LIFE INSURANCE HEALTH INCENTIVE PROGRAM PROPOSAL

SuperLife

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Executive Summary

This report outlines a proposed health incentive program aimed at improving SuperLife's existing life insurance products by incentivising healthy behaviours amongst policyholders. Key objectives and metrics include mortality rates, number of policies sold, and product competitiveness

Metrics for evaluating program performance include policyholder participation rates, policies sold, lapse rates, mortality rates, market share, customer satisfaction, and profitability.

Findings reveal significant mortality savings, indicating positive financial performance over the 20-year timeframe. Retrospectively, mortality savings with the implementation of this program are Č0.58b, and projections for mortality savings and program pro Č125.43m and Č75.95m, respectively. Proposed pricing changes include discounts for whole life premiums to attract customers and enhance competitiveness.

Risk mitigation strategies address financial, strategic, underwriting, operational, and reputational risks. Ethical considerations focus on program equality, device overdependence, discrimination in modelling, and target market discrimination.

In summary, the proposed health incentive program offers a great opportunity for SuperLife to make additions to its insurance products and promote healthier lifestyles for its policyholders, while achieving strong long-term financial results, and increased life insurance sales.

1. Program Overview

1.1 Objectives

The proposed health incentive program is designed to be bundled alongside SuperLife's longer-term insurance products. The mains goals of this program for policyholders include incentivising healthy behaviours and reducing expected mortality. For SuperLife, the program aims to increase life insurance sales, and enhance product marketability, competitiveness, and overall economic value. More details about each objective are outlined below:

- **Incentivise Healthy Behaviours:** The program seeks to motivate policyholders to adopt and maintain healthy lifestyles through participating in and tracking physical wellbeing activities. Through providing discounted gym memberships and incentives for these activities, the program seeks to motivate policyholders to make positive health choices.
- **Decrease Expected Mortality:** The program is designed to reduce overall policyholder mortality. Incentivisation and promotion of physical wellbeing activities would improve policyholder life expectancy, as well as quality of life.

- **Increase Life Insurance Sales:** The introduction of the program is targeted towards attracting new customers, retaining existing ones, and incentivising current term insurance holders to move towards whole life insurance for extended coverage.
- **Improve Product Marketability and Competitiveness:** The program enhances the appeal of SuperLife's insurance offerings in the market by distinguishing them from competitors through incentives and wellbeing interventions.
- **Add Economic Value to SuperLife:** The program aims to create long-term economic value through furthering customer loyalty and realising mortality savings from a reduced cost of claims through the introduction of discounted gym memberships and fitness tracking incentives.

1.2 Performance Metrics

The following metrics will be used to track the program's performance:

- **Policyholder Participation:** The percentage of policyholders who have signed up for the program.
- **Policies Sold:** Number, type, and sum assured of policies.
- **Lapse Rate Monitoring:** The proportion of policyholders lapsing on their policies before and after the introduction of the health incentive program.
- **Mortality Rate Monitoring:** Changes to policyholder mortality before and after the introduction of the program.
- **Market Share:** Number of policies sold compared to competitors.
- **Customer Satisfaction:** Surveys provided to policyholders regarding the program, using metrics such as Net Promoter Score (NPS) and customer satisfaction surveys.
- **Profitability:** Economic value of SuperLife's insurance products with and without introduction of the program.
- **Claim Frequency and Severity:** The number and cost of claims made by policyholders, broken down into product type and (20-year term insurance or whole life insurance).

The above metrics should be summarised by policyholder demographics (e.g., age, sex, rural/urban residence, smoker status, etc.) for detailed analysis. Initially, frequent tracking of these metrics, such as monthly or quarterly, is recommended to monitor the program's performance. Over time, less frequent tracking may be viable for ongoing assessment.

2. Program Design

2.1 Program Incentives

The health incentive program was designed to achieve the objectives mentioned above.
Its proposed incentives aim to prioritise reducing expected policyholder mortality while also encouraging active, ongoing participation in the program. The proposed incentives are as follows:

- **Fitness Tracking Incentives:** Policyholders will be incentivised to track their physical activities through smartphones, wearables, or other exercise tracking devices, and upload their progress to the SuperLife website or app. Metrics including step count, calories burned, distance covered, and exercise duration will be used to determine each

policyholder's activity level. Monetary rewards will be provided to policyholders who meet predetermined activity benchmarks based on their age group.

- **Discounted Gym Memberships:** Participants of the health incentive program will gain access to gym facilities at discounted rates. This intervention is designed to incentivise policyholders to enrol in the program and encourages them to maintain consistent physical activity. SuperLife partnering with gyms and providing affordable access to fitness facilities and promoting regular exercise, this initiative jointly supports policyholders in achieving their goals set in the fitness tracking initiative.

2.2 Incentive Justification

The selection of fitness-based incentives for the program were based on an analysis of SuperLife policyholders' primary causes of death: C00-D48 (Neoplasms) and I00-I99 (Diseases of the circulatory system), which collectively contribute to 63.5% of policyholder deaths. While Lumaria specific data is unavailable, long-running case studies from other countries have shown that physical activity can reduce mortality from these causes by approximately 17% each. Additionally, ongoing physical activity has been shown to reduce mortality related to E00-E88 (Endocrine, nutritional, and metabolic diseases), F01-F99 (Mental and behavioural disorders), and J00-J98 (Diseases of the respiratory system), accounting for 12.6% of SuperLife policyholder deaths.

The fitness tracking incentive has been selected based on SuperLife policyholders' primary causes of death and the observed effect of physical activity on reducing mortality for these causes. Furthermore, providing discounted gym memberships offers accessible pathways for policyholders to engage in regular physical exercise, which aligns with the goals of the fitness tracking incentive. The synergy between these two incentives has been shown to increase participation and improve the overall health of policyholders, as displayed by similar programs implemented by health and life insurers in other countries.

2.3 Program Evaluation Timeframe

To evaluate overall program performance, financial metrics, mortality rates, and policy data should be assessed over both short and long-term periods.

The short-term evaluation timeframe for this program has been set at the 5-year mark. This time frame has been selected for the following reasons:

- It provides sufficient time for mortality trends to become evident and trends in claim frequency and severity, which may not be immediately observable.
- This timeframe allows for a better understanding of metrics such as profitability, mortality savings, and market share. This is due to the long-term nature of the health incentive program benefits compared to the upfront program costs.
- While the short-term evaluation timeframe has been selected at the 5-year mark, regular monitoring is recommended to allow for any immediate program adjustments to premiums and policyholder incentives. This ensures that SuperLife can address any issues regarding policyholder satisfaction and product competitiveness.

The long-term evaluation timeframe for this program has been set at the 20-year mark. This time frame has been selected for the following reasons:

- SuperLife's insurance products are designed for long-term coverage and should be evaluated in a timeframe that aligns with the duration of these products.
- The 20-year timeframe allows for better understanding of long-term financial performance, as well as trends relating to policyholders such as mortality rates, physical activity levels, and lapse rates.
- This long-term evaluation period allows for assessment of product resilience across multiple economic cycles, including periods of economic downturn and growth.
- Additionally, this timeframe allows for a better understanding of the product's performance in various scenarios, such as financial crises or pandemics (e.g., GFC, COVID-19). Evaluating the program over a 20-year duration mitigates the risks associated with making business decisions based on short-term fluctuations in results.

3. Pricing/Costs

3.1 Methodology

Mortality savings refers the overall reduction in claim costs resulting from the proposed program's improvements to policyholder mortality and reduction in claim frequency. To determine the mortality savings from this program, a comparison of total claims costs over the past 20 years with and without the program was carried out. For further details on methodology, refer to Appendix A.

Additionally, a prospective assessment of the program was conducted to forecast future mortality savings and profitability. This was done similarly comparing total claim cost over the timeframes identified above (5-year and 20-year timeframes) with and without the program. This was done to ensure that policy benefits under the proposed program are greater than policy benefits without it.

3.2 Retrospective Mortality Savings

	Total Claim Costs (Č)		**Mortality Savings**		
	Without Program	**With Program**	**Č**	**%**	**# Policies**
20-year Term	4.21b	3.88b	0.33b	7.7	311,595
Whole Life	27.38bm	27.13b	0.25b	0.9	117,566
Total	31.60b	31.02b	0.58b	1.8	429,161

The total prospective mortality savings over the past 20 years is Č579.4m. Mortality savings for whole life and 20-year term insurance policies are Č254.2m and Č325.2m respectively. The higher savings observed with the 20-year term insurance product can be attributed to the larger number of policies and the limited term coverage offered. As a result, policyholders who outlive the 20-year term due to the program's mortality improvements will not file claims, contributing to this higher savings figure.

3.3 Prospective Mortality Savings

5-year Timeframe	Total Claim Costs (Č)				
	Without Program	**With Program**	**Mortality Savings (Č)**	**Expenses**	**Profit**
20-year Term	4.86m	4.58m	0.28m	6.59m	(6.31m)
Whole Life	19.89m	18.55m	1.34m	6.71m	(5.37m)
Total	24.75m	23.13m	1.62m	13.30m	(11.68)

20-year Timeframe	Total Claim Costs (Č)				
	Without Program	**With Program**	**Mortality Savings (Č)**	**Expenses**	**Profit**
20-year Term	1,069.81m	994.92m	74.89m	24.28m	50.61m
Whole Life	664.86m	614.33m	50.54m	25.20m	25.34m
Total	1,734.68m	1,609.25m	125.43m	49.48m	75.95m

The total retrospective mortality savings for the 5-year and 20-year terms are Č1.6m and Č125.4m, respectively. The total profits of the proposed program over the same timeframes are -Č11.7m and Č75.9m, respectively. Despite unfavourable financial performance at the 5-year mark, both products show positive results at the 20-year timeframe. The 20-year term insurance performs better in the long run for the same reasons mentioned in the retrospective analysis. Long-term financial performance evaluation shows that SuperLife's policy benefits are greater with the implementation of the proposed program than without.

3.4 Proposed Pricing Changes

While 20-year term insurance provides greater aggregate policy benefits, it is important to consider the long-term investment income generated from whole life insurance. To achieve this investment income, it is important to attract customers to whole life insurance, specifically younger policyholders as they are more likely to purchase a 20-year term insurance policy. Hence, a discount to whole life premiums is suggested, as it would encourage term insurance policyholders to swap over to whole life insurance. Discounts would also allow SuperLife's whole life insurance to be more competitive in Lumaria's life insurance market.

4. Assumptions

This section outlines the key assumptions made during the health incentive project design, and performance evaluation. These assumptions are related to policy data, economic favours, and program specific details.

Category	Explanation
Policy Data Assumptions	- The in-force policyholder data utilized for projections spanning 2024-2046 is assumed to mirror the provided data for the period of 2001-2023.

Economic Assumptions	- The inflation rate used for projections was calculated as the average inflation rate from the last two years. - The discount rate used was calculated as the average of the 1-year discount rate from the last 10 years.
Financial Assumptions	- Death benefits are paid at the end of each calendar year. - Expenses associated with policyholder gym memberships and monetary rewards are paid at the start of each calendar year. - To allow for direct comparison, net profit margin and expense profit margin figures, both with and without the health incentive program, are discounted back to the start of 2024. - Gym membership expenses and fitness tracking rewards are assumed to cost SuperLife Č104 and Č106 per policyholder per annum respectively.
Program Assumptions	- Program participation rates and reward probabilities (the likelihood that policyholders meet their activity thresholds) are based on case studies on activity levels across various age groups. - The baseline mortality improvement rate was selected at 16% based on case studies on the effects of physical activity on mortality. - The mortality reduction for each age group is determined by analysing which causes mortality risk are affected by physical activity and the proportion of the age group affected by those causes.

The following assumptions had the most significant impact on the health incentive program's costs:

- **Gym Membership Discounts:** Based on research across various countries and provided information about Lumaria's economy, a gym membership was assumed to cost Č20 per week. The discount rate was assumed at 10%, (Č2 per week) resulting in a fixed annual expense of Č104 per policyholder.
- **Participation and Reward Rates:** These rates were derived from case studies across different countries on levels of physical activity for different age groups. The overall rate that policyholder will participate in the program and hit their fitness goals was assumed to be 68%.
- **Fitness Tracking Incentives:** Participants who achieve their weekly physical activity goals receive a Č3 reward per week. This incentive is strategically aligned with the gym membership discount, offering policyholders an additional monetary benefit for using gym facilities to hit their fitness goals. The annual expense per policyholder, based on the participation and reward rates mentioned above, is estimated at Č106.

5. Risk and Risk Mitigation Considerations

5.1 Key Program Risks and Mitigation Techniques

The implementation of the health incentive program involves both quantifiable and qualitative risks. These risks have been categorised and assigned levels of severity and likelihood (1 being the lowest and 5 being the highest). To ensure program success, SuperLife must have appropriate risk mitigation strategies in place.

Quantifiable risks are those that can be evaluated using numerical metrics, such as financial performance, policyholder statistics, and economic variables.

#	Risk Category	Risk	Severity, Likelihood	Description/Mitigation
1	Financial Risk	Inflation Risk	(4,2)	Inflationary pressures may affect program participation rates, expenses, incentives, and premiums. This may lead to a higher lapse rate and reduced profitability. **Mitigation:** Sensitivity analysis for higher inflation, expenses, lapse rates with contingency strategies prepared.
2	Strategic Risk	Gym Under-utilisation Risk	(2,2)	Policyholders sign up for discounted gym facilities without using them, resulting in minimal impact on mortality rates or savings. **Mitigation:** Monitor attendance rates and exercise frequency. Consider adjusting discounts based on participation (i.e., a tiered discount system).
3	Under-writing Risk	Selection Risk	(2,3)	Policyholders who already engage in a high level of physical activity join the program for the monetary benefits, and do not actually decrease their mortality risk. **Mitigation:** Define goals for participants based on their recent fitness levels to properly incentivise activity levels.

Qualitative risks involve factors that are subjective and not easily measurable, such as reputation damage, customer behaviour, and large-scale, global event.

#	Risk Category	Risk	Severity, Likelihood	Description/Mitigation
4	Operati-onal Risk	Moral Risk	(2,3)	The potential for policyholders to submit inaccurate or dishonest fitness data to receive monetary rewards. **Mitigation:** Implement user authentication methods when uploading activities to SuperLife to verify data submissions.
5	Operati-onal Risk	Injury Risk	(3,2)	Encouraging physical activity may lead policyholders to engage in unfamiliar exercises, increasing the risk of injury. **Mitigation:** Provide injury prevention information upon enrolment to policyholders.
6	Strategic Risk	Reputati-onal Risk	(4,1)	Policyholders provide sensitive, personal data and may misunderstand how it is used by

				SuperLife, leading to mistrust and a damaged reputation for the company. **Mitigation:** Communicate clearly to policyholders the collection, storage, and use of their data, obtaining consent upon enrolment on SuperLife's data processes.
7	Event Risk	Crises/ Pandemic Risk	(5,1)	A global event such as a financial crisis or pandemic occurs. **Mitigation:** Use experience from previous events (e.g., GFC, COVID-19) to develop contingency plans. This information should be provided to policyholders in the program's PDS.

The above risks are specific to the proposed health incentive program. Additional risks that SuperLife may want to consider regarding insurance practices in general are in Appendix B.

5.2 Ethical Considerations

- **Program Equality:** The program emphasises physical activity which may pose challenges for policyholders with disabilities, which may result in the program being perceived as unfair and exclusive.
    - **Mitigation:** Collect information about policyholder abilities upon enrolment and tailor activity goals accordingly to accommodate those of all ability levels.
- **Device Overdependence:** Policyholders may feel excluded if they lack access to or are unfamiliar with fitness tracking devices, potentially leading to lower participation rates.
    - **Mitigation:** Offer alternative methods for fitness tracking, such as manual logging with the supervision of a qualified instructor.
- **Discrimination in Modelling:** Variables such as age, gender, or race used to calculate program metrics may indirectly lead to discrimination or bias, possibly resulting in dissatisfied policyholders and reputation damage.
    - **Mitigation:** Conduct research on ethical variable usage in accordance with Lumarian regulations. Remove variables and their proxies to prevent inadvertent discrimination.
- **Target Market Discrimination:** Certain demographics may feel excluded if the marketing campaigns are not tailored to reach them, which may lead to lower participation rates.
    - **Mitigation:** Conduct market research on advertising styles and channels to ensure that campaigns are targeted equally at all policyholder demographics.
    -

5.3 Sensitivity Analysis

Various scenarios have been tested below to ensure robustness of the proposed program against a range of mortality, lapse, and economic risks, over the 20-year timeframe.

- Scenario 1: New trends in policyholder mortality (+/- 10% to mortality rates for all age groups)

	-10% Mortality Rates			+10% Mortality Rates		
	Mortality Saving (Č)	**Expense (Č)**	**Profit (Č)**	**Mortality Saving (Č)**	**Expense (Č)**	**Profit (Č)**
20-year Term	67.52m	26.98m	40.54m	82.23m	21.74m	60.49m
Whole Life	45.60m	25.20m	20.40m	55.46m	25.20m	30.26m
Total	113.12m	52.19m	60.94m	137.69m	46.94m	90.75m

- Scenario 2: Change in lapse rate (+/- 10% lapse rate for 20-year term insurance)

	-10% Lapse Rates			+10% Lapse Rates		
	Mortality Saving (Č)	**Expense (Č)**	**Profit (Č)**	**Mortality Saving (Č)**	**Expense (Č)**	**Profit (Č)**
20-year Term	75.34m	24.28m	51.05m	75.45m	24.28m	50.16m

- Scenario 3: Change in interest rates (+/- 10% for interest rates)

	-10% Interest Rates			+10% Interest Rates		
	Mortality Saving (Č)	**Expense (Č)**	**Profit (Č)**	**Mortality Saving (Č)**	**Expense (Č)**	**Profit (Č)**
20-year Term	76.08m	25.07m	51.01m	73.73m	23.73m	49.99m
Whole Life	51.44m	25.97m	25.47m	49.66m	24.47m	25.20m
Total	127.52m	51.04m	76.48m	123.39m	48.20m	75.20m

- Scenario 4: Change in inflation rates (+/- 10% for inflation rates)

	-10% Interest Rates			+10% Interest Rates		
	Mortality Saving (Č)	**Expense (Č)**	**Profit (Č)**	**Mortality Saving (Č)**	**Expense (Č)**	**Profit (Č)**
20-year Term	74.89m	23.69m	51.20m	74.89m	24.59m	50.29m
Whole Life	50.54m	24.63m	25.91m	50.54m	25.87m	24.67m
Total	125.43m	48.32m	77.11m	125.43m	50.47m	76.96m

6. Data and Data Limitations

6.1 Data Sources

The data provided by SuperLife's task force was used to design the health incentive program proposal. No additional data sources were used for analysis. The following datasets were used:

- SuperLife Inforce Dataset (policyholder data)
- Lumaria Historical Inflation and Interest Rates
- Online Encyclopedia Entry: Lumaria

Additionally, the key to the SuperLife Inforce Dataset was referred to for a comprehensive understanding of the dataset.

6.2 Data Limitations

Data from SuperLife's task force was used during program design, assumption setting, modelling, and program evaluation. Although the data used was sufficient for the program proposal, the following data limitations were present:

- **Insufficient Historical Data:** SuperLife provided 23 years of policyholder data, however, due to the long-term nature of life insurance products, it is difficult to observe long-term trends.
- **Mortality Data Depth:** Cause of death categorised according to the ICD-10 database. More granular data on cause of death would allow for a better understanding of mortality for SuperLife policyholders. This extra granularity would have allowed for the consideration of interventions targeting specific causes of death.
- **Data Reliability:** The observed lapse rate for the 20-year term insurance product was approximately 1%, while industry estimates it at approximately 6%. There is also an absence of lapses for whole life products, hence these policies have no surrender value. This is an unrealistic scenario that suggests potential inaccurate data collection or transformation.
- **Physical Activity Data:** The proposed program encourages physical activity with the aim of improving policyholder mortality, however, data on the activity levels of policyholders is not available. Hence, case studies from other countries were used when setting assumptions regarding activity levels for SuperLife's policyholders.
- **Data Availability:** Data on SuperLife's reserve rate, capital, and commission expenses were not available. Without this data, constructing an accurate premium pricing model for SuperLife's products becomes challenging.

7. Conclusion

The proposed health incentive program presents an opportunity for SuperLife to enhance its insurance offerings and promote healthier lifestyles among its policyholders. The physical activity interventions of this program have significant potential for reducing mortality rates and improving SuperLife's economic value. To ensure success in the implementation of this program, SuperLife must monitor program metrics, employ risk mitigation techniques, and address any potential ethical considerations that may arise. SuperLife should consider offering a discount to policyholders who are signing up to whole life insurance. This is to encourage 20-year term insurance policyholders and new policyholders to sign up for more complete life insurance coverage and provides greater investment capital for SuperLife to explore or improve existing products.

Appendices

Appendix A – Methodology

For calculating the total expected claim cost in term life insurance, the methodology centers around accurately assessing the financial impact of policyholder deaths. This begins with determining the death benefits, which are the product of the expected number of deaths and the predetermined death benefit value. The expected deaths are computed by applying the standardized mortality rate, to the current number of in-force policies, adjusting for scale. This mortality rate is adjusted to reflect a more practical figure of anticipated deaths within the policyholder pool, providing a foundational metric for subsequent calculations.

Subsequently, the calculation incorporates policy lapses and the dynamic nature of in-force policies over time. Policy lapses are identified as either the product of the lapse rate and initial in-force policies or the difference between initial in-force policies and the number of deaths, whichever is lesser. This accounts for policyholders exiting the policy pool through means other than death. In-force policies at the start of each period are then updated by subtracting both deaths and lapses from the previous period's end-of-period in-force policies. Through this iterative process, the methodology effectively captures the evolving landscape of policyholder demographics and behaviours, ensuring a comprehensive assessment of the insurer's expected financial liabilities.

The calculation for whole life is very similar except it excludes the effect of lapse rate (as we assume the lapse rate for whole life is 0), and the number of years calculated in the 120 - issue age of the policy holder rather than 20 years.

- **Mortality Loading:** Policyholders are categorised into 10-year age brackets and the overall mortality rate is calculated for each group. Further segmentation is applied based on smoking status and underwriting class. Ratios are then calculated and scaled to maintain a range between 0.80 and 1.50 for reasonableness. This results in loading factors based on age group, smoker status, and underwriting class.
- **Lapse Rate:** Due to the limited data for 20-year term insurance products, a dataset was sampled using policies issued in 2001. The number of active in-force policies and policies lapsed was used to calculate the lapse rate for each year using the following formula:

$$Lapse\ rate\ = \frac{Number\ of\ lapse\ in\ this\ year}{Number\ of\ in-force\ policies\ at\ the\ beginning\ of\ this\ year}$$

Appendix B – Risk

Below are some additional risks and mitigation strategies that SuperLife should consider. While not tailored explicitly to the health incentive program, these considerations are important in managing risks that are part of SuperLife's operations in the life insurance market.

- **Adverse Selection:** Policyholders with higher underwriting risk levels are more likely to seek coverage, leading to a sub-optimal level of risk in SuperLife's portfolio.
    - **Mitigation:** Underwriters should take into account the proportions of policyholders' risk levels, with an optimal level of risk in mind for the overall portfolio.
- **Mortality Risk:** New trends regarding mortality may occur in the long-term. These may be positive or negative.
    - **Mitigation:** Regularly monitor mortality assumptions to ensure that they remain accurate.
- **Interest Rate Risk:** Fluctuations in interest rates will impact the financial performance of SuperLife's products.
    - **Mitigation:** Conduct scenario analysis to ensure that SuperLife's financial performance is relatively stable over a range of interest rate assumptions.
- **Regulatory Risk:** Non-compliance with regulatory requirements may result in fines, stopping of operations, or reputational damage.
    - **Mitigation:** Ensure that all of SuperLife's products and operations are in compliance with the relevant Lumarian or international regulations through use of auditing and employee training.
- **Cybersecurity Risk:** Potential IT system hardware/software errors or data breaches would impact SuperLife's financial performance and reputation.
    - **Mitigation:** Implement strong cybersecurity measures to safeguard data and test disaster recovery plans to ensure minimal disruption to operations.
- **Competition Risk:** Competitors are introducing products that are more appealing than SuperLife's, causing a loss in market share.
    - **Mitigation:** Conduct market research to ensure that SuperLife's products remain competitive in the market to maintain or grow market share.
- **Human Error Risk:** Accidental errors made by employees in data collection, processing, modelling that impact business decisions and financial performance.
    - **Mitigation:** Implement peer reviews and sense checks throughout operations to detect any erroneous practices, notify the relevant manager(s), and correct the error as soon as possible.
- **Catastrophe Risk:** Natural hazards such as floods, cyclones, or bushfires can lead to a rise in both claim frequency and severity.
    - **Mitigation:** Consult climate scientists and consider scenario modelling for various types of natural hazards and their effects on overall claim costs.

References

AIA Insurance | Life Insurance | AIA Australia n.d., www.aia.com.au.

Australian Bureau of Statistics 2022, *Physical activity*, Australian Bureau of Statistics.

Gottlieb, D & Smetters, K 2021, 'Lapse-Based Insurance', *American Economic Review*, vol. 111, no. 8, pp. 2377–2416.

Kokkinos, P 2012, 'Physical Activity, Health Benefits, and Mortality Risk', *ISRN Cardiology*, vol. 2012, no. 718789, pp. 1–14.

Lee, DH, Rezende, LFM, Joh, H-K, Keum, N, Ferrari, G, Rey-Lopez, JP, Rimm, EB, Tabung, FK & Giovannucci, EL 2022, 'Long-Term Leisure-Time Physical Activity Intensity and All-Cause and Cause-Specific Mortality: A Prospective Cohort of US Adults', *Circulation*, vol. 146, no. 7, pp. 523–534.

Leitzmann, MF, Park, Y, Blair, A, Ballard-Barbash, R, Mouw, T, Hollenbeck, AR & Schatzkin, A 2007, 'Physical Activity Recommendations and Decreased Risk of Mortality', *Archives of Internal Medicine*, vol. 167, no. 22, pp. 2453–2460.

Li, T, Wei, S, Shi, Y, Pang, S, Qin, Q, Yin, J, Deng, Y, Chen, Q, Wei, S, Nie, S & Liu, L 2016, 'The dose-response effect of physical activity on cancer mortality: findings from 71 prospective cohort studies', *British Journal of Sports Medicine*, vol. 50, no. 6, pp. 339–345.

Stensvold, D, Viken, H, Steinshamn, SL, Dalen, H, Støylen, A, Loennechen, JP, Reitlo, LS, Zisko, N, Bækkerud, FH, Tari, AR, Sandbakk, SB, Carlsen, T, Ingebrigtsen, JE, Lydersen, S, Mattsson, E, Anderssen, SA, Singh, MAF, Coombes, JS, Skogvoll, E & Vatten, LJ 2020, 'Effect of exercise training for five years on all cause mortality in older adults—the Generation 100 study: randomised controlled trial', *BMJ*, vol. 371.

Zhang, Y & Liu, X 2024, 'Effects of physical activity and sedentary behaviors on cardiovascular disease and the risk of all-cause mortality in overweight or obese middle-aged and older adults', *Frontiers in Public Health*, vol. 12, Frontiers Media.