

Accepted Manuscript

Evaluating the impact of optimization algorithms for patient transits dispatching using discrete event simulation

N. Furian, M. O'Sullivan, C. Walker, S. Vössner

PII: S2211-6923(17)30158-3
DOI: <https://doi.org/10.1016/j.orhc.2018.03.008>
Reference: ORHC 164

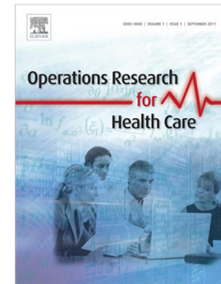
To appear in: *Operations Research for Health Care*

Received date: 20 October 2017

Accepted date: 31 March 2018

Please cite this article as: N. Furian, M. O'Sullivan, C. Walker, S. Vössner, Evaluating the impact of optimization algorithms for patient transits dispatching using discrete event simulation, *Operations Research for Health Care* (2018), <https://doi.org/10.1016/j.orhc.2018.03.008>

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.



Evaluating the Impact of Optimization Algorithms for Patient Transits Dispatching Using Discrete Event Simulation

N. Furian^{a,*}, M. O'Sullivan^a, C. Walker^a, S. Vössner^b

^a*Department of Engineering Science, University of Auckland
70 Symonds Street, Auckland, New Zealand*

^b*Institute of Engineering and Business Informatics, University of Technology Graz
8010 Graz, Austria*

Abstract

The on-time completion of patient transits can be identified as a bottleneck for the efficiency of health care services in major New Zealand hospitals. Delayed transits of patients between wards and treatment or diagnostic facilities lead to increasing waiting times at clinics and inefficient resource utilization (e.g. surgery teams) as appointment times are not met. Patient transits are carried out by orderlies, but in some cases require the assistance of a nurse. Ad-hoc dispatching of staff members, nurses and orderlies, to transits has been identified as one major source for delays currently observed in the system. To address this issue we present automated, optimized dispatching algorithms for staff members performing those transits. To develop these algorithms, a network formulation of the problem is introduced that is strongly related to classical vehicle routing problem with semi-soft time windows. However, the need to synchronize the routes of staff members of different types (nurses and orderlies) adds a whole new layer of complexity to the problem, as routes cannot be assessed independently. We present a set of algorithms with varying complexity, ranging from simple heuristics to the use of critical path methods to combine mixed integer formulations for the separated orderly and nurse problems. To address a transit service's stochasticity, volatility and the resulting need for constant re-optimization, we embed the optimization algorithms in a discrete event simulation to evaluate their performance under realistic circumstances.

Keywords: Patient Transit, Vehicle Routing, Discrete Event Simulation, Meta-heuristics, Column Generation, Limited Subsequences

1. Introduction

In this article we present results within a project that aims to install automated and optimized job-dispatching for patient transits in major New Zealand hospitals. During their stay, patients often require transportation to and from clinical appointments within the hospital, known as *transits*. These transits are usually carried out by an orderly, but, in some cases, the condition of the patient requires a nurse to assist during the transit. Transits are required to arrive at the destination location within a certain time-window, usually between 15 minutes prior the appointment and the appointment time. However, the actual system performance deviates significantly from this target for two reasons: 1) transit requests are made without enough notice from the corresponding facilities; and 2) the dispatching available resources (orderlies and nurses) to perform transits is done in an ad hoc manner. While the first issue may only be overcome by applying and enforcing stricter policies for transit-requests, which is not within the scope of this article, the second issue may be tackled by the installation of automated, optimal dispatching strategies, as described in this paper.

*Corresponding author, Phone: +43 316 873 8000 (N. Furian)

Email address: nfur003@aucklanduni.ac.nz (N. Furian)

URL: <http://www.engineering.auckland.ac.nz> (M. O'Sullivan)

متن کامل مقاله

دریافت فوری ←

ISIArticles

مرجع مقالات تخصصی ایران

- ✓ امکان دانلود نسخه تمام متن مقالات انگلیسی
- ✓ امکان دانلود نسخه ترجمه شده مقالات
- ✓ پذیرش سفارش ترجمه تخصصی
- ✓ امکان جستجو در آرشیو جامعی از صدها موضوع و هزاران مقاله
- ✓ امکان دانلود رایگان ۲ صفحه اول هر مقاله
- ✓ امکان پرداخت اینترنتی با کلیه کارت های عضو شتاب
- ✓ دانلود فوری مقاله پس از پرداخت آنلاین
- ✓ پشتیبانی کامل خرید با بهره مندی از سیستم هوشمند رهگیری سفارشات