

Accepted Manuscript

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PII: S1386-5056(18)30036-4

DOI: <https://doi.org/doi:10.1016/j.ijmedinf.2018.02.004>

Reference: IJB 3654

To appear in: *International Journal of Medical Informatics*

Received date: 8-11-2017

Revised date: 23-1-2018

Accepted date: 3-2-2018



Please cite this article as: Jesper Martinsson, Silje Gustafsson, Modelling the effects of telephone nursing on healthcare utilization, *International Journal of Medical Informatics* (2018), <https://doi.org/10.1016/j.ijmedinf.2018.02.004>

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Modelling the effects of telephone nursing on healthcare utilization

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Abstract

Background: Telephone nursing is the first line of contact for many care-seekers and aims at optimizing the performance of the healthcare system by supporting and guiding patients to the correct level of care and reduce the amount of unscheduled visits. Good statistical models that describe the effects of telephone nursing are important in order to study its impact on healthcare resources and evaluate changes in telephone nursing procedures.

Objective: To develop a valid model that captures the complex relationships between the nurse's recommendations, the patients' intended actions and the patients' health seeking behavior. Using the model to estimate the effects of telephone nursing on patient behavior, healthcare utilization, and infer potential cost savings.

Methods: Bayesian ordinal regression modelling of data from randomly selected patients that received telephone nursing. Inference is based on Markov Chain Monte Carlo (MCMC) methods, model selection using the Watanabe-Akaike Information Criteria (WAIC), and model validation using posterior predictive checks on standard discrepancy measures.

Results and Conclusions: We present a robust Bayesian ordinal regression model that predicts three-quarters of the patients' healthcare utilization after telephone nursing and we found no evidence of model deficiencies. A patient's compliance to the nurse's recommendation varies and depends on the recommended level of care, its agreement with and level of the patient's prior intention, and the availability of different care options at the time. The model reveals a risk reducing behavior among patients and the effect of the telephone nursing recommendation is 7 times higher than the effect of the patient's intended action prior to consultation if the recommendation is the highest level of care. But the effect of the nurse's recommendation is lower, or even non-existing, if the recommendation is self-care. Telephone nursing was found to have a constricting effect on healthcare utilization, however, the compliance to nurse's recommendation is closely tied to perceptions of risk, emphasizing the importance to address caller's needs of reassurance.

Keywords: Modelling, Healthcare utilization, Health economy, Health seeking behavior, Telephone nursing, Telecare, Bayesian analysis, Ordinal regression

1. Introduction

Later year's increased patient strain on the healthcare system has increased the focus on efficiency improvements within the healthcare system. Increasing healthcare costs as well as a continuous rise in emergency department consultations for inappropriate and non-urgent conditions represent an incitement to treat illnesses at the correct level of care [1]. The number of visits to the Swedish emergency departments in Stockholm are increasing by 4.5% annually. Not only the emergency departments are experiencing an increased strain, visits to the out-of-hours clinics and primary care clinics have increased with 6.1% and 3.1% respectively [2]. This is a phenomenon that is not unique for Sweden, but can be seen in other western countries as well with up to a 40% increase in primary care consultations during the last 20 years [3, 4, 1].

For many care-seekers, the first line of contact with healthcare services is the Swedish Healthcare Direct (SHD). The SHD is an on-call telephone nursing service similar to the NHS Direct in the UK, LINK in Canada and Health Direct in Australia. Telephone nursing is a common work procedure for nurses in primary care, and is described by [5] as performing medical assessments over the telephone, while at the same time providing care with the aim of supporting, strengthening and teaching the callers and guiding care-seekers to the correct level of care. The nursing care provided is based on the caller's individual needs, and the level of care that is recommended to the callers depends on the nature of and the urgency of their symptoms. A computerized decision support tool aids the nurse in making medical assessments, and provides a shared basis for medical decisions regardless of the nurse's experience and skills and independent of geographical location, socio-economics or other demographic factors. The system is symptom-based and designed as a checklist where questions relating to the callers symptoms is suggested, and level of urgency is indicated to the nurse [6]. Through a

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