days. Time-series models have traditionally been used in econometrics to develop financial models, but have been adapted in other fields, such as health informatics. This study uses a time-series approach to assess whether these impressions are valid. **Methods:** The daily volume of patients presenting to four emergency departments (ED) at the Nova Scotia Health Authority from Jan 2010 to May 2015 were analyzed to assess for the effect of previous volumes on future volumes. Parameters were selected using the auto-correlation (ACF) and partial auto-correlation functions (PACF) for a Seasonal Auto-regressive Integrated Moving Average (SARIMA) model. The Box-Jenkins statistic was assessed for model suitability. To assess for accuracy, a forecast of the model was evaluated with a year of volumes set aside for testing. **Results:** The EDs saw an average of 365.1 patients per day, with a minimum of 188 patients and a maximum of 479. The increasing trend in volumes consistent with the increasing number of ED presentations nation-wide was detrended using linear regression. There was a significant correlation in ACF with the previous day ($\rho_1 = 0.297$). A seasonal, periodic trend was seen weekly. Significant correlations occurred annually ($\rho_{365} = 0.279$) and at 29 days ($\rho_{29} = 0.339$), consistent with the lunar cycle. A seasonal model was postulated incorporating an auto-regressive (AR) coefficient, and a moving average (MA) coefficient for the previous day's volume. An AR and MA seasonal coefficient were each incorporated using the weekly period. When using the model on the test data, the model predicted 4 more patient presentations on average than the true value, with 90% of the values within 37 presentations of the true volume. The Box-Jenkins statistic was non-significant, indicating no problems with model specification. **Conclusion:** The volume of patients presenting to an ED system is correlated with that of the previous day. A weekly seasonal variation was confirmed. Auto-correlations also occur annually and possibly associated with the lunar cycle. Previous ED volumes may be useful in forecasting patient volumes. The time-series approach may discover further ways to predict ED volumes.

Keywords: crowding, time-series, forecasting

P018

A prospective diagnostic support tool for the differentiation of abdominal pain in the adult emergency department population

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Introduction: The chaotic environment of the emergency department has a deleterious effect on clinical judgement. The diagnosis of abdominal pathology is difficult to differentiate. There are also many diagnoses that could be considered abdominal in nature, exacerbating the task of diagnosing these patients. We propose a novel machine-learning method, Hierarchical Structured Models (HSMs), to provide an adjunct to clinician judgement, that provides a ranking of the probabilities of a patient having each of 39 abdominal pathologies, using only variables at the triage stage of emergency department care, and compare its performance to several machine-learning methods. **Methods:** This was a retrospective analysis of 25,861 patients that presented with one of 39 ICD-9 abdominal pathologies. 90% of the data was used to build and fine-tune the model, and 10% was used for testing. Predictors included age, gender, triage vitals and presenting complaint. All variables were solely collected from the Emergency Department Information System (EDIS). A decision tree structure was built using hierarchical clustering algorithms, and then a support vector machine (SVM) was fit at each node. To optimize the parameters for each node, a grid-search method was used to maximize ten-fold classification accuracy. The output of the decision tree was the probability of a particular presentation having each of the 39 diagnoses. This output was translated to a ranking of the relative likelihood of each of the diagnoses as a suggestion system for the treating physician. The accuracy of the system on the test set was compared to conventional machine-learning methods: pair-wise SVMs, gradient boosted models (GBM), neural networks (NN) and k-nearest neighbours (KNN). **Results:** The HSM ranked the correct diagnosis first 51.0% of the time, and ranked the correct diagnosis within the top three ranks 67.6% of the time. The most accurate model was GBMs (52.3%), and the least was neural networks (50.4%). **Conclusion:** The HSM approach using only variables available electronically at triage successfully ranked the correct diagnosis 51.0% of the time, and within the top three 67.6% of the time. Future research will focus on the inclusion of clinically lab results and radiology reports that are available electronically to improve HSM accuracy, and supplement physician diagnosis.

Keywords: machine-learning, artificial intelligence

P019

Understanding patient perceptions of emergency department wait time publication: a mixed-methods needs assessment

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Introduction: Many emergency departments (EDs) have begun publishing wait times. This study seeks to develop an understanding of patients' needs with respect to publishing ED wait times, which, to our knowledge, has not been described in the literature. **Methods:** We conducted a two-stage mixed methods study at a dual campus tertiary care academic center. First, we held focus group discussions comprising of 7 patient advocacy hospital committee members. Themes generated from focus group discussions were then utilized to create a patient survey. Focus groups were analyzed using content theme analysis. Hospital sites for survey administration were randomized and pre-assigned shifts were established to ensure a balance of weekdays, weekends, days, evenings, and overnights. All adult patients (age > 18) in the waiting room were eligible, but excluded if they were directly referred to a specialty service or did not speak French or English. Survey data was analyzed using descriptive statistics. **Results:** We found 9 dominant focus group themes: definition of wait time, wait time posting, lack of communication, education in waiting room, patient expectations, utilization of the ED, patient behavior, physical comfort, and patient empowerment. Of the 240 patient questionnaires administered, 81.3% (195) wanted to know ED wait times before arrival to hospital and 90.8% (217) wanted ED wait times posted in the ED waiting room. The most popular choice for publishing wait times outside the ED was a website (46.7%) whereas, within the ED, patients were not particular about the specific display modality as long as times were displayed (39.6%). Overall, 76.7% (184) stated their satisfaction with the ED would be improved if wait times were posted. **Conclusion:** ED patients we surveyed strongly supported both the idea of having access to wait time information prior to arrival, as well as physical display of wait times in the waiting room.

Keywords: wait-times, patient-centered, waiting room

P020

Paramedic comfort with providing palliative support: pre-implementation survey