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THE MATHEMATICAL MODELING OF THE QUANTITATIVE RELATIONSHIP BETWEEN INCREASING THE SURVIVAL RATE OF ONCOLOGICAL PATIENTS AND THE GROWTH OF CANCER MORBIDITY

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The issue of assessing the dependence of oncological morbidity on the probability of cure of such a disease is considered in this paper. It is considered that malignancy of cells requires damage to a certain number of certain genes (Lopez-Lazaro M., 2010), (Knigavko V. et al., 2014). Since the damage to one or another gene is accidental, cell malignancy for the same initial (from birth) gene numbers in the genotype should occur at different times of time with varying probabilities. Obviously, due to the randomness of the mutation process, the initial number of these genes in the genotypes of different people is different. Thus, the less unharmed such genes are in the genotype of the individual, the greater is the likelihood of his oncological disease occurring in him. To solve such a question, the method of mathematical modeling was used. Let α is the probability of damage to some a-gene in one cycle of division, *n* is the number of cycles of division from the moment of formation of this tissue, *k* is the initial number of a-genes in the cell, t = n·T, where T is the duration of the cell cycle. Let also *m* is the initial number of a-genes in gametes, $\varphi(m)$ is the probability that *m* a-genes are contained in the gamet in the beginning of the reproductive cycle in gametes, $\psi(m)$ is the probability that at the end of the reproductive cycle in gametes contains *m* a-genes, *s (t)* is the function of distribution of the life expectancy of those individuals who do not have cancer; $\nu(\tau)$ is the density of the probability of reproduction time, Φ(m,t) and F(k,t) - the function of distribution of the time of the formation of a malignant tumor in the initial presence in gametes *m* a-genes and time the formation of a malignant tumor with an initial presence in the genotype of individuals and *k* a-gene, respectively, *L* - probability cure cancer. At first, the probability that gamete, originally having 4 genes subject to malignancy, was preserved during the reproductive cycle was funded. Let's denote this probability $P_{4\to4}$. To preserve such a gamete, it is necessary that the mutations do not damage any of these genes, so that the life expectancy of the individual containing this gamete is greater than the duration of the reproductive period. Necessary also that the individual with such a gamete has not acquired or acquired an oncological illness during the reproductive period. The probability that the reproduction will occur at the time *t* (more precisely, in the interval of time from t to t + dt) is equal to $\nu(t)dt$. The probability that an individual is still alive by this moment is equal to 1 – s(t). The probability that by the time t, none of the a-genes in the gamete considered is not damaged is equal to $\beta^{\frac{4t}{T}}$. The probability that an individual with a gamete to be considered will not acquire at the time of the oncological illness is equal to 1 – Φ(4,t). The probability that this individual will acquire an oncological illness before that time, but then cured, is equal to Φ(4,t)·L.

In the experiment, a formula is obtained that allows us to calculate the mean value of the time ($\bar{t}_k$) of occurrence in an individual oncologic disease in the initial presence in the genotype of the individual k-genes. The solution of this system of equations for the determination of probabilities $\varphi(m)$ allows, in turn, to calculate the probability values ($\xi(k)$) of the presence of k a-genes in the individual in the genotype. Thus, with known values of $\xi(k)$, the average time ($\bar{t}$) of appearance in an individual oncologic disease in the general case is calculated by the following formula: $\bar{t} = \sum_{k=1}^{8} \bar{t}_k \cdot \xi(k)$

In terms of assessing the dependence of oncological morbidity on the probability of cure of such a disease the probability of occurrence of cancer to a certain age of a person should be considered as major indicator. Obviously, the probability of preserving gametes depends on the time of reproduction and on the length of life of the individual. Factors that affect life expectancy can be divided into those that are related to cancer patients and those that are not associated with such diseases. In turn, the life expectancy of a cancer patient and the possibility of reproduction depend on the effectiveness of treatment.