

INTISARI

MODEL MULTI STATUS SEMI-MARKOV UNTUK ASURANSI PERAWATAN JANGKA PANJANG SUAMI ISTRI

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Long-term care (LTC) adalah satu bentuk asuransi yang dirancang untuk melindungi individu atau kelompok yang kehilangan kemampuan merawat diri sendiri akibat kondisi fisik atau psikologis, sehingga membutuhkan bantuan untuk menjalankan aktivitas dasar kehidupan sehari-hari atau dikenal sebagai *Activity of daily living* (ADL). Dari perspektif pasangan suami istri, asuransi LTC berperan penting dalam memberikan perlindungan bagi pasangan serumah. Pertumbuhan populasi lansia di berbagai negara, semakin memperkuat urgensi perlindungan melalui asuransi LTC. Penelitian ini bertujuan memodelkan hubungan dependensi antara sisa usia hidup pasangan suami istri dan menghitung produk asuransi terkait menggunakan pendekatan semi-Markov multi-status. Model yang dikembangkan mengintegrasikan asuransi LTC dan asuransi jiwa dengan memanfaatkan intensitas transisi dari model semi-Markov multi-status. Intensitas transisi diestimasi menggunakan metode maksimum likelihood dan parameter Gompertz, kemudian digunakan untuk menghitung peluang transisi melalui persamaan diferensial Kolmogorov. Hasil estimasi disesuaikan dengan faktor proporsional yang relevan dalam asuransi LTC. Peluang transisi digunakan untuk menghitung premi asuransi LTC gabungan berdasarkan pemodelan semi-Markov multi status. Data penelitian mencakup 12.170 pasangan suami istri dengan periode observasi tahun 1988 hingga 1993 oleh *Society of Actuaries*, serta analisis prevalensi LTC perumahan dan tren penurunan kematian di rumah. Studi ini juga menganalisis tingkat prevalensi *Long-Term Care* (LTC) perumahan serta tren penurunan angka kematian di rumah. Hasil penelitian menunjukkan adanya dependensi antara usia suami-istri, di mana terjadi peningkatan *force of mortality* sejak kematian pasangan. Simulasi perhitungan



produk asuransi LTC gabungan dilakukan pada pasangan berusia $x = 62$ tahun dan $y = 60$. Santunan asuransi diberikan sebesar Rp200 juta jika pasangan suami istri meninggal dunia dan manfaat Long-Term Care (LTC) sebesar Rp10 juta per tahun selama periode pertanggungan 20 tahun. Berdasarkan jenis produk asuransi yang ditawarkan, pasangan suami istri dapat memilih produk sesuai dengan kebutuhan dan kondisi mereka.

Kata Kunci: Model multi-status, semi-Markov, *long-term care* (LTC), premi asuransi.

ABSTRACT

MULTI STATE SEMI-MARKOV MODEL FOR SPOUSE TERM CARE INSURANCE

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Long-Term Care (LTC) is a form of insurance designed to protect individuals or groups who have lost the ability to care for themselves due to physical or psychological conditions, requiring assistance to perform basic activities of daily living, also known as Activity of Daily Living (ADL). From the perspective of a married couple, LTC insurance plays a crucial role in providing protection for spouses within the same household. The increasing elderly population in various countries further highlights the urgency of protection through LTC insurance. This study aims to model the dependency relationship between the remaining life expectancy of a married couple and to calculate the associated insurance products using a multi-state semi-Markov approach. The developed model integrates LTC insurance and life insurance by utilizing the transition intensity of the multi-state semi-Markov model. The transition intensity is estimated using the maximum likelihood method and Gompertz parameters, which are then used to calculate the transition probability through the Kolmogorov differential equation. The estimation results are adjusted by relevant proportional factors in LTC insurance. Finally, the transition probability is applied to calculate the combined LTC insurance premium based on multi-state semi-Markov modeling. The research data covers 12.170 married couples with an observation period from 1988 to 1993, collected by the Society of Actuaries, and includes an analysis of the prevalence of residential Long-Term Care (LTC) and the downward trend of at-home mortality. This study also examines the prevalence rate of residential LTC and the declining trend of at-home mortality. The results indicate a dependency between the ages of husbands and wives, showing an increase in the force of mortality following the death of a spouse. The simula-

tion for calculating the combined LTC insurance product is conducted for couples aged $x = 62$ and $y = 60$. Insurance benefits amounting to *IDR 200 million* are provided in the event of the simultaneous death of both the husband and wife and Long-Term Care (LTC) benefits of *IDR 10 million* per year for a coverage period of 20 years. Based on the type of insurance product offered, married couples can select a product that aligns with their needs and conditions.

Keywords: Multi-state model, semi-Markov, *long-term care* (LTC), insurance premium.