SHORT COMMUNICATION

Brief Report: Medicare And Personal Health Spending In Nebraska-Forecasting Results For Years 2021-2026: Implications For Health Planning

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Abstract

Background: Medicare was created in 1965 as a public program for individual's age 65-plus. A recent report examined national health expenditures from 2018 through 2027 and found that by 2027 total U.S. health expenditures could reach almost $6 trillion dollars. The national, state, and local governments combined may pay for 47 percent of the total amount of national health expenditures. Medicare and personal health spending are important issues for state governments, as well as, the U.S. federal government. The published literature from 2016 to the present did not reveal an examination of Medicare and personal health spending for the state of Nebraska nor related forecasting on how Medicare and personal health insurance expenditures may look for the state in the next decade.

Methods: The principles of an ecologic time-trend study design were used to examine Medicare and personal health spending in the state of Nebraska. Forecasting techniques were also used to examine the trends in the data and make forecasting estimates.

Results: The forecasting of the Medicare health care spending data using the Holt's Linear Trend, an exponential smoothing model, showed a possible increase in spending from 2021 through 2026.

Conclusion: Examination of aggregate spending and its impact on forecasting results is an important consideration in health service planning.

Key Words: Medicare; Private Personal Health Spending; Managerial Epidemiology; Forecasting; Health Services Planning

Introduction

Medicare was created in 1965 as a public program for individual's age 65-plus as well as those enrolled in Disability Insurance or suffering from end-stage renal disease (ESRD) to pay for needed medical services [1]. The program continues to be popular among beneficiaries because it is a health insurance program that pays for many medical procedures that elderly Americans need as part of the American social contract [2]. Many Medicare beneficiaries also have some type of private health insurance to pay for services not covered by the federal program. For those Medicare beneficiaries without supplemental insurance, the unpaid amount of care is a concern to both the U.S. federal government and state governments.

A recent report examined national health expenditures from 2018 through 2027 and found that by 2027 total U.S. health expenditures could reach almost $6 trillion dollars. The national, state, and local governments, combined, may pay for 47 percent of the total amount of national health expenditures. In particular, Medicare spending is projected to increase by 7.4 percent over the 2018-2027 time period, and over the same time period, private out-of-pocket spending may increase by 4.8 percent and physician and clinical service payments could increase by 5.4 percent from 2018 to 2027 [3].

A different report that found economic and demographic trends across the nation are likely to lead to growth in spending and enrollments in Medicare and private health insurance. Between 2018 and 2027, GDP is projected to increase from approximately $20 billion dollars to $30 billion dollars while the U.S. population will change from 327 million people to 352 million people [4]. These factors may require health planners at the national and state levels to consider actions that could support the needs of the population while also controlling expenses.

These findings relied upon statistical projections and forecasting techniques to identify usable data and the insights needed to guide the consideration of health service planning options. Traditionally, the meaning of health services planning can be understood as follows [5]

"Health services planning are a process that appraises the overall health needs of a geographic area or population and determines how these needs can be met in the most effective

manner through the allocation of existing and anticipated future resources".

Planning for health services is concerned with making plans to anticipate the needs of a selected population. To do this, many analytic methods are needed [5]: demographic analysis; epidemiologic analysis; spatial analysis; evaluation analysis; gap analysis; and "what-if" simulation analysis. The focus of this report is on forecasting methods used in managerial epidemiology [6]. Forecasting techniques provide an estimation of conditions at a future time period [7, 8] and could be used with other data and information for health service planning activities.

Medicare and personal health spending are important issues for state governments, as well as, the federal government. A database search of the published literature from 2016 to the present did not reveal an examination of Medicare and personal health spending for the state of Nebraska nor related forecasting on how Medicare and personal health insurance expenditures may look for the state in the next decade.

Of primary interest in this project is whether the forecasts of Medicare and personal health spending for the state of Nebraska from 2021 to 2026 are similar to the national forecast results for the same time period. This brief report explored three issues. First, we examined the association of Medicare spending categories and, separately, personal health spending categories from 1980 to 2014. Then, forecasting methods were used to extrapolate Medicare and private health spending expenditures (by category) for the State of Nebraska for the time period, 2014 through 2026. Finally, consideration of the state forecasting results was discussed in a health services planning context.

Methods

The principles of an ecologic time-trend study design [9] were used to examine Medicare and personal health spending in the state of Nebraska. In this secondary data analysis project, the data used were the cleaned, public use data files (Microsoft Excel.csv files) from the U.S. Centers for Medicare and Medicaid Services and contained 35-years (rows) worth of data [10].The specific data files included data for aggregate personal health care spending by state and service in millions of dollars, and data for Medicare personal health care spending by state and service in millions of dollars. For the state of Nebraska, the specific service categories included in each data file were personal health care, hospital care, and physician and clinical services.

First, using the aggregate data, the association of the specific category of services from a specific data file was examined to confirm positive, statistical-graphical correlation. Then, forecasting techniques were used to examine the trends in the data and make forecasting estimates. For the 35-year time span, the exponential smoothing (Holt's Linear Trend) model was used because a non-seasonal time series with a global trend was likely. This exponential smoothing forecasting model computes an evolving trend with a special function

that places emphasis on most recent time periods. The Holt's Linear Trend algorithm uses the following formulas [11]:

$$a_t = \alpha X_t + (1-\alpha)(a_{t-1} + b_{t-1})$$

$$b_t = \beta(a_t - a_{t-1}) + (1-\beta)b_{t-1}$$

In the formulas α and β are smoothing constants which are each between zero and one while a_t gives the y-intercept (or level) at time t. The slope at time t is indicated by b_t. The smoothing constant(s) determine the speed to which the weights of the series will decay.

For each data file, a specific category of expenditure was used with the Holt's Linear Trend model. The values for each expenditure category were converted to a log (base 10) transformation for the analysis and the converted back to its original value before display. The numbers of forecasted values calculated were 12 beyond the final year of the time series; this represented a third of the length of the original time series and the maximum suggested extrapolation. Forecast and Residual Plots were generated with attention given to the vertical scale of both plots: The forecasting results would be considered satisfactory if the scale of the residual plot is much less that the forecasting plot [11].

A table of projections for 2021 through 2026 was constructed for each category of service for Medicare and personal health expenses, and average annual growth for spending was calculated. Line graphs were also constructed of the projections from 2014 through 2026, with selected results shown.

Data management and statistical analysis were accomplished using the NCSS Statistical Analysis and Graphics Software.

Results

Figure 1 For this 35-year time span, Medicare personal health care spending and Medicare hospital care spending in the
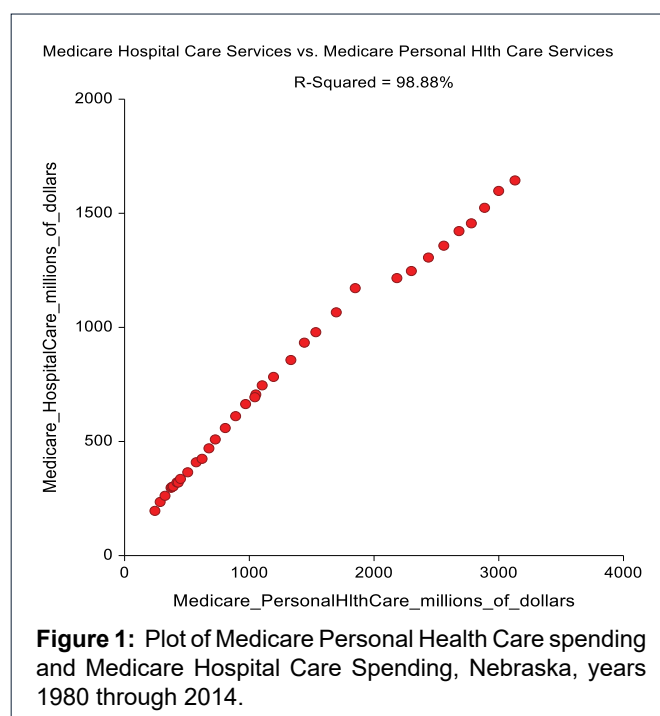

Figure 1: Plot of Medicare Personal Health Care spending and Medicare Hospital Care Spending, Nebraska, years 1980 through 2014.

state of Nebraska were examined using a data visualization technique and showed a positive, increasing slope (Figure 1).This pattern was found in the examination of Medicare personal health care spending and Medicare physician-clinical spending (not shown). Again, the pattern was found in personal health spending for the same categories of spending (not shown). Collectively, the data visualization exercise demonstrated an increasing, 35-year trend in Medicare and personal health spending for the state.

The forecast (Figure 2a) using the Holt's Linear Trend, exponential smoothing method with the Medicare personal health care spending data showed a possible increase in spending for time-period/row 36 (year 2015) through time-period/row 47 (year 2026). A plot of residuals (Figure 2b) suggests that the forecasted values could be valid. Again, the pattern was seen for all categories of spending for Medicare and personal health spending amounts (not shown) included in this project (Table 1).

Table 1 shows the forecasted spending values in Medicare and personal health care spending for the future time periods. The table also includes the Average Annual Growth Rate (Figure 3).

The Medicare spending (Figure 3) and the personal health spending (not shown) for these future years demonstrated a smooth increase in spending and that it could be possible for the amount of personal health care spending to be different from hospital care spending and physician-clinical services spending.
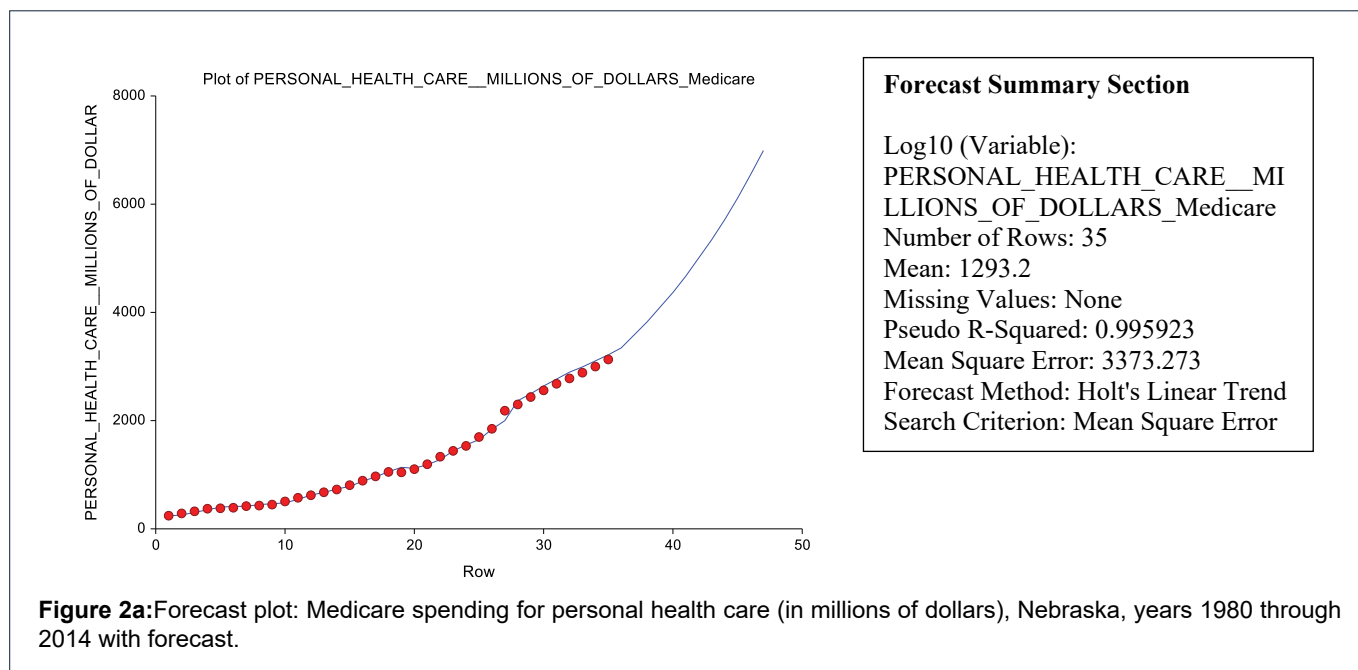

Forecast Summary Section

Log10 (Variable): PERSONAL_HEALTH_CARE__MILLIONS_OF_DOLLARS_Medicare
Number of Rows: 35
Mean: 1293.2
Missing Values: None
Pseudo R-Squared: 0.995923
Mean Square Error: 3373.273
Forecast Method: Holt's Linear Trend
Search Criterion: Mean Square Error

Figure 2a: Forecast plot: Medicare spending for personal health care (in millions of dollars), Nebraska, years 1980 through 2014 with forecast.
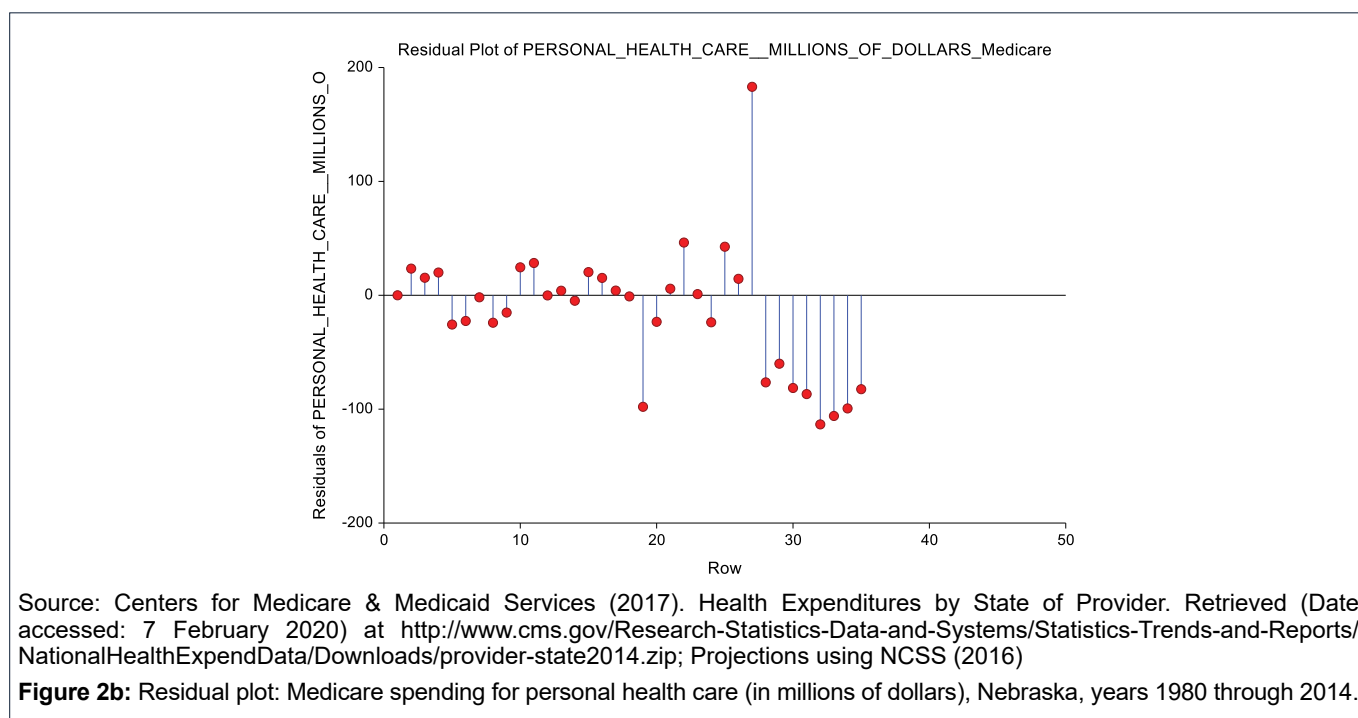
Source: Centers for Medicare & Medicaid Services (2017). Health Expenditures by State of Provider. Retrieved (Date accessed: 7 February 2020) at http://www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/ NationalHealthExpendData/Downloads/provider-state2014.zip; Projections using NCSS (2016)

Figure 2b: Residual plot: Medicare spending for personal health care (in millions of dollars), Nebraska, years 1980 through 2014.

Table 1: Nebraska Medicare and Personal Health Spending by category of spending, forecast, years 2021-2026, with Average Annual Growth Rate for spending.

	2021	2022	2023	2024	2025	2026	Average Annual Growth Rate
Personal Health Care							
Medicare spending (USD in millions)	5002	5349	5719	6115	6539	6992	6.928%
Personal health spending (USD in millions)	21670	22595	23560	24567	25616	26710	4.271%
Hospital Care							
Medicare spending	2369	2496	2630	2771	2919	3076	5.358%
Personal health spending	10071	10647	11256	11901	12582	13302	5.724%
Physician & Clinical Services							
Medicare spending	816	856	898	942	989	1037	4.906%
Personal health spending	4217	4340	4467	4598	4733	4871	2.926%

Source: Centers for Medicare & Medicaid Services (2017). Health Expenditures by State of Provider. Retrieved (Date accessed: 7 February 2020) at http://www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/NationalHealthExpendData/Downloads/provider-state2014.zip; Projections using NCSS (2016); Average Annual Growth Rate calculated using MS-Excel (2016).
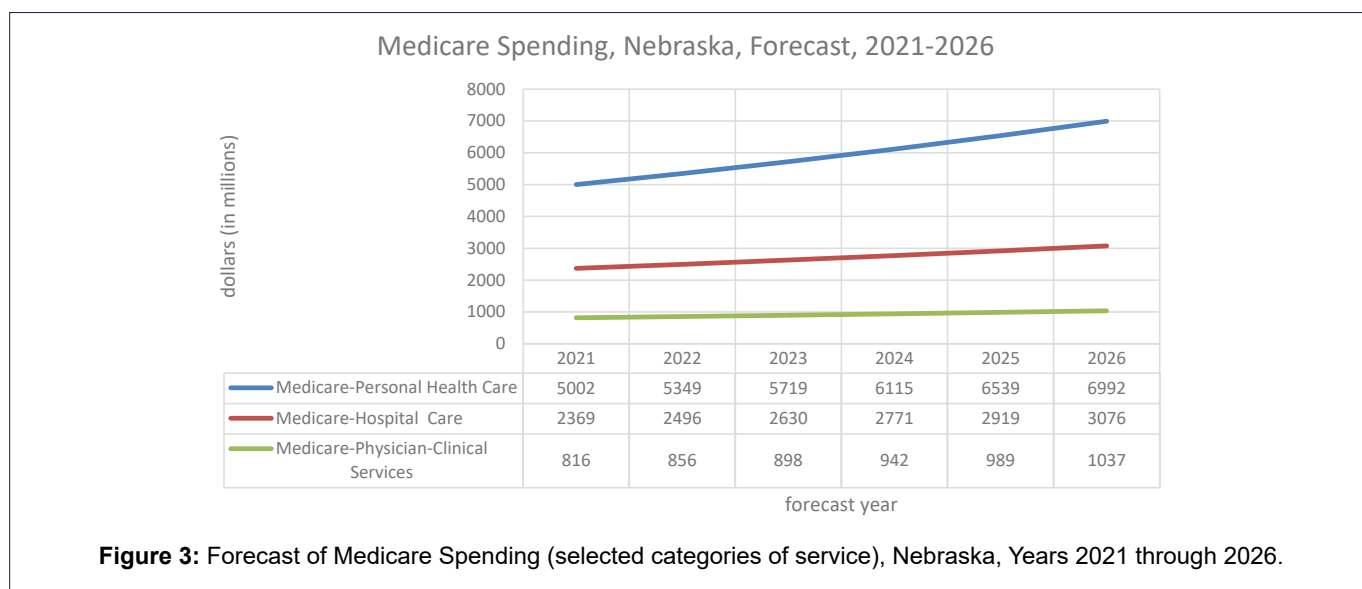

Figure 3: Forecast of Medicare Spending (selected categories of service), Nebraska, Years 2021 through 2026.

Discussion

Examination of aggregate spending and its impact on forecasting results are important considerations in health services planning. The aggregate spending data for the state of Nebraska showed that the 35-year time span between 1980 and 2014, Medicare spending and personal health spending increased for selected categories of spending (Figure 1). Having established this pattern of historical spending, forecasting methods were used to calculated possible spending amounts from 2021 through 2026 in the state (Figure 2a and 2b; Table 1). Personal health care spending will likely outpace spending for hospital care services and physician-clinical services for both Medicare spending and personal health spending (Figure 3). The Average Annual Growth Rates (Table 1) were in keeping with the general patterns found in published reports [12].

These findings may prompt health planners within the state to explore additional aspects of the population (age 65-plus) served by Medicare and related health insurance coverage plans. For example, a deeper examination of the personal health care services (including screening and preventive services used by adults [13]) utilized by Medicare beneficiaries (e.g., Figure 3) in the state along with a similar examination by large health insurance providers in the state could produce some important insights into state health services planning for this age group.

The availability of high-quality data at the individual-level (without identifiers) that includes demographic data elements, health insurance elements, selected medical/health procedures, and health outcomes data over a period of time in useful datasets could allow meaningful data aggregation and use in state-level or regional health reporting and health services planning in any state or any geographic region.

Limitation: The population composition was not available in the 35-year time series datasets nor is it possible to know the exact composition of future populations. In health services planning exercises, we assume that the population composition in future time periods will be similar to the prior ones.

Conclusion

Medicare is a financing program designed to help elderly individuals, who qualify, to pay for selected medical services within the limits of the program; private health insurance available in a particular state, ideally, pays for the balance of medical services not covered under Medicare. State health planners might want to know for a specific historical time-span what was the pattern of Medicare or private health insurance spending for specific medical/health services that would be included in specific categories of spending for the program (e.g., personal health care spending) in a geographic area. Additionally, an epidemiologic profile of the individuals associated with the specific medical/health services that were paid for under "personal health care spending" might be very useful in health services planning within a state government as well as private health insurance programs within a state.

The epidemiologic profile previously described could be useful for partnerships of health service networks and health insurance payers in health marketing, health resource planning, and population health management activities [14]. The use of data from an epidemiologic profile with results from statistical forecasting models has the potential to provide meaningful data and insights useful in health service planning activities.

Disclaimer

The views in this paper are those of the author and do not represent the official position of the U.S. Government.

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