Journal of Mathematics and Modeling in Finance (JMMF)
Vol. 5, No. 1, Winter & Spring 2025
Research paper

Modifying premiums for life insurance products using specific mortality tables

Mahboubeh Aalaei[1], **Khadijeh Ebrahimnezhad**[2]

[1] Insurance research center, Tehran, Iran
aalaei@irc.ac.ir

[2] Department of Economic, Faculty of Social and Economics, Alzahra University, Tehran, Iran.
ebrahimii.sara77@gmail.com

Abstract:
The aim of this study is to examine the impact of different adjustment multipliers (β) on mortality tables and their effect on premium calculation in the life insurance industry. In this research, standard mortality tables are compared with mortality tables adjusted by modification multipliers to explore the differences in insurance risks for individuals with varying health statuses. The results show that as the value of the adjustment multiplier (β) increases, the mortality rate significantly rises. These changes directly impact the calculation of premiums, with premiums being higher for individuals with more health problems. Furthermore, the study emphasizes the importance of using specific mortality tables at younger ages, as health status changes during these periods can significantly affect risk assessment and premium determination. The use of these tables allows insurers to calculate fairer premiums aligned with the actual health status of policyholders, thereby improving both the accuracy of insurance risk assessments and their financial solvency, as well as strengthening their competitive position in the insurance market.

Keywords: Longevity risk, Life table, Adjustment multipliers, Mortality probabilities.
Classification: JEL Classifications: C02, G12, G22.

1 Introduction

Life insurance products are priced based on a variety of factors, one of the most crucial being mortality rates. These rates help insurers estimate how long policyholders are expected to live, enabling them to calculate the risk associated with issuing a policy. A key tool used in determining these mortality rates is the mortality table. Over the years, the development of specific mortality tables tailored to the insured population has played a pivotal role in the calculation of life insurance premiums, long-term obligations of insurance companies, social security organizations, pension funds, and many other calculations related to the life insurance market [23].

A mortality table, also known as a life table, is a statistical representation of the death rates experienced by a population at each age. It shows the probability that

[1]Corresponding author
Received: 30/12/2024 Accepted: 24/05/2025
https://doi.org/10.22054/JMMF.2025.83627.1165

an individual of a given age will die before reaching the next age. Traditionally, mortality tables were created based on data from the general population, but in recent years, insurers have begun using specific mortality tables that reflect the characteristics of insured individuals [22].

While traditional mortality tables are based on national or regional population data, specific mortality tables are constructed using data from insured populations. Insured individuals typically exhibit different mortality characteristics compared to the general population due to factors such as underwriting practices, health monitoring, and selection effects. Insurers assess applicants' health through underwriting, which filters out high-risk individuals. As a result, insured populations generally have lower mortality rates than the general population, especially in the early years of a policy.

Standard mortality tables have significant limitations in terms of accuracy and applicability to specific subgroups. These tables fail to reflect individual differences such as health status, lifestyle, occupation, and socio-economic conditions of the insured population. In particular, the mortality risk of individuals with specific medical conditions or high-risk lifestyles may differ substantially from that of the general population. Therefore, using such tables for pricing life insurance products may lead to inaccurate premium estimations. In such cases, insurers may set premiums that are either non-competitive or so low that they result in financial losses [4, 7].

Another fundamental limitation of standard mortality tables is their inability to reflect the selection effect of insured individuals. In practice, healthier individuals are more likely to purchase life insurance; therefore, estimating risk based solely on general population data may lack the necessary accuracy. Moreover, standard mortality tables are typically not updated regularly to incorporate medical advancements and changing mortality patterns, which undermines their credibility. Collectively, these factors can lead to phenomena such as adverse selection. In contrast, specific mortality tables offer a more accurate representation of the mortality experience among insured individuals and enable insurers to price their products more precisely and fairly.

The adoption of specific mortality tables has significant effects on the premiums of life insurance products as follows [11].

- **More Accurate Risk Assessment:** Mortality tables provide life insurance companies with data on the probability of death of individuals in certain age groups. By using this data, insurers can estimate the likely life span of the policyholder and determine the appropriate life insurance premium rates [12]. Now, if these tables are determined according to the situation of the insured, it allows insurers to evaluate the risk associated with each insured more accurately. This results in premiums that are closely aligned with the actual risk of the insured population. Policies that rely on general mortality tables may overestimate or underestimate the risk, leading to premiums that are either too high or too low.

- **Fairer Premiums for Policyholders:** Specific mortality tables help ensure that policyholders are not overcharged or undercharged. This can lead to fairer pricing models where individuals pay premiums that reflect their true risk profile. Policyholders with lower risk factors (e.g., non-smokers, healthy individuals) benefit from more favorable pricing [1, 2, 5].

- **Improved Competitiveness of Insurers:** The mortality rate is one of the driving factors that affect policy pricing and financial stability for both life insurance and annuity liabilities [18]. Therefore, by using specific mortality tables, insurers can offer more competitive premiums without compromising their profitability [6]. They can underwrite policies that reflect a better understanding of their insured portfolio, allowing them to adjust premiums based on more granular mortality data. This enables insurers to attract more customers with favorable premiums while maintaining their financial health.

- **Differentiation Across Products:** Mortality rates can vary across different life insurance products, such as term life, whole life, and universal life insurance. Since the life expectancy of the insured is one of the most important factors in the pricing of life insurance products, by using specific mortality tables, insurers can differentiate the pricing structure of these products based on the unique mortality experiences of their target markets. For example, term life insurance may see more pronounced differences due to the selection effect, where policyholders are generally healthier at the time of application. Whole life insurance, with its longer duration, may see premiums more affected by mortality changes at older ages.

Due to the prominent role and significant effects of specific mortality tables on the premiums of life insurance products, this article explores the impact of using these tables on the pricing of life insurance products, focusing on how they can assist insurers in balancing risk, maintaining competitiveness, and ensuring the sustainability of their policies. In this context, the use of specific mortality tables can help insurance companies set more accurate rates for their products while also reducing the risks associated with predicting the mortality of policyholders. This leads to an improvement in the pricing process and the offering of more suitable insurance proposals to customers.

In Iran, with the development of life insurance products, the need for the use of specific mortality tables is increasingly felt. To achieve this objective, this paper first defines the fundamental concepts and key definitions related to specific mortality tables, providing the necessary theoretical foundation for a deeper understanding of this topic. Then, a systematic review of the research conducted in this area is presented, examining the current state of studies and the methodologies employed. Subsequently, the research methodology used in this study is explained, and the process of data collection and analysis is described in detail. Finally, the findings and results of the analyses are discussed, and the impacts of using specific mortality tables on life insurance pricing are analyzed in detail. The results of this study can significantly contribute to the strategic decision-making of insurance companies in the areas of risk management and improving their financial performance.

2 Basic concepts

Given the crucial role of mortality tables in calculating life insurance premiums, the use of specific tables instead of standard ones can significantly improve the accuracy of liability estimates and risk classification. Standard mortality tables, which are based on general population data, do not necessarily reflect the statistical reality of specific subgroups of policyholders. This misalignment can lead to incorrect pricing and disruptions in the calculation of insurance reserves. For example, using a general table may overestimate the life expectancy of high-risk individuals, resulting in the collection of lower premiums than the actual risk level. Conversely, these tables might set higher-than-necessary premiums for low-risk individuals. This situation can cause low-risk groups to exit the market and exacerbate adverse selection. The specific tables developed in this study, utilizing various adjustment multipliers (β), particularly for older age groups, show that the mortality risk in high-risk groups is significantly higher. The findings allow insurance companies to adjust their pricing structures with greater accuracy, make more realistic reserve estimates, and enhance their financial stability and ability to meet obligations. As a result, using these tables instead of general assumptions not only leads to more fair and competitive premium determination but can also strengthen the financial resilience of life insurance companies in Iran. In pursuit of these objectives, the following introduces the basic definitions and concepts that will be used in subsequent analyses.
Suppose a x-year-old person with health problems wants to purchase a whole life insurance policy with M monetary unit benefits. The single premium at the start of the insurance policy for this person should differ from a standard health status. In the other words, this person should pay more premium than the standard status for the same contract. Therefore, we should use the specific mortality table for calculating the premium. Because the insured with bad health conditions has a different life expectancy (LE) than ordinary people, and using the standard life table shows the LE more than it is.
In the whole life insurance contract, if the insured dies, the insurance company will pay M monetary units to the beneficiaries at the end of year of his death. The single premium of life insurance is [3, 7, 9]:

$$SP = M \sum_{k=1}^{\omega - x} (1+r)^{-k} \times {}_{k-1|}\, q_x^*, \tag{1}$$

where ${}_{k-1|}q_x^*$ is the probability that the insured aged x dies during the kth year, r is the interest rate and ω is the maximum attainable age in the considered mortality table.
In order to calculate the mortality probability according to the health status of insured, an adjustment multiplier is used to construct the specific mortality table. The insured of age x survives k years as

$$ {}_kp_x^* = \prod_{t=0}^{k-1}(1 - q_{x+t}^*). \tag{2} $$

Consequently, the LE of the insured can be calculated by:

$$ e_x^* = \sum_{k=1}^{\omega-x} {}_kp_x^* = \sum_{k=1}^{\omega-x}\prod_{t=0}^{k-1}(1 - q_{x+t}^*) \tag{3} $$

Therefore, we should determine how to calculate the adjustment multiplier. For this aim, some methods have been proposed. In [8, 19], the adjustment multiplier is calculated as follows :

$$ \beta = 1 + \sum_{j=1}^{m} \rho_j $$

In insurance models, particularly in life insurance with specific health conditions, the adjustment multiplier β is used as a tool to align the mortality probability and assess the risk of the insured more accurately. This coefficient is calculated using the coefficients ρ_j, which represent the positive or negative impacts of various factors on the mortality risk. Specifically, ρ_j includes factors such as chronic diseases, poor medical conditions, or unhealthy lifestyles, which can directly or indirectly affect an individual's life expectancy and risk of death. As a result, β and ρ_j, by reflecting the actual risks more accurately, not only lead to greater transparency in premium determination but also help improve risk assessment and optimize the resources of insurance companies [13,19,24]. The modified mortality probability q_x^* is considered as a linear function of the standard probability q_x and is calculated by:

$$ q_x^* = \beta q_x = (1 + \sum_{j=1}^{m} \rho_j) q_x. \tag{4} $$

Since $0 \le q_x^* \le 1$, we should have:

$$ -1 < \sum_{j=1}^{m} \rho_j < \frac{1}{q_x} - 1. $$

For this purpose, the following equation is proposed in [24]

$$ q_{x+t}^* = min\{1, (1 + \sum_{j=1}^{m} \rho_j) q_x\}, t = 1, 2, \cdots, \omega - x. \tag{5} $$

Equation 2.5 restricts the adjusted mortality probability q_x^* to the valid range $[0, 1]$. As the mortality probability must be within the range $[0, 1]$, this equation ensures that the calculated value of q_x^* always remains within this permissible range. Consequently, this allows the adjusted mortality probability to remain mathematically valid, even when the adjustment multiplier (β) leads to values greater than 1. The application of this restriction is more tangible in cases where the applicant has serious health problems and therefore a higher coefficient is used to adjust the probabilities, or the insured is older and therefore has higher mortality probabilities. In this section, the fundamental concepts and key relationships for calculating life insurance premiums using specific mortality tables and adjustment multipliers have been outlined in detail. These models clearly demonstrate that using standard mortality tables cannot accurately reflect the real risks of individuals with health problems. The use of adjustment multipliers allows insurers to more precisely account for the health status of each individual when calculating premiums. Moving forward, to better understand the practical applications of these methods and their outcomes in the insurance industry, we will review the research background. A review of previous studies will help us gain new insights into how these tables can be used in premium determination and insurance risk assessment.

3 Literature Review

This section reviews the research and studies conducted on the use of specific mortality tables in the life insurance industry. The aim of this section is to clarify the theoretical and empirical foundation of the research and identify gaps and opportunities in previous studies. Specifically, the examination of various methods and models for determining premiums based on specific health conditions and how these models impact the more accurate assessment of insurance risk is an area that has been less explored in past studies. In this context, various studies on the application of specific mortality tables and their impact on the accuracy of risk prediction and improvement in premium determination transparency will be reviewed:

Aalaei and Atatalab (2024) in [6] examined the impact of changing the life table from the French life table to the Iran life table on the present value of future losses in the life insurance products portfolio and analyzed the differences in calculations for insured individuals with standard and substandard health statuses. This study utilized a quantitative research method and secondary data analysis. The native life table has been used since 2021 by the Central Insurance of Iran to calculate life insurance premiums. The French life table (TD8890), which was used previously, was also calculated and the results of both tables were compared. The findings of this study revealed that insurance companies make a profit from standard insurance policies and incur losses from substandard insurance policies. Furthermore, using the French life table results in higher profits for standard policies and lower losses for substandard policies compared to using the Iran life table.

Aalaei (2022) in [4] examines the impact of using the Iranian life table compared to the French life table on the premiums of life insurance products, particularly term and whole life insurance and endowment insurance life annuity. The article also analyzes the changes in premiums based on variations in age and contract duration of life insurance policies. The findings indicate that the premiums calculated using the French life table for different types of insurance products differ from those calculated using the Iranian life table, and these differences are still evident in the adjusted premiums for specific health conditions.

Kulekci and Kestel (2021) in [25] examined the impact of mortality rates on the financial stability of insurance and pension providers, focusing on identifying and analyzing longevity risk. Using the Lee-Carter mortality model and historical census data, they forecasted future mortality rates for countries with significant differences in life expectancy and demographic structures, such as Turkey, Germany, and Japan. The results of this study indicated that longevity risk could have a significant impact on the sustainability of insurance portfolios, particularly when static and dynamic mortality tables are employed. Furthermore, calculations of the net single premium for annuity products in the selected countries demonstrated that using stochastic mortality models and credibility approaches can lead to more accurate estimates and reduced financial risk in the long term. These findings highlight the importance of employing advanced methods in managing longevity risk.

Siswono et al. (2021), in [21] focus on forecasting future mortality rates using Indonesia's abridged life table and evaluating its impact on the calculation of expected present value (EPV) of term annuities. The aim of this study is to update and predict the mortality data for Indonesia and assess the implications of these predictions on insurance policies and related calculations. The findings indicate that mortality rates will decrease in the coming years, and this change specifically points to longevity risk. The reduction in mortality rates could lead to the increased likelihood of longevity risk occurring in the future. The conclusion of this study emphasizes the importance of updating mortality tables and making more accurate mortality projections to optimize insurance calculations and prevent negative impacts on the insurance industry.

Hosseini et al. (2020), in [14] examined the alignment of various model life tables with the age-specific mortality patterns in Iran and its provinces. The research employed a secondary analysis of cross-sectional data obtained from the Statistical Center of Iran and the National Organization for Civil Registration (NOCRI). After assessing and correcting population and mortality data, a life table was constructed for each province and its consistency with model life tables was evaluated using the MORTPAK software. The results indicated that a common standard mortality pattern based on gender and age cannot be identified across all provinces in Iran. These findings highlight the importance of developing standard life tables based on Iran-specific mortality data and that of its provinces.

Kousheshi and Torkashvand (2017) in [16] examined the compatibility of mortality models with the age-specific mortality pattern in Iran. For this analysis, data from the ongoing death registration system and the 2011 census population were used. The mortality rates by age and sex were calculated, and then the compatibility of model life tables with the age-specific mortality pattern of Iran was assessed using the Logit Brass method. The findings revealed that the age pattern of mortality in Iran, influenced by changes in the timing of death due to various causes, especially early deaths from accidents, differs from existing models. Although there is apparent compatibility with the Northern model from Coale-Demeny life tables, this compatibility does not indicate complete similarity. The results emphasized the necessity of using mortality models that are tailored to the specific conditions of Iran.

Santos and Rickman (2017) in [20] explore the impact of annual changes in mortality rates on the financial stability of life insurance companies and propose strategies for managing these fluctuations. Their research reveals that mortality rate changes are not uniform across different age groups. For instance, mortality rates for individuals in their 30s have increased, while those in their 40s have seen a decrease. The study indicates that these variations can have significant negative effects on the financial sustainability of life insurance companies. To address this challenge, two main strategies are proposed: adjusting premiums annually to reflect mortality rate changes, or diversifying the insurance portfolio by offering products to different age groups. These approaches can help mitigate the financial impact by balancing out mortality rate changes across various age groups. The findings emphasize the importance of adopting flexible strategies and using dynamic mortality tables, which play a crucial role in ensuring the long-term financial stability of life insurance companies.

Kilgour (2017) in [15] the changes in mortality tables and their impact on pension plans and related costs are explored. The U.S. Internal Revenue Service (IRS) replaced outdated mortality tables with new ones, RP-2014 and MP-2016, effective from January 1, 2018. These changes significantly affect the valuation of pension plans, variable rate premiums, and the calculation of lump sum distributions. Notably, they lead to a substantial increase in the funding costs of traditional defined benefit pension plans. The article emphasizes the importance of using updated and flexible mortality tables to effectively manage risks and costs associated with pension plan design.

Souri et al. (2016) in [23] focused on creating life tables based on gender (men and women) as well as an overall life table without gender differentiation, using mortality data. Additionally, life tables were customized for urban and rural areas. The study used census data from the 2006 and 2011 population and housing censuses and registered death data from the Civil Registration Organization between 2006 and 2012. It also included methods for mortality coverage evaluation and data correction. Life tables for 2011 and 2012 were developed. Finally, the article discusses calculating the premiums for various life insurance products using the proposed life tables and compares the results with premiums calculated using the French TD8890 life tables.

Kwon and Jones (2006) in [17] examined mortality modeling using various risk factors that affect mortality predictions and life insurance and annuity calculations. Using data from the National Population Health Survey of Canada, the study analyzed the effects of factors such as socio-economic status, individual behaviors, and health indicators on mortality. A discrete-time Markov chain model was used to simulate transitions between different states and their impact on mortality. The results show that differences in mortality among various risk groups significantly affect life insurance and annuity values, and the use of more advanced models can help determine fairer insurance rates.

Brown and McDaid (2003) in [10] examined the factors influencing post-retirement mortality and their impact on annuities and mortality-based benefits. This study analyzed factors that could play a role in risk classification for retirees, pricing annuities, and improving mortality assumptions for assessing retirement benefits. Brown and McDaid reviewed 45 articles, analyzing factors such as age, gender, education, marital status, occupation, income, and health behaviors like smoking and alcohol consumption. The findings indicated that various factors, including socio-economic status, occupation, marital status, health behaviors, and obesity, significantly affect retirees' mortality. The results suggested that the annuities and life insurance market requires enhanced risk classification to determine fairer rates and improve mortality predictions. Additionally, introducing "impaired life annuities" and advanced risk classification structures for retirees may create new market opportunities.

In comparison to previous studies that have analyzed general mortality tables and their alignment with specific population characteristics, the present research offers notable differences. For example, Aalaei and Atatalab in [6] and Kousheshi and Torkashvand in [16] primarily focus on comparing general mortality tables with foreign models or Iranian data, while this study specifically examines the use of tailored mortality tables for policyholders with distinct health conditions. The primary innovation of this study lies in the application of adjustment multipliers (β) designed to enhance the accuracy of calculations related to mortality tables within Iran's insurance industry. These multipliers offer a more precise estimation of mortality risk by considering individual health conditions, particularly for policyholders with specific illnesses such as various types of cancer. While standard mortality tables are typically developed based on general population data, this research emphasizes that the risk factors used to calculate the adjustment multiplier should be designed to align with the individual characteristics of policyholders and the specific health system and demographics of Iran, rather than relying solely on general and international multipliers. In all previous articles, calculations have been made for a specific age. In this article, the aim is to design specific mortality tables for groups of people with specific diseases or lifestyles. In fact, there are some countries where the life tables are different for smokers and non-smokers. These tables also can be designed for different diseases and used in insurance companies. This will be especially useful for common diseases. This article will encourage insurance companies to use different methods of calculating insurance premiums and analyzing their performance, in addition to using additional numerical methods. Therefore, calculating specific mortality tables for substandard applicants (health or lifestyle) and calculating insurance premiums based on them for Iran is the innovation of this article. The approach presented in this research holds particular significance in the realm of life and health insurance, as it lays the groundwork for fairer premium pricing based on the actual health status of individuals. Furthermore, the proposed framework enables insurance companies to conduct risk assessments more accurately and purposefully, thereby leading to more effective management of risks associated with insured individuals.

4 Methodology

The research method of this paper is a combination of quantitative research and secondary analysis. The main objective of this study is to examine the impact of using specific mortality tables on life insurance pricing. Initially, the mortality rate is calculated based on mathematical models and available statistical data, and the premiums for policyholders with different health conditions are determined. This study particularly emphasizes the differences between general mortality tables and specific tables, demonstrating that using specific tables can lead to more accurate risk assessment and life insurance pricing. The quantitative research method in this study is based on numerical data analysis, which helps to achieve a more precise risk assessment and life insurance pricing. This method allows for the generation of reliable statistical results and the identification of meaningful relationships between various variables (such as age, health status, and mortality rate). Secondary analysis in this research refers to the use of data and information previously collected and published by other researchers or reliable sources. These data include existing statistics, reports, scientific papers, and library resources that indirectly assist in assessing the impact of specific mortality tables on life insurance pricing. Secondary analysis enables the reuse of existing data, resulting in time and cost savings. In this study, the mortality tables of Iran are specifically used to examine their impact on life insurance pricing. These tables more accurately reflect the mortality situation among individuals with specific characteristics, such as health status, in Iran, which increases the accuracy of risk assessment and premium pricing. The data collection method in this research is primarily based on library resources, including scientific papers, official reports, books, and reliable statistical data. Through this approach, the study has been able to investigate the impact of specific mortality tables on premium determination and has reached conclusions that can help improve the competitiveness and accuracy of life insurance pricing in Iran.

5 Main Results

In this section, we consider different adjustment multipliers (βs) to show how the calculated motality tables can be different from standard status, which is the state $\beta = 1$. Here we are discusing generally and one can calculate β for different cancers based on [5, 8, 19]. As it is clear in Table 1, standard mortality probabilities are different from the state in which a person has health problems, and the higher the beta, the higher the mortality probabilities. Because the life expectancy of a person becomes lower than the standard state. Therefore, the insurance premium obtained for a person with more health problems will be higher.

Table 1: Specific mortality tables for different adjustment multipliers

Age	$\beta = 1$	$\beta = 3$	$\beta = 5$
1	0.001241528097206	0.003724584291617	0.006207640486028
6	0.000603031510952	0.001809094532855	0.003015157554758
11	0.000532972551914	0.001598917655741	0.002664862759568
16	0.000698984416759	0.002096953250278	0.003494922083796
21	0.000990834778301	0.002972504334902	0.004954173891504
26	0.001193404107386	0.003580212322157	0.005967020536928
31	0.001336702938658	0.004010108815974	0.006683514693289
36	0.001524935321709	0.004574805965126	0.007624676608544
41	0.001930072006533	0.005790216019598	0.009650360032663
46	0.002712758543045	0.008138275629135	0.013563792715225
51	0.004162535005612	0.012487605016835	0.020812675028059
56	0.006626957075646	0.019880871226937	0.033134785378228
61	0.010850077999488	0.032550233998463	0.054250389997439
66	0.017882270898970	0.053646812696910	0.089411354494851
71	0.029518240044556	0.088554720133667	0.147591200222779
76	0.048465753883796	0.145397261651388	0.242328769418981
81	0.078702860265987	0.236108580797960	0.393514301329933
86	0.125353440150801	0.376060320452403	0.626767200754006
91	0.193981362742584	0.581944088227751	0.969906813712918

Table 1 presents mortality rates for different values of β. In this table, three scenarios for β are considered:

- $\beta = 1$ (Standard Condition): This represents a normal health status where the individual has no health issues.

- $\beta = 3$ and $\beta = 5$ (Substandard Conditions): These values reflect a deteriorated health status, indicating that the individual faces more serious health problems, which in turn lead to a higher risk of mortality.

The table provides the probability of death for each age (from 1 to 91 years) corresponding to the three different β values. A comparison between the standard condition ($\beta = 1$) and the substandard conditions ($\beta > 1$) reveals the following patterns:

- In early ages (e.g., 1 to 6 years), the differences in mortality probabilities between $\beta = 1$ and higher β values ($\beta = 3$ and $\beta = 5$) are relatively small, although the mortality risk remains higher for larger β values. For instance, at age 1, the probability of death is 0.00124 for $\beta = 1$, while it increases to 0.00372 for $\beta = 3$ and to 0.00621 for $\beta = 5$.

- In middle ages (e.g., 31 to 51 years), the differences in mortality probabilities become more pronounced, with individuals in poorer health (higher β values) experiencing significantly higher mortality risks. For example, at age 31, the probability of death is 0.00134 for $\beta = 1$, rising to 0.00401 for $\beta = 3$ and 0.00668 for $\beta = 5$.

- In older ages (e.g., 66 years and above), the differences become even more noticeable. Individuals with health impairments ($\beta = 3$ and $\beta = 5$) exhibit substantially higher mortality probabilities compared to those in standard health ($\beta = 1$). For instance, at age 66, the mortality probability is 0.01788 for $\beta = 1$, compared to 0.05365 for $\beta = 3$ and 0.08941 for $\beta = 5$.

- At very advanced ages (e.g., above 76 years), the mortality gap between $\beta = 1$ and the higher β values reaches its peak. For example, at age 76, the mortality probability is 0.04847 for $\beta = 1$, while it increases to 0.14540 for $\beta = 3$ and 0.24233 for $\beta = 5$.

These variations clearly demonstrate the impact of health conditions on increasing mortality risk and reducing life expectancy. In other words, the rise in mortality probabilities associated with deteriorated health underscores the importance of accounting for these differences in the calculation of insurance premiums and in the design of insurance programs. Table 2 also examines life insurance premiums for individuals aged 21 to 76. Assume the benefit amount (M)=1000 monetary units, interest rate (r) is based on regulation 68 in Iran industry: 16% for the first two years; Also 13% for the next two years; and 10% for the remaining years of the contract. maximum age (ω) is considered 100 based on Iran life table (ILT1400).

The results clearly indicate that an individuals health statusmeasured through an increased probability of mortalityhas a significant impact on the premium amount. In other words, a decline in health and a rise in mortality risk lead to a substantial increase in the premium required to cover life risk.

Table 2: Specific mortality tables for different adjustment multipliers for 21 to 76 years old people with an interval of 5 years

Age	$\beta = 1$		$\beta = 3$		$\beta = 5$	
	q_x	Premium	q_x	Premium	q_x	Premium
21	0.000990	16.175	0.002972	41.372	0.004954	63.139
26	0.001193	20.507	0.003580	50.544	0.005967	75.643
31	0.001336	26.604	0.004010	62.892	0.006683	92.006
36	0.001524	35.737	0.004574	81.005	0.007624	115.728
41	0.001930	49.324	0.005790	107.336	0.009650	149.781
46	0.002712	68.864	0.008138	143.812	0.013563	195.942
51	0.004162	96.012	0.012487	191.922	0.020812	254.979
56	0.006626	132.39	0.019880	252.191	0.033134	326.064
61	0.010850	179.386	0.032550	323.979	0.054250	406.892
66	0.017882	237.603	0.053646	404.878	0.089411	493.402
71	0.029518	306.371	0.088554	490.936	0.147591	580.715
76	0.048465	383.220	0.145397	577.167	0.242328	664.020

An analysis of the net single premium amounts across different age groups reveals that the health status of policyholders plays a decisive role in determining the amount of this premium. For instance, at the age of 21, the net premium for an individual in standard health is approximately 16 units, while for an individual with health problems, this amount rises to over 63 unitsan increase of about four times. This ratio decreases with age, so that at the age of 76, a healthy individual pays a premium of 383 units, while for an unhealthy individual, this amount increases to 664 unitsonly about 1.7 times higher. This trend indicates that the impact of health status on the net premium is much more pronounced at younger ages. The reason for this can be attributed to the very low mortality probability in young individuals in standard health, where any increase in this probability due to illness or health problems leads to a significant reduction in life expectancy and, consequently, a meaningful increase in the present value of the insurers liabilities. In contrast, at older ages, where the probability of death is higher even under normal health conditions, differences in health status have a relatively smaller effect on the premium amount. Therefore, a precise assessment of health status at younger ages is of strategic importance, as even small changes in mortality rates can significantly raise future costs for insurers.

Of course, the difference between standard and substandard premiums can also be examined from other aspects, especially from the perspective of the customer, i.e. potential policyholder and the insurer. Although personalization of life insurance sales is attractive to people with higher than normal health status and reduces

their premiums, it will increase the premium for people with health problems as discussed in this article, and as a result, the person may not be financially able to pay a higher premium than normal. Therefore, calculating the premium based on the proposed life tables from the perspective of a policyholder with substandard risk may lead to the financial insolvency of these people to pay the premium.
On the other hand, accurate risk assessment by insurance companies and receiving premiums commensurate with the risk of individuals will also cause appropriate reserves to be taken for these products, and as a result, the insurance company will be more confident in meeting its obligations, which will indirectly increase customer trust in the insurance company.

6 Conclusions

General and specific mortality tables each have their own characteristics, advantages, and disadvantages that impact the life insurance pricing process. General mortality tables offer significant advantages due to their simplicity and easy accessibility. These tables are based on broad, publicly available data and are readily accessible. Their use does not require the collection of complex or specific information, which results in lower operational costs. Furthermore, general tables are applicable to all age groups and populations. However, the primary limitation of these tables is their lack of accuracy in assessing individual risk. General tables cannot account for individual differences such as health status, lifestyle, or specific medical conditions, which can lead to inaccurate and unfair premium pricing.
In contrast, specific mortality tables provide greater accuracy in risk assessment. These tables, using more detailed information such as an individual's health status and lifestyle, are able to estimate risk with higher precision. This feature enables insurers to set more accurate premiums tailored to the specific condition of each policyholder. Additionally, due to the greater flexibility of these tables, they have the ability to adapt to changes in health status and medical advancements, which enhances their alignment with variable and complex conditions.
The use of specific mortality tables offers many benefits; however, it also presents challenges that could pose problems for insurance companies. These challenges mainly arise in the stages of data collection, analysis, and updating of these tables, especially in countries with weak information systems. One of the main challenges is the collection of accurate data regarding the characteristics of the insured, including medical information, lifestyle, socio-economic status, occupation, and other risk factors, which requires significant resources. Furthermore, specific mortality tables need to be continuously updated to maintain high accuracy, which can be time-consuming and costly. The design and use of these tables require complex analyses since they are not solely based on general demographic data but also take into account the specific characteristics of each insured individual. Another challenge concerns privacy issues, as the collection and use of personal data may be

subject to legal restrictions and data protection regulations. Additionally, the high costs associated with the design, data collection, and updating of these tables can be burdensome for some insurance companies, particularly in smaller or developing markets. In certain markets, limited access to specific data about the insured, particularly regarding medical conditions or lifestyle, can affect the accuracy of the tables, potentially leading to incorrect mortality rate predictions and, ultimately, improper pricing of insurance policies.
In conclusion, the integration of specific mortality tables is paramount for the insurance industry to adapt to the dynamic nature of mortality risk. Insurers that prioritize the development and refinement of these tables will be better equipped to manage their portfolios, ensuring both their financial health and the equitable treatment of their policyholders. This ongoing commitment to data-driven decision-making will ultimately lead to a more sustainable and fair life insurance market.

7 Suggestions for Future Research

In the context of the development and improvement of the application of specific mortality tables in the insurance industry, the following more specialized suggestions for future research are proposed:

- **The Impact of Medical Advances on Specific Mortality Tables:** Future research could examine the impact of medical advancements in disease prevention, treatment, and longevity on mortality rates and the updating of specific mortality tables, and assess the effect of these changes on premiums.

- **Mortality Modelling with Machine Learning:** The use of machine learning algorithms and individual policyholder data could enhance the accuracy of mortality rate predictions in specific mortality tables.

- **The Impact of Social and Economic Changes:** Investigating the economic and social effects of using specific mortality tables in reducing financial losses due to inaccurate predictions in insurance companies could improve risk management.

- **The Impact of Policyholder Screening on the Accuracy of Specific Mortality Tables:** Assessing the impact of the policyholder screening process on the accuracy of specific mortality tables and how it affects mortality rates could contribute to better pricing and risk assessment.

- **Challenges and Opportunities in Social and Retirement Insurance:** Investigating the challenges and opportunities of using specific mortality tables in social and retirement insurance could help improve the financial sustainability of insurance and social welfare systems.

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How to Cite: Mahboubeh Aalaei[1], Khadijeh Ebrahimnezhad[2], *Modifying premiums for life insurance products using specific mortality tables*, Journal of Mathematics and Modeling in Finance (JMMF), Vol. 5, No. 1, Pages:137–153, (2025).