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P55

Nursing Case-Mix in the Hospital. Development of two Systems for Case-Mix Classification

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Background

The objective of the research projekt FiliP is to develop an open source software tool for strategical personnel planning that can be used to simulate the effects of compared shift models for nursing wards in hospitals. This agent–based simulation covers characteristics of the ward and the staff as well as the case mix of the patients and the work scheduling related needs of the nursing staff.

In this context, a case mix measure for the patients‘ resource use was needed. While a number of case mix classification systems have been developed for nursing homes (Grebe 2008), still little is known about nursing resource use in hospitals (Isfort 2008).

In Germany, the groups of the *Pflegepersonalregelung* (PPR) are still used in the vast majority of hospitals, although this system was suspended in 1997. In 2012 this classification was extended with additional groups (DIMDI 2018) using the *Pflegekomplexmaßnahmen Score* (PKMS). The PPR uses normative times that have never been systematically evaluated.

As the suitability of the PPR for our purpose was questionable, the objective of the part of the FiliP– project described here, was to develop an alternative case mix measure.

Methods

Two types of data were collected: patient-related times for nursing effort and patient assessment data. Only patients that had declared informed consent were included in the study.

Every nurse on duty was accompanied by a rater that measured times for nurse-patient contacts ans indirect care using stopwatches. For each period of time (e.g. one contact) the predominent task type (e.g. special care or communication) also was recorded for descriptive analysis and plausibility checks, but this information was not used for modeling. Only day-shifts were measured.

Assessment data for each patient was collected in standardized interviews with the nursing staff using 64 dichotomous items that covered self–care related abilities as well as special care needs. For PPR data only the group assignment was used, not the normative times of that classification.

The statistical learning algorithm CART (Breiman et al. 1984) was used for modeling, utilizing the implementaion *rpart* (Therneau & Atkinson 2017) for the statistical software R.

Results

The sample consisted of N=196 patients from 3 wards (general medicine, respiratory and geriatric) out of 3 different hospitals.

75% of the measured times was spent for direct care (self care assistance, special care and communication), 10% of all measured times was used for documentation tasks (**figure 1**).

There were remarkable differences in the nurse-to-patient ratios in the observed shifts (minimum: 1:8, maximum 1:3). The analysis did not adjust for this variance and used the measured raw times.

The original 12-groups PPR model explained R^2=48.09% of the variance in the measures times. A variant *(Filip-PPR)*, that collapses the PPR to 5 groups, explained R^2=56.62% (**figure 2**).

The 7-groups model that uses dichotomous variables of the FiliP assessment *(walking, showering, venous catheter, dressing upper body, bed mobility and bowel continence)* explained R^2=56.52% (**figure 3**).

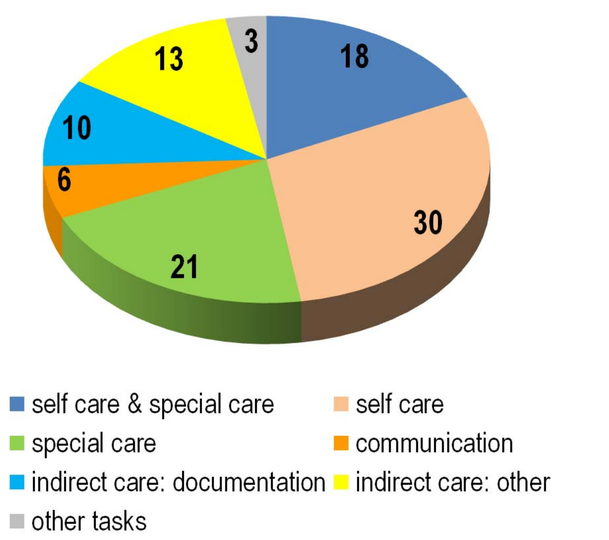
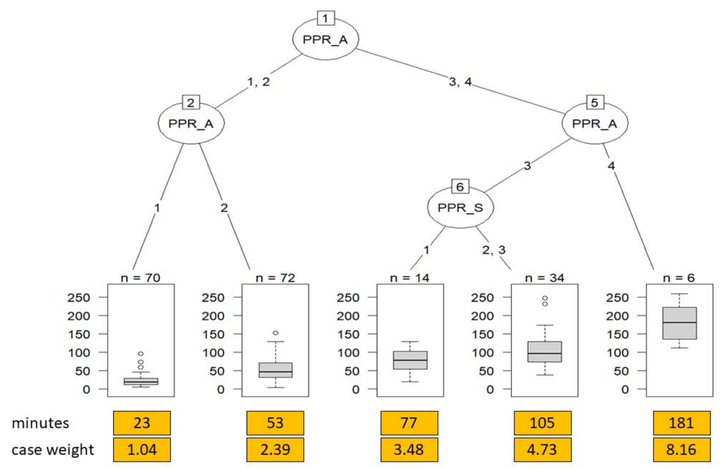
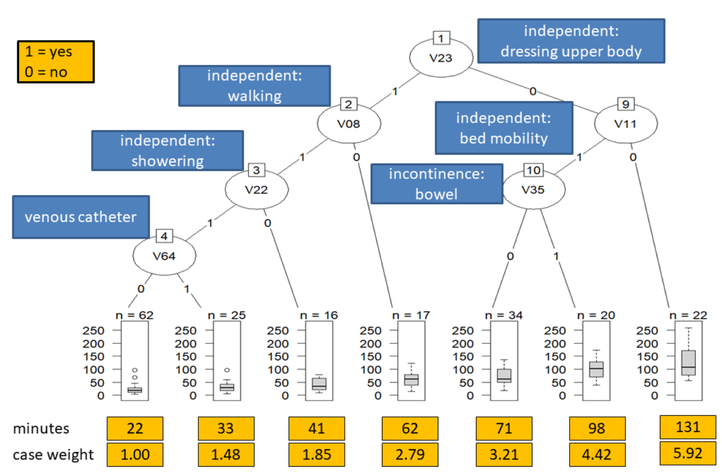


Figure 1: Distribution of patient–related times by task (in%)



case weigths are standardized to the empirical resource use in PPR A1/S1 (22.22 min.)

Figure 2: FiliP-PPR model (collapsed PPR groups)



case weigths are standardized to the empirical resource use in PPR A1/S1 (22.22 min.)

Figure 3: FiliP model (based on FiliP assessment data)

Conclusions

It should be noted that the focus of this analysis was not to validate the normative PPR–minutes, but to evaluate if the groups of the tested models are suitable to discriminate patient groups with respect to their resource use.

The findings related to minutes and case weights should not be generalized to other hospitals or even other wards of the hospitals that participated in the study. However, the results show that the collapsed PPR groups of the FiliP-PPR model, as well as the groups based on FiliP assessment data, are suitable to discriminate groups of patients with similar resource use.

In the FiliP project, the FiliP-PPR model will now be used as the measure of case mix for further modeling, because the data required for its grouping is available as routine data in the participating hospitals of the FiliP project.

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