



Healthcare Workforce Economics: Study the Economic Effects of the Changing Demographics of Healthcare Workers, Including the Rise of Gig Economy Roles in Healthcare

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ABSTRACT

This study looks into how the gig economy and shifting demographics are affecting the healthcare industry economically. Through the use of machine learning models, demographic analysis, and attrition trend analysis, the research sheds light on the dynamics of the healthcare workforce and its financial effects. One of the most important conclusions is that nurse attrition continues even in the face of overall workforce stability, underscoring the necessity of focused retention initiatives. The significance of customised workforce management strategies is shown by differences in attrition rates between departments and job positions.

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Gig Economy, Healthcare, Burnout, Regression Analysis, Attrition, Demographic

Introduction

Background

The healthcare staff has experienced notable changes in recent times, primarily due to shifting demographics and the rise of non-traditional labour models like the gig economy. A gig economy is an employment sector where full-time long-term workers are less common than freelancers and independent contractors filling temporary and part-time roles. Gig workers benefit from freedom and adaptability but have little to no stable employment. The changing demographics of medical professionals reflect greater societal transformations, including diversity in cultures, population ageing, and changing trends in education. These trends can take numerous shapes, such as alterations in the chronological age breakdown for medical professionals, fluctuations in the proportion of women in various specialisations and an increase in the socioeconomic and ethnic variety of professionals. These shifts in demographics all have different financial consequences that affect the availability of labour and how resources are allocated within the healthcare system.

The gig economy is making almost everyone working in the medical sector reevaluate their career. It must come as expected that medical professionals have been dramatically shifting from steady employment to prospective or gig labour as a result of the problem that COVID-19 caused [1]. Clinicians are looking for the flexibility that gig employment offers them regarding their work schedule, location, and methods of operation after seeing the pandemic's pandemonium. Healthcare organisations can further affordably address employment shortfalls thanks to the growing gig economy, although additionally presents new chances for both contracted workers and full-time staff members in the field. A reliable source of income, perks, and opportunities for professional growth can all be satisfied by full-time employees.

These gig economy jobs, which are changing conventional labour structures and reshaping the pattern of workforce involvement in the healthcare industry, present both possibilities and problems. Examples of these professions include telemedicine providers and immediate nursing services.

Aim and Objectives

Aim

This study uses algorithmic analysis to improve understanding and predictive abilities to get the trend in the monetary impacts of the changing demographics of healthcare workers and the growth of gig economy roles in the industry.

Objectives

- To assess the trends in the demographics of the healthcare workforce through an in-depth literature review.
- To examine the rise and features of gig economy jobs in the medical field.
- To investigate the way the economy affects worker flexibility and the dynamics of the labour market.
- To make use of machine learning tools to forecast labour developments and their effects on the economy.

Literature Review

Demographic Trends in the Healthcare Workforce

The way drug manufacturers and medical professionals' function is greatly influenced by population demographics, making it a crucial component of the medical landscape. A demographic categorization of individuals is based on factors such as age, nationality, ethnicity, etc [3]. Age is a significant demographic that mostly impacts the healthcare sector. The world's population

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is ageing rapidly, which has a significant impact on the healthcare sector and its clients, for example on service prices. Together, the private and public sectors are currently working to rise system funding and enhance the overall standard of healthcare service. To enhance the overall quality of treatment, the healthcare industry is working alongside the technology, fitness, and telecommunications sectors [2]. The need for more advanced and better medical services has grown as the number of people middle-aged and elderly keeps growing and the age demographic widens. As a result, the healthcare sector can now respond to patient and customer requirements more quickly. It has fuelled the industry's inventiveness in terms of marketing tactics, technology advancements, and ways to take care of chronic illnesses.

Gig Economy and Health Care

Healthcare organisations are currently adopting the gig economy, as evidenced by the intermittent recruitment of nurse practitioners, medical technicians, and other clinical staff members. Many variables are driving this pattern, including the increase in healthcare expenses, the shortage of healthcare workers, and the perception among many healthcare workers believe the gig market offers them more adaptable and lucrative independent employment. There is an influence from the Affordable Care Act, chronic diseases, and ageing populations, among other factors which drive up medical expenses.

This is notable that, the integration of gig workers within the medical field is nothing but a significant characteristic that is capable of acting in terms of mitigating factors to deal with situations like long-term employee burnout. By distributing the labour more fairly, their integration lessens the strain and tension that might cause burnout. This improves full-time staff members' health and job satisfaction while also fostering a more upbeat and encouraging work atmosphere. Healthcare providers need to be ahead of the curve and use creative staffing techniques to anticipate these changes. Adopting the gig economy helps firms develop sustainably and remain resilient in facing the prospect of future healthcare needs, in addition to solving urgent staffing issues.

The move to gig labour is a fundamental aspect of this trend, one that Oliver Wyman anticipates will continue. Our most recent Healthcare Survey showed a 1400% increase in the total number of nurses switching to gig arrangements since the pandemic began, including traveller, day agency, and other forms of per diem [4]. More flexibility and more control over their timetables are what nurses want from gig employment, which allows them to prioritise the volume, duration, location, and scheduling of their shifts while maintaining control over their personal and professional lives.

Literature Gap

Although several investigations have looked into how demographic changes affect the provision of healthcare and the acceptance of gig economy responsibilities throughout the industry, there has been a lack of information in the literature about how demographic changes affect the requirement for and make-up of gig economy roles in the industry. Research on the phenomenon of gig economy in healthcare has primarily focused on aspects like affordability, workforce mobility, and employee

satisfaction; however, it has not thoroughly investigated how changing demographics affect the need for freelance employees and the kinds of jobs they do in the healthcare sector. If papers regarding complete ethical guidelines and legislation are to be developed to direct these functions using AI in healthcare settings, then these gaps must be filled.

Methodology

Data Collection and Analysis

Considering the informational pieces, especially databases, research papers, and articles on the implementation of artificial intelligence (AI) in therapeutic decision-making is a necessary part of data collecting. There are two primary components to this technique: the first is gathering current and extensive data overall by using a variety of sources such as trade journals, healthcare facilities and academic databases. Additionally, these data are then handled by systematising and doing independent qualitative and/or quantitative analyses. Scholars might concentrate on the recurrent themes, trends, and moral dilemmas that emerge in the information by employing qualitative strategies like content assessment and thematic inquiry. In this sense, quantitative approaches may only employ statistical procedures in economics to evaluate patterns or correlations among variables.

Tools and Technique

This part is responsible for analysing the facts linked to the approach that has been followed to perform the practical implication. In that aspect, this is notable that the practical implementation indicates the usage of the proper tools and techniques to conduct the analysis. In that aspect, the Google Collab has been utilised to perform the analysis followed by the utilisation of machine learning and Python deployment. The dataset utilised in that aspect, has been collected from the open source called Kaggle.

Dataset Description

The dataset includes corporate and employee data that has been specially designed to examine nurse attrition in the US healthcare system, with an emphasis on hospitals contains information about age, gender, years of experience, and degree of education. Moreover, indicates if a worker has left the company; this is the variable that predictive modelling uses as its aim. Dataset Link: <https://www.kaggle.com/datasets/jpmiller/employee-attrition-for-healthcare?resource=download>.

Ethical Consideration

Regarding informed permission, confidentiality, and data protection, this study will abide by ethical standards. To protect the privacy of the persons and organisations engaged, all data is going to be aggregated and anonymized. The most crucial component in this situation is autonomy as it necessitates acknowledging employees' rights to self-governance and decision-making in the context of the gig economy.

Result and Discussion

Result

This part is responsible for performing a detailed analysis of the data with the use of the Python and machine learning framework to understand the current trend in health workers. The dataset's

attrition distribution offers valuable insights into the stability and financial consequences of nurse turnover in the US healthcare system, which is consistent with the focus of research on the financial impacts of shifting demographics and the emergence of gig economy employment in the healthcare industry.

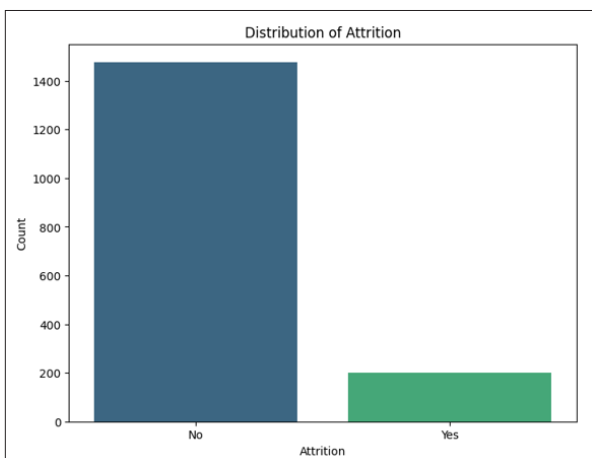


Figure 1: Distribution of Attrition

A highly steady workforce is shown by the analysis, which shows that out of the total employees, about 88.1% (or 1477 people) stayed in their roles. On the other hand, 11.9% (199 workers) departed the company, indicating the existence of nursing attrition, albeit at a reduced rate. Healthcare organisations face both direct and indirect costs related to nurse attrition, which includes recruitment charges.

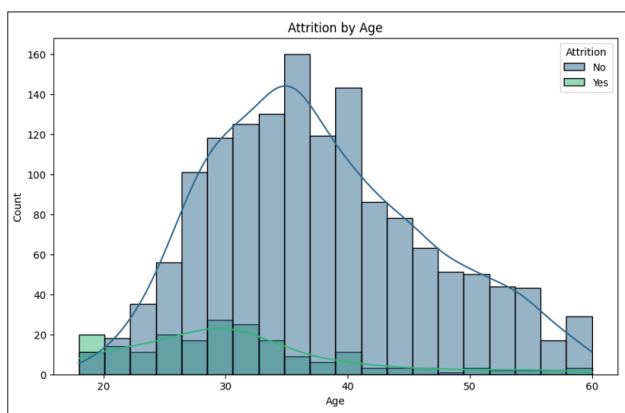


Figure 2: Attrition by Age

This research closely aligns with the focus on the economic effects of changing demographics and the rise of gig economy roles in the healthcare industry. The numerical insights on the decline by age give helpful context to analyse the impact of changes in demographics on the turnover of nurses within the medical field. When comparing the age distribution of personnel who left the organisation (attrition category 1) against those who stayed in their roles (attrition category 0), the study shows clear trends. To be more precise, the average age of the remaining employees is around 37.67 years, with an 8.87-year standard deviation. Employee attrition, on the other hand, has a significantly lower mean age of about 30.90 years, with a standard deviation of 8.86 years.

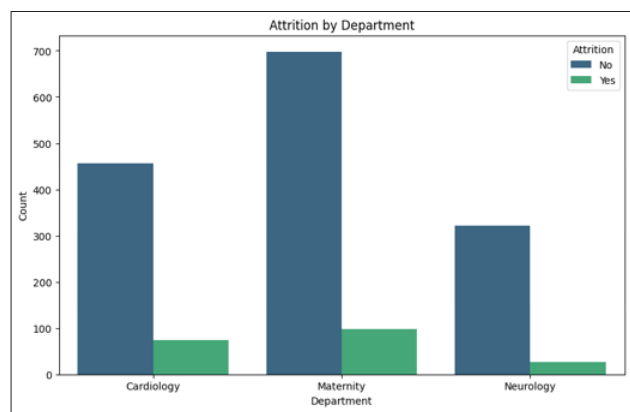


Figure 3: Attrition by Department

The analysis shows clear differences in attrition rates within departments, which reflects the various dynamics and difficulties that exist within each sector of the healthcare profession. The Department of Cardiology has a moderate rate of employee turnover, with 74 workers departing the company, or around 13.9% of the total workforce. Second, of the departments examined, the Maternity department has a higher attrition rate than the Cardiology department, with 98 employees, or 12.3% of its workforce, leaving the company. In contrast, the Neurology department has the lowest attrition rate, with only 27 employees, or 7.7% of its workforce, departing.

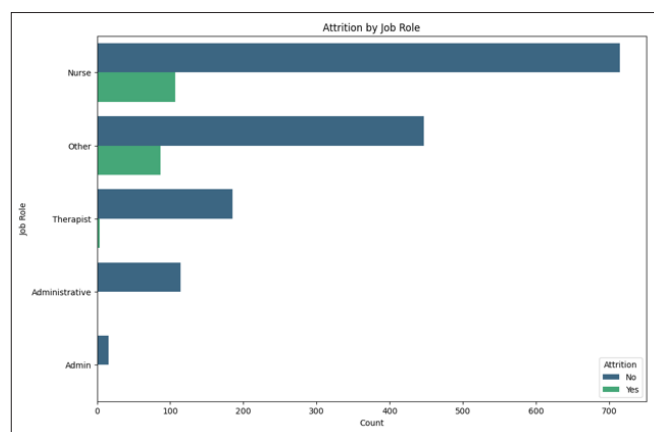


Figure 4: Attrition by Job Role

With just one employee out of 115 in administrative responsibilities, the attrition rate is rather low. These points to a steady workforce in administrative roles, which things like possibilities for professional progression and employment stability may impact. On the other hand, out of 822, nurses had a higher attrition rate of 107. This research highlights the difficulties nurses' encounter, such as work discontent and burnout, which are common in the medical field.

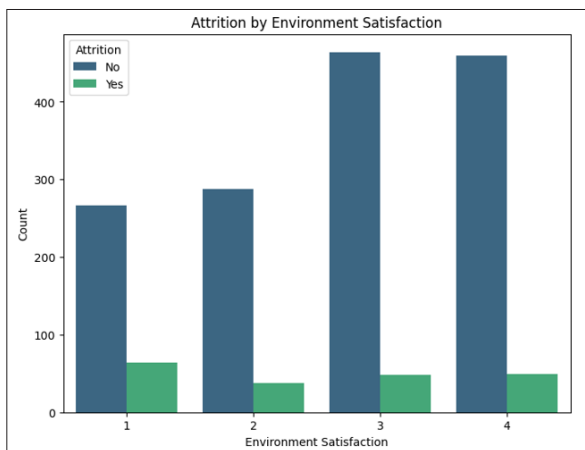


Figure 5: Attrition by Environmental Satisfaction

64 of the 330 employees in the lowest satisfaction group (rating 1) departed the company, representing a notable turnover rate of almost 19.4%. An attrition rate of about 11.7% was also seen in the second-lowest satisfaction group (rating 2) when 38 out of 326 workers quit. Attrition rates often decline with increasing levels of environmental satisfaction. Lower attrition rates are observed among employees who indicate moderate to high levels of satisfaction (ratings 3 and 4). In the moderate satisfaction group (rating 3), for example, out of 512 employees, only 48 departed, meaning that the attrition rate was around 9.4%. Comparably, 49 workers departed out of 508 in the group with the highest satisfaction (rating 4), for an attrition rate of almost 9.6%.



Figure 6: Attrition by Work-Life Balance

A noteworthy trend in attrition rates across various work-life balance levels is shown by the investigation. Out of 90 workers, 24 leave the company, or an attrition rate of around 26.7%. These employees who rank their work-life balance the lowest (rating 1) have a rather high attrition rate. According to this research, workers who feel that their personal and professional lives are not balanced enough may be more likely to look for possibilities elsewhere as a result of stress, burnout, or discontent with their current workplace.

Discussion

From the analysis, it can be identified that it is more common for younger people to quit their jobs than for their older colleagues. Further clarification of these tendencies is provided by looking

at the quartiles. Employee attrition tends to be concentrated at the lower quartiles, suggesting a concentration of younger persons among those who go, even if the median age for both groups is in the 30s. Notable attrition also affects workers in other roles; out of 534, 87 quit their jobs. The lack of specificity in the responsibilities under 'Other' raises concerns about turnover in the healthcare organization's non-nursing employment. On the other hand, out of 189 employees, therapists have a comparatively low turnover rate-just four have left. This might be explained by things like specific training and steady employment in therapy positions [5].

Important insights on labour stability and financial implications have been revealed by looking at attrition trends within the dataset. Considering the above result and analysis this is notable that, to deal with the nurse attrition rate gig economic implementation within the medical field can be beneficial to deal with the scenario.

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Evaluation Metrics:
Model: Random Forest
MSE: 0.0794264880952381
MAE: 0.14633928571428573
R-squared (R2): 0.3398415077670618

Model: Linear Regression
MSE: 0.08279133490174045
MAE: 0.20460147400282674
R-squared (R2): 0.3118743616972032

Model: Decision Tree
MSE: 0.10714285714285714
MAE: 0.10714285714285714
R-squared (R2): 0.10947507914304655
    
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Figure 7: Model outcome

Model	Mean Squared Error (MSE)	Mean Absolute Error (MAE)	R-squared (R2)
Random Forest	0.0794	0.1463	0.3398
Linear Regression	0.0828	0.2046	0.3119
Decision Tree	0.1071	0.1071	0.1095

With the R-squared value of around 0.3398 and a comparatively low mean squared error (MSE) of about 0.0794, Random Forest regression is accountable for performing in terms of the fact to become the best model comparing all sorts of analytical aspects. It is responsible for performing the support of workforce planning and retention initiatives. Conversely, the other two models have showcased poorer predictive accuracy having higher MSE values and lower R-squared values.

Conclusion

In a nutshell, this is notable that, the study's research is accountable for clarifying the economic significance linked to the shifting demographics while as well as performing research on the increase of gig economy employment in the healthcare sector. This is notable that, research has found essential insights into the dynamics of the healthcare staff so that it can further understand the monetary ramifications to be obtained via a thorough analysis of attrition rates, demographic traits, and predictive modelling.

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The derivatives are accountable for emphasising the significance of focused retention measures while as well as highlighting the commonness linked to nurse attrition in spite of having a rather persistent workforce.

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