
COMPREHENSIVE ASSESSMENT OF THE MAIN INDICATORS OF THE HEALTHCARE SYSTEM IN SURKHANDARYA REGION USING FUZZY MODELING

Ismoilova Dilfuza Ibodullayevna

Independent researcher at Termez State University, Uzbekistan

ABSTRACT

This article analyzes the healthcare system indicators of Surkhandarya region using statistical and econometric methods. Based on data from 2013–2024, trend models were constructed and forecasts for 2025–2030 were made. The key indicators include population size, birth and mortality rates, morbidity, number of medical personnel, hospital beds, and outpatient facilities. Fuzzy modeling methods were applied to estimate the upper and lower bounds of forecast values, while weight coefficients were calculated using the Fishburn rule. The results revealed regional disparities and emphasized the need to adjust investment policy and expand private sector participation in the healthcare system.

KEYWORDS: Healthcare system, Surkhandarya region, statistical analysis, econometric model, forecasting, fuzzy modeling, Fishburn rule, investment.

INTRODUCTION

One of the priority directions in the socio-economic development of Surkhandarya region is improving public health and increasing life expectancy. Therefore, the healthcare system indicators of the region were analyzed using statistical and econometric methods.

The study is based on data from 2013–2024. The main indicators selected include population size, birth and mortality rates, the number of doctors and mid-level medical personnel, hospital beds, outpatient facilities, morbidity rates, and certain types of diseases. To generate fuzzy forecast scenarios for the number of doctors of all specialties and mid-level medical staff in Surkhandarya region, the proposed methodology was applied.

Using GRETl software, trend models were constructed. The results showed that the number of healthcare workers has been steadily increasing year by year, while the number of primary morbidity cases is also rising, though at a slower pace. Forecasts for 2025–2030 indicate stable growth in births and respiratory diseases, while mortality and the number of outpatient institutions demonstrate relatively weak stability.

At the next stage of the study, a comprehensive quantitative assessment of the healthcare system in Surkhandarya region was carried out using the theory of fuzzy sets. The assessment was performed with a standard three-level $[0,1]$ fuzzy classifier, based on annual statistical data from Surxonstat characterizing the state of regional healthcare during 2013–2024. For the analysis, the indicators were normalized as the ratio of each value to its maximum level.

Fuzzy modeling made it possible to determine the upper and lower limits of forecast values for 2025–2030, and both optimistic and pessimistic scenarios were developed. In addition, weight coefficients were calculated using the Fishburn rule, and normalized indicator values were determined.

As a result, medium-term forecast scenarios for the main healthcare indicators of Surkhandarya region up to 2030 were developed based on 2013–2024 data. The findings show that the overall state of the healthcare system in the region is assessed as high, but ensuring stability in morbidity indicators and the number of medical institutions remains a pressing task.

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