

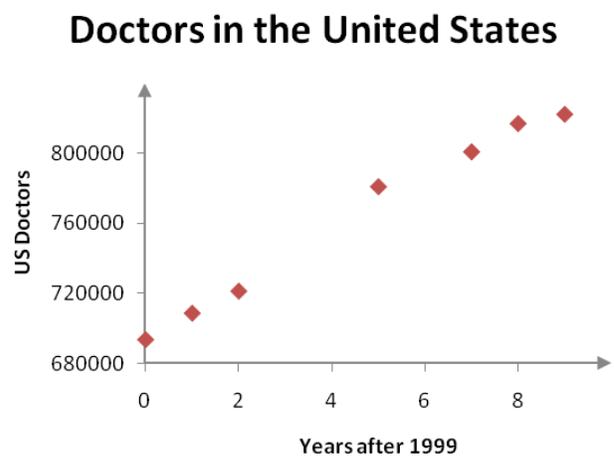
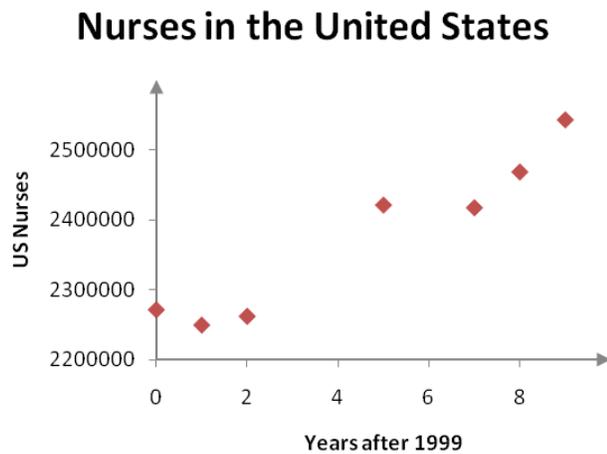
Independent Mathematical Contractors
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Dear IMC:

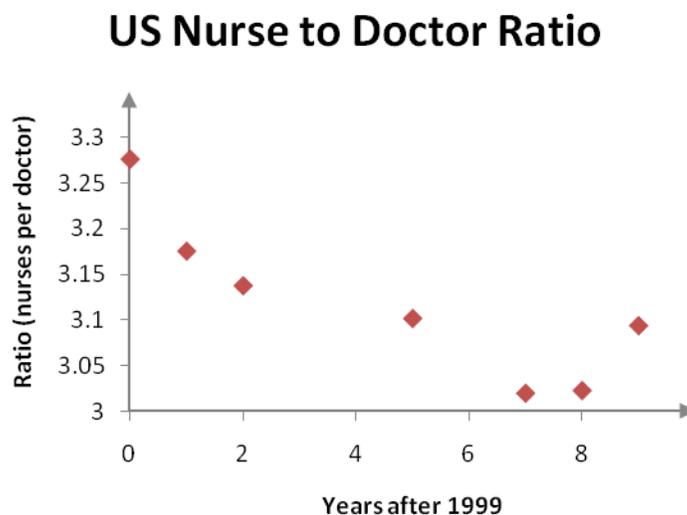
Since 1999, the numbers of doctors in the US healthcare system has been increasing. The growth in the doctors has mirrored the growth of the US population in general. To keep pace with this growth, the number of nurses in the US has grown. The goal of this growth is to insure that the number of nurses per doctor remains at a sustainable level. The US healthcare system relies on an adequate number of nurses to help doctors provide excellent patient care.

Nurses are needed to carry out various tasks in doctors' offices, clinics, and hospitals. By utilizing nurses to carry out basic services, doctors are able to perform more complex services leading to decreased cost overall. We need to forecast the ratio of nurses to doctors in the future to determine whether it is sufficient to maintain minimum essential public health and clinical services. In 1993, the World Bank's World Development Report advocated that the ratio of nurses to doctors should exceed 2 to 1 as a minimum standard. A ratio of 4 to 1 or higher is considered more satisfactory for cost effective and quality care.

Shown below are graphs of the numbers of nurses and doctors for several years.



You might expect the nurse to doctor ratio to increase with the large and growing nurse population, but a graph of the ratio quickly dispels this notion.



Even though the number of nurses is growing, the number of nurses per doctor is decreasing because the growth in nurses is not keeping up with the growth in doctors. Note that the ratio is between 3 to 1 and 3.3 to 1 so that the ratio is above the minimum level advocated by the World Bank. However it is below the 4 to 1 level that is associated with cost effective and quality care. It appears that the ratio will continue to decrease and perhaps level off.

For this project, I would like you to model the nurse to doctor ratio in the state you have been assigned. I am interested in knowing if your state has or is going to attain the ideal ratio of 4 nurses per doctor. In addition, I would like to know if the nurse to doctor ratio in your state will ever level off in the future. I would anticipate that your ratio will level off and I want to know what the level will be when it does level off. If you model the ratio of nurses to doctors with a ratio of two functions, you should be able to accomplish this goal.

To help you, I suggest following the strategy outlined below.

1. Make a scatter plot of the number of nurses as a function of time.
2. Make a scatter plot of the number of doctors as a function of time.
3. Find an appropriate regression model for the scatter plot in 1.
4. Find an appropriate regression model for the scatter plot in 2.

5. Use the two regression models from 2 and 4 to create a function that models the nurse to doctor ratio as a function of time.
6. If the trend in your model from step 5 holds true in the long term, at what value will the nurse to doctor ratio level off?
7. Use your function from 5 to predict the year in which the nurse to doctor ratio was or will be 4 to 1.

You will carry out these steps by utilizing the Technology Assignments your instructor has provided for you. In these assignments (listed below), you will learn the process needed in your analysis via the data for the entire US. You will need to adapt this strategy and carry out the analysis on the number of nurses and doctors in the state assigned to you.

1. Technology Assignment 1 – Scatter Plots
2. Technology Assignment 2 – Regression Models
3. Technology Assignment 3 – Rational Model
4. Technology Assignment 4 – Limits at Infinity

We expect that the report will be in technical memo format. This means that you should report your results and explain the steps you followed to get those results. A scientific expert (your instructor) is available to answer any questions that you might have in the course of your investigations. You should plan on consulting with this expert as soon as possible as this project will take several weeks to complete. You will not be able to finish this project if you try to complete it the week it is due.

Warmest regards,

Vargas Weatherbee
Project Director