Nations Population Division, over the last fifty years, the total fertility rate (TFR) has halved. As of 2021, the global TFR stands at 2.32. Furthermore, projections suggest that the global population of individuals aged 65 years or older will increase from 9.3% in 2020 to 16.0% by 2050.

Population pyramids effectively illustrate the age and sex composition of both rural and urban populations in 2010 and 2020 (Figure 1A). Compared to urban populations, the rural population pyramids display a more marked decline. This is characterized by a significantly smaller children's population, an expanded older-adult population, and the outflow of working-age adults. It's notable that from 2010 to 2020, the middle section of the rural regions' pyramid has narrowed, paired with an evident bulge at the top. This indicates a substantial decrease in the adult population and a growing proportion of elderly people, placing increased strain on the diminishing labor-age population. In light of declining fertility rates and

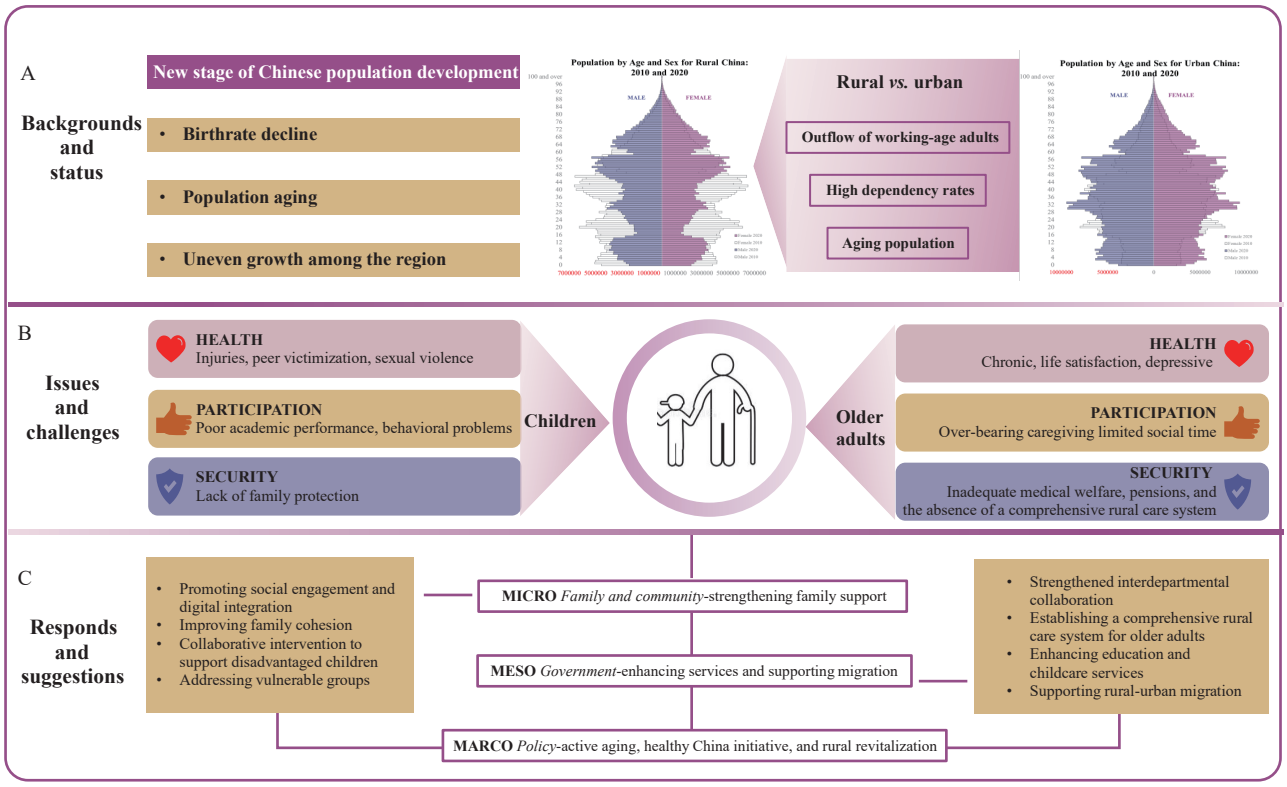

FIGURE 1. Conceptual framework addressing the challenges for left-behind older adults and children in rural areas. (A) Backgrounds and status; (B) Issues and challenges; (C) Responds and suggestions.

heightened life expectancy, the middle-aged population will shift towards an older population. This shift will result in a diminishing number of working-age adults available to support the growing older generation, which may exacerbate existing resource scarcity.

Social security issues in rural China have been amplified due to simultaneous labor force emigration and aging population. The lack of parental and formal institutional care (*5*), along with shifting family dynamics towards smaller family units and weakened family functions (*6*), not only inhibit childhood development but also place severe health management demands on the elderly population.

Triple Challenges of Health, Participation, and Security

The aforementioned context underscores the pressing necessity for all-encompassing support mechanisms that cater to the needs of child-rearing and elderly care during diverse stages of societal transition. These associated challenges encapsulate health, participation, and security concerns, which are applicable to both left-behind children and the elderly population (Figure 1B).

Health challenges in both physical and mental wellbeing: Elderly individuals left behind confront grave health challenges, as evidenced by lower self-rated health and heightened severity of mental health issues (*7*), predominantly attributed to their children's lack of care. For instance, when children migrate, the resulting increased levels of depressive symptoms and loneliness, as well as diminished life satisfaction, plaguing their left-behind parents (*8*). Also, the incidence of chronic diseases amongst these deserted seniors tends to be higher (*9*). Furthermore, it's important to underscore that female elderly individuals left behind confront more severe health issues and bear heavier living burdens (*10*).

Children in rural areas who are left behind face increased health risks due to a deficit in parental support and protection. This group of children experiences elevated levels of anxiety and depression (*11*). Concurrently, they are more likely to suffer from unintentional injuries, an example of which includes falls (*12*). When compared to their counterparts who are not left behind, these children endure a higher level of peer victimization and have a greater rate of non-suicidal self-injury (*13*). Moreover, these left-behind children encounter intense issues pertaining to sexual violence and abuse (*14*). Given that older adults often

assume the role of caregivers for these left-behind children, both generations are exposed to heightened health risks.

Challenges in participation during the information and digital era: The responsibilities of older adults residing in rural areas often encompass care for grandchildren and extensive involvement in domestic and agricultural tasks (*15*). This increased burden often results in decreased social participation and limited interaction with their children, a dynamic which amplifies their risk of social isolation (*16*). Coupled with an enlarging digital divide, rural seniors are increasingly becoming marginalized in the digital age, faced with restricted access to resources, information, and new forms of social engagement (*17*). Amid overwhelming circumstances such as the pandemic situation, dependency on internet services surged (*18*); an area where the rural elderly found themselves to be increasingly bereft, thereby contributing to heightened stress responses and an amplified sense of vulnerability due to social isolation.

Simultaneously, children who are left behind often exhibit heightened vulnerability to social anxiety, which may result in subpar academic performance and behavioral issues such as inattention, and potentially even deviant behavior (*19*). Viewed through the lens of a life-course perspective, it can be inferred that a childhood marked by traumatic experiences, such as abuse, exclusion, and various forms of bullying (on campus or online), can indelibly impact the mental health of these left-behind children (*20*). In conclusion, both senior residents and left-behind children tackle significant obstacles in the form of social isolation and exclusion.

Security challenges related to elderly care and child rearing: With regard to healthcare security, the New Cooperative Medical Scheme (NCMS) has notably increased medical insurance coverage in rural regions. However, its objective is centered on providing affordable basic medical services, indicating that the standard of medical welfare in rural communities significantly trails behind that in urban areas (*21*). Elderly individuals residing in rural areas often grapple with inadequate medical security and insufficient pensions, exacerbating their already difficult situation (*22*). Concurrently, the lack of an established rural care system severely impacts the overall well-being of these rural seniors (*23*). This lack of security further compounds their difficulty in providing adequate care for their dependent grandchildren.

Children who are left behind often experience deficient familial care. More precisely, the absence of communication and emotional rapport with their parents adversely affects the family stability and adaptability of these children (*24*). In situations where only the father migrates for work, the responsibility of parenting intensifies for the mother who stays behind. This added burden may lead to a heightened level of control over the children.

A Three-Level Linkage Coping Strategy At Macro, Meso, and Micro Levels

In the context of China's "Actively Responding to Population Ageing" strategy and "Healthy China" initiative, it becomes critically important to address the challenges faced by the elderly and children left behind in rural areas (Figure 1C). As the future of the country and its society, children's health and well-being are a crucial part of ensuring a balanced population development. Simultaneously, the elderly population must be empowered to have healthier and more content lives in their later years, as a component of promoting "active aging." Considering these aspects, this study aims to provide some recommendations.

At the macro level, there is a call for enhanced policy guidance to tackle challenges confronted by older adults and children residing in rural regions. This objective could be realized by reinforcing the growth of these areas, apart from administering favored policies that motivate adult migrants to revisit their native places in the course of applying the rural revitalization strategy. National improvement of rural infrastructure is also essential, fostering an environment conducive for young migrants to return to their familial roots.

At the meso level, it is imperative for the Chinese government to bolster inter-departmental communication and introduce targeted policies to augment implementation efficiency. Specifically, the need for a comprehensive support system for older adults in rural areas is paramount to facilitate better access to medical resources and thereby improve the general health of older adults situated in rural areas (*22*). Concurrently, investments in rural education and childcare services could alleviate the parenting burden on older adults left behind and elevate the educational achievements of children (*10*). Lastly, initiatives should be rolled out to lessen the workload of rural young workers in cities, affording them additional time and resources to care for their elderly parents and children at their original domicile.

On a micro level, numerous strategies can be

implemented to enhance the wellbeing of older adults left behind. To begin with, rural areas should establish dedicated activity centers for these individuals. These centers can provide training on the use of smart technologies, tailored to the specific attributes of the digital age. Alongside this, efforts must be made to improve the health literacy of older adults. Enhanced health literacy is likely to boost their social participation and networks, diminish potential mental health issues, and fortify their social capital. Furthermore, families of left-behind children in rural areas should receive assistance to foster better family cohesion and improve parent-child relationships. Lastly, communities must also work closely with schools and social services to offer interventional social support (*19*) to left-behind children facing difficulties. This will facilitate their adaptation to school life.

In conclusion, the current stage of population development in China pressing issues for the elderly and child populations left in rural areas. These challenges impact and relate to each other across domains of health, participation, and security. Currently, various government departments, including those dealing with civil affairs, health, women and children, family, and agriculture are charged with addressing the challenges faced by rural older adults and children left behind. Nonetheless, these departments must bolster their collaboration or even introduce specialized offices for rural senior and child affairs to ensure the policy effectiveness specifically geared towards the left-behind population.

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Perspectives

Understanding the Effects of Iatrogenic Management on Population Health: A Medical Innovation Perspective

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In this paper, we introduce an iatrogenesis intervention framework guided by medical innovation, which encompasses the objectives, influences of medical innovation on iatrogenesis, factors affecting various types of iatrogenesis, and strategies for controlling iatrogenesis. Advancements in medical innovation across various domains can bridge the patient safety implementation gap by uncovering, characterizing, refining, accelerating, scaling, extending, and mobilizing the external and internal conditions and factors that influence the control and elimination of iatrogenesis.

Iatrogenesis, or the adverse effects and risks associated with medical interventions, poses a significant challenge in global public health as it ranks as the fifth leading cause of death worldwide and a leading cause of death in numerous countries (*1*–*2*). Prior to the coronavirus disease 2019 (COVID-19) pandemic, 2.6 million deaths occurred annually due to safety lapses in hospitals in low-income countries, while nearly 15% of hospital expenditure and activity in developed nations were attributed to addressing treatment safety failures (*3*).

Iatrogenesis Definition, Current Situation, and International Attention to this Issue

According to the World Health Organization (WHO), "iatrogenesis, often called adverse drug reactions (ADRs), is any noxious, unintended, and undesired effect of a drug, which occurs at doses used in humans for prophylaxis, diagnosis, or therapy" (*4*). Based on this definition, approximately 5%–8% of global deaths are attributed to ADRs, accounting for half of all preventable harm in medical care and yielding an estimated annual cost of 42 billion United States dollar (USD) worldwide (*5*–*6*). However, this definition and associated data may underestimate or overlook the impacts of other factors, such as diagnostic procedures, nosocomial infections, and hospital management. Therefore, we propose that iatrogenesis should be more comprehensively defined as any injury or illness resulting from medical care or caused by medical intervention, encompassing diagnostic procedures, treatment methods, healthcare practices, and other relevant factors.

Numerous studies have been conducted to understand the extent, impact, and improvement strategies of iatrogenic harm or iatrogenesis (*1*,*7*–*8*). Innovative technologies are being developed to reduce iatrogenic harm, while also introducing new varieties of iatrogenic errors and events (*9*–*10*). Risk assessment tools for iatrogenesis management are evolving, potentially enabling health professionals to better identify patients at higher risk of iatrogenic harm and allowing healthcare providers to implement preventive measures (*11*–*12*). Various stakeholders have developed guidelines and frameworks to address iatrogenesis management (*6*,*13*–*14*). Innovations in patient care models may help mitigate iatrogenic risks and consequences (*15*–*16*).

Given the significant impact of iatrogenesis on population health, the 72nd World Health Assembly, convened in Switzerland in May 2019, adopted a resolution designating September 17th as World Patient Safety Day. This initiative aims to disseminate the concept of patient safety and foster global collaboration to enhance patient safety.

In light of the COVID-19 pandemic, the first theme of World Patient Safety Day highlighted the safety of health workers who protect us all while facing a 5 to 10 times higher risk of contracting COVID-19 compared to the general population (*17*).

Unfortunately, vulnerable populations are most susceptible to iatrogenesis — especially those with multiple conditions and medication requirements. These disparities exacerbate global health inequalities and hinder the attainment of the Sustainable Development Goals (SDGs).

The Underlying Factors Contributing to the Issues and the Obstacles Encountered During their Resolution Process

As global demand for health care continues to rise

due to factors such as aging populations, climate change, and emerging infectious diseases, promoting safe medical practices has become an urgent and challenging task. Patient safety within the healthcare system is a complex, multi-disciplinary, and multi-level dynamic issue. Externally, it involves macro-level elements such as policy systems (particularly health insurance policies and health laws and regulations), economic development, technological progress, cultural beliefs, social environments, and natural ecosystems. At the meso level, it encompasses family, organizational, and social support, while at the micro level, it relates to individual knowledge, beliefs, and behavior patterns.

Internally, patient safety is the cumulative and comprehensive outcome of unsafe medical practices on patients and even on healthy populations, such as adverse vaccine reactions. Iatrogenesis spans from outside the healthcare institutions to within them. The probability, extent, and types of iatrogenesis are connected to the preventable harms at each stage or process of health management and medical practices accompanying various health statuses, including disease, disability, and death. On one hand, iatrogenic risks stem from the medical intervention itself, such as ADRs or complications from surgical procedures (*1*,*3*,*6*). On the other hand, iatrogenesis can result from errors or mistakes made by healthcare personnel during medical activities, such as negligence, nosocomial infections due to improper protection, and drug safety issues arising from irrational drug use (*1*,*3*,*6*).

Internal and external factors interact to form a complex network of causes and mechanisms affecting avoidable harm, causing iatrogenesis to manifest in diverse ways among patients and healthcare workers. For instance, WHO estimates that 50% of prescribed and marketed medications are unsuitable, and 50% of patients administer these medications improperly, emphasizing the need to address medication iatrogenesis risk (*18*). Contributing factors may include inaccurate or delayed diagnoses, carelessness by patients and healthcare workers, lack of health awareness, insufficient high-quality medicines, shortcomings in the drug regulatory system, and inappropriate incentives and constraints within health insurance and health services. These issues may exist or coexist across primary care, hospital, and rehabilitation systems, interacting with various stakeholders, information systems, manufacturers, and management platforms.

Addressing iatrogenesis is not solely a matter of disease management, but rather involves tackling the underlying avoidable health disparities and medical costs. This is particularly important as the world faces challenges such as limited health resources, funding for pandemic response, global aging, and climate change. The challenge of iatrogenesis, which is more complex than other diseases, necessitates a comprehensive framework to guide all aspects of the work.

The Complexity of the Innovation

According to the third edition of the Oslo Manual, "Innovation is the implementation of a new or significantly improved product (good or service), process, marketing method, or organizational method in business practices, workplace organization, or external relations" (*19*). In the field of medicine, innovation is specifically defined as "a new type of diagnostic, therapeutic, or screening health technology that is in its first stage of commercialization, marketing, or promotion and has been validated for its effectiveness and safety in clinical research" (*20*). Considering the relationship between the nature of innovation and the scope of change is relevant since the definition of innovation includes notions of novelty and change (*21*).

Generally, medical innovation can be described as any new tests, devices, drugs, vaccines, procedures, plans, management measures, or systems developed for disease prevention, diagnosis, or treatment, with the primary goal of enhancing health levels and health system efficiency. In order to optimize the utilization efficiency of health resources, identifying disruptive innovations from incremental innovations is crucial (*21*). In the healthcare field, disruptive innovations have the greatest potential to significantly impact expenditures, particularly through changes in medical strategies, care pathways, or even health pathways that encompass care, prevention, social support, and medical-welfare accompaniment, as well as home return or care assistance (*21*).

The Impact of Medical Innovation on Iatrogenic Outcomes

Medical innovation is inextricably linked to iatrogenesis, and the definition and scope of iatrogenesis continue to evolve due to advancements in the medical field. On one hand, medical innovation has decreased healthcare costs related to chronic lifelong diseases and transformed conditions such as

breast cancer, HIV/AIDS, heart disease, and lung cancer from being synonymous with a death sentence (*22*). Research involving 30 developing and high-income countries revealed that from 1960 to 1997, new therapies contributed to a 45% increase in life expectancy; this contribution rose to 73% between 2000 and 2009 (*23*).

On the other hand, the integration of technologies such as the Internet, the Internet of Things, big data, and artificial intelligence into medical and healthcare services and management has given rise to new forms of iatrogenesis. These emerging forms are evident in remote diagnosis and treatment, internet-based self-diagnosis and treatment models, variable online medical resources, and commercial information.

In our opinion, medical errors can be effectively reduced, and patients' health can be maximally restored through medical innovation at all levels. Hence, we propose an iatrogenesis intervention framework from the standpoint of medical innovation (Figure 1).

Currently, there is a lack of consensus regarding the categorization of medical innovations, which are often classified into various types, including medical equipment and devices, pharmaceuticals, surgical procedures, organizational systems, and patient management strategies (*21*).

Innovations in medical equipment and devices can enhance detection, improvement, evolution, acceleration, scalability, precision, medical operation efficiency, and patient safety monitoring. Additionally, innovations in pharmaceuticals, surgical procedures, and medical practices can help evolve, accelerate, scale, and extend the prevention and elimination of iatrogenic injuries caused by factors beyond the control of medical professionals at a given time.

Furthermore, innovations in organizational systems and patient management, such as strengthening business guidance and industry supervision, enhancing medication safety education for patients and their families, can help identify, classify, and mitigate various types of iatrogenesis. These innovations can improve the control and eradication of iatrogenesis and act simultaneously on iatrogenic risk prevention and control at different stages, maximizing the positive impact of narrowing implementation gaps in patient safety.

The management of iatrogenesis can be significantly

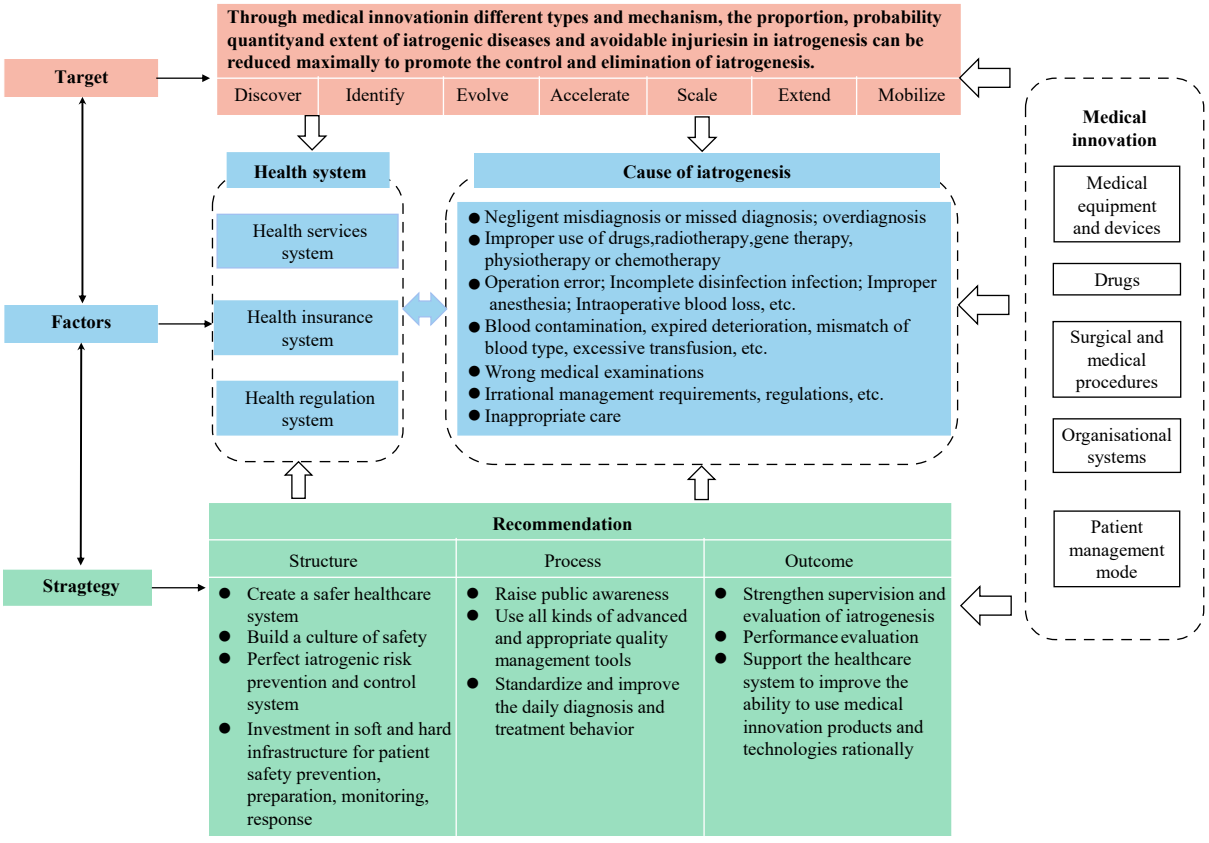

FIGURE 1. Framework for iatrogenesis intervention from the perspective of medical innovation.

enhanced through medical innovation. By focusing on patient safety, usability, and the integration of technology into healthcare procedures, medical innovations can reduce the likelihood of unforeseen negative outcomes. Developments in medical imaging, machine learning, and artificial intelligence can increase diagnostic accuracy and minimize diagnostic errors. Innovative monitoring tools, wearable sensors, and remote monitoring technologies enable continuous tracking of health indicators and other measures.

Evaluating and Implementing Medical Innovations in Iatrogenesis Management

Medical innovation, while offering potential benefits, may also introduce new risks. As such, it is crucial to establish a risk-benefit evaluation mechanism for medical innovation products, technologies, or systems. This would enable the identification and adoption of suitable innovations for controlling, mitigating, and eliminating medical risks.

In an effort to manage risks associated with medical innovation and expand its benefits to a greater number of individuals, we propose a structure-process-outcome framework for integration in iatrogenic management. In the structure dimension, increasing government investment in both software and hardware for patient safety prevention, preparation, monitoring, and response is recommended. This involves fostering collaboration among various stakeholders. Additionally, the implementation of relevant risk control measures through continuous medical innovations is necessary.

In the process dimension, stakeholders should focus on raising public awareness, employing appropriate management tools, standardizing and enhancing daily diagnostic and treatment procedures, utilizing benefit-risk assessment methods to guide clinical practices, and maximizing the appropriate usage of risk assessment tools to minimize medical risks while increasing the degree, speed, and scope of benefits to the public. In the outcome dimension, policymakers should work towards strengthening iatrogenic disease and injury reporting and learning systems, establishing a "quality first" performance management mechanism, and improving quality control and operational mechanisms. Supporting and investing in the healthcare system to enhance the ability to utilize innovative products and technologies, and involving patients and their families in data reporting and service evaluations, are also crucial steps in achieving these goals. This will ultimately lead to the establishment of a closed-loop system for innovative products and technologies, improving healthcare outcomes and the effectiveness and efficiency of service delivery.

In conclusion, the development and appropriate application of medical innovation can contribute to the prevention and control of iatrogenesis in a more efficient, effective, and affordable manner.

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