Is Technology Eating Nurses? – Evidences from Nursing Homes Staffing and Process Quality

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-- Evidences from Nursing Homes Staffing and Process Quality

Advancement and adoption of information technology is changing the landscape of the healthcare industry. While many studies have examined the effect of increased use of information technology on quality of care, little is known about the effect of increased use of information technology on the staffing of healthcare providers. With the aid of advanced information technology, will healthcare providers find it profitable to reduce staffing? Such a concern, at a broad level, has recently been raised in a Wall Street Journal article by former U.S. Treasury secretary Lawrence Summer. Similarly, but in a more optimistic tone, Marc Andreessen, a well-known entrepreneur and software engineer, said in an interview that "software will eat the world" to express his view that information technology will revolutionize whole sectors of the economy, from retail to real estate to health care, and will replace old jobs with new jobs along the way. Thus, the first objective of this paper is to examine whether advanced information technology will reduce staffing by healthcare providers, or in Marc Andreessen's phrase, whether technology will eat the nurses. To study this research question, we choose the nursing home industry, because, compared to hospitals, nursing homes provide relatively homogeneous services and nursing input is the most critical component of the care. Traditionally, nurses are swamped with tasks such as hunting for supplies, tracking down medications, filling out paperwork at the nursing station and looking for missing test results. Advanced information technology not only reduces medication/documentation errors, it also improves the efficiency of utilizing professional nursing time by changing daily operations. For example, information technology increases labor flexibility via process and enables nurses to access clinical information quickly and to fill out medical charts while keeping close to patients. Because nursing is the primary form of care in a nursing home and information technology can free up nurses to focus on that job, the nursing home industry provides an ideal setting to investigate the

effect of information technology on health providers' staffing decisions. Because quality, especially the process quality in a nursing home, is mainly determined by nurse input, there are less confounding factors affecting the quality of care in a nursing home than in a hospital where quality of care is affected by many other factors such as physician skill, medical facility, and patient morbidity. Hence, nursing home is also an ideal place to study the effect of increased use of information technology on quality of care, which is the second objective of this paper. Although previous literature has studied this question extensively in the hospital setting, little work has been done to address the question for nursing homes which constitute an increasingly important component of the healthcare industry as the challenge of population aging grows in modern societies. An important feature in the nursing home industry is the vertical differentiation in service quality. Quality provided by a nursing home is mainly determined by nurse conducts on a daily basis. The Nursing Home Compare (NHC), a federal report card, publicly released the staff-to-patient ratio of each individual nursing home in order to guide consumers choose nursing homes. We model this important feature of the nursing home industry when we develop and test our hypotheses.

Using data from Online Survey Certificate and Reporting Database (OSCAR) and the 2005-2011 Health Information Systems Society (HIMSS), we locate 2,119 nursing homes and construct a seven-year, unbalanced panel with 12,313 observations. To measure the increased use of information technology in nursing homes, we use the adoption of computerized physician order entry (CPOE), an advanced information system that can help healthcare providers streamline operations and improve efficiency via automation. Because a nursing home's decision to adopt CPOE is unlikely to be exogenous, we use the yearly hospital CPOE adoption rates in the local market as an instrument for CPOE adoption. The idea is that nursing homes are responsive to past adoption by local hospitals. Our estimation results suggest that the effect of information technology on nursing home staffing depends crucially on the vertical position of a nursing home. For a high-

end nursing home, an increase in information technology use leads to a reduction in staffing level. However, for a low-end nursing home, an increase in information technology actually leads to an increase in staffing level. The intuition relies on the interplay of two competing effects of information technology. First, using advanced information technology makes nurses more productive, hence the marginal benefit of quality improvement from staffing increases. We call this the ***magnifier*** effect of information technology. Because quality improvement will translate to more demand and thus higher revenue, this "magnifier" effect explains why the optimal staffing level increases for low-end nursing homes. However, although an increase in quality attracts more demand, the marginal effect of quality on demand decreases as quality improves. Hence, the marginal benefit of quality improvement diminishes when quality is sufficiently high. Given that the marginal cost of staffing is constant, for high-end nursing homes, an increase in information technology level may actually lead to the substitution of technology for labor, which we call the ***substitution*** effect of information technology. We also find that an increase in technology use leads to an increase in the process quality (measured through the number of customer complaints) of a nursing home, regardless of its vertical position.

Our study contributes to the literature in terms of research findings, methodology, and data. We are the first in the literature to reveal how a healthcare provider's vertical position moderates the effects of information technology on its staffing decision and process quality. We also contribute methodologically by developing an analytical model and constructing instrument variables to better infer the causal effects of advanced information technology on staffing and process quality in the healthcare industry. In terms of data, we are among the few papers in the literature on healthcare and information technology that uses nursing homes data whose simpler functions compared with hospitals helps reduce other confounding factors.