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Research report

Demand- and competency-based grade mix in nursing

A process-oriented activity analysis based on LEP Nursing 3

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Abstract

This study describes how clinical data from the patient record based on nursing interventions from LEP Nursing 3 can be used to support staffing decisions according the new Austrian Health and Nursing Care Act (GuKG, 2016). The results make it possible to visualise the nursing workload for each occupational group. For the first time, this provides a data-driven basis for discussions around an optimal grade mix in nursing.

Short Abstract

This study shows how routine data from patient records based on LEP nursing interventions can be used to provide data-driven support for decisions aimed at implementing an optimal grade mix in nursing.

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1. Introduction

The Austrian healthcare sector is experiencing dramatic change. Well-known factors like demographic change, polymorbid patients, advances in medical technology, shortened hospital stays and the associated increase in service density require well-founded expertise from occupational groups in the healthcare sector. Financial viability and staffing shortages are also part of the discussion. To ensure the public's continued access to sustainable, high-quality nursing care, the Austrian Health and Nursing Care Act (Gesundheits- und Krankenpflegegesetz, or GuKG) of 1997 (Weiß & Lust, 2014) was replaced by the new GuKG (2016) in September 2016. Through a sharper differentiation of the health and nursing professions and of competency-based collaboration between those professions, the new amendments to the Health and Nursing Care Act are expected to result in (a) more efficient use of resources, (b) higher job satisfaction at the same quality of care, and (c) improved resource management in the healthcare sector. The new law introduces updates to occupational profiles and a new distribution of core nursing skills into three occupational groups. The former Nursing Support (Pflegehilfe) group, now called Nursing Assistance (Pflegeassistenz or PA), has been relieved of housekeeping and logistical tasks and forms the basis of a tiered health and nursing care structure. The Professional Nursing Assistance category (Pflegefachassistenz or PFA), a new occupational group requiring two years of education, is intended to relieve pressure from the upper-level Registered Healthcare and Nursing Service category (Dienst für Gesundheits- und Krankenpflege, or DGKP), primarily by carrying out nursing procedures and assisting with therapeutic and diagnostic measures. The occupational profile of the upper-level Registered Healthcare and Nursing Service (DGKP) group has been updated, more sharply defined in terms of its content, and assigned to a tertiary level of education. The areas of activity for these three occupational groups as defined in GuKG 2016 include §14 Core Nursing Competencies (previously "area of independent responsibility"), §15 Medical Diagnosis and Treatment Competencies (previously "area of shared responsibility"), and §16 Multiprofessional Care Team Competencies (previously "interdisciplinary area") (1194 der Beilagen XXV. GP - Regierungsvorlage - Vorblatt und WFA, 2016).

The concept of grade and skill mix is described in various ways in the literature. "Grade" refers to career grade or rank, and relates to a job title or membership in a profession that can be documented with proof of training (basic education, additional training and continuing education). As such, grade is a clearly defined quantity. Skill covers various kinds of abilities (proficiencies), professional experience and individual skills. The grade and skill mix is the mixture of different occupational groups (official and additional training = grades) and of employees' various individual abilities, proficiencies and experiences (= skills) in support of an organisation's service portfolio (Zulehner, 2016). In the English-language literature, the term "skill mix" is also used in connection with "nurse-to-patient ratio" as the proportion of registered professional nurses (Aiken, Clarke, & Sloane, 2002). In the present study, only the grade mix – also called "distribution of qualifications" (Zulehner, 2016) – is addressed.

1.1. Problem statement and objective

Decision-makers in the healthcare sector, especially management, are faced with the challenge of ensuring that the updated distribution of competencies and the integration of new occupational groups are implemented as effectively as possible in practice. They are also faced with the question of what grade mix should be selected in different individual wards to ensure that they can continue

to provide high-quality care. Efficiency, resource management and workflow design are central aspects of this process and have a direct impact on the optimal distribution of qualifications (Zulehner, 2016).

While the use of computer-assisted documentation systems is widespread in Austria (Hübner, Ammenwerth, Flemming, Schaubmayr, & Sellemann, 2010), the routine data that can be generated from such systems have thus far not often been used for data-driven resource management.

The objective of this study is to present methods for calculating the grade mix based on routine data from patient documentation. Our focus here is on developing conceptual approaches and possible calculation methods to determine a current and future grade mix, focusing on Austria as an example (GuKG 1997, 2016).

2. Conceptual model for grade and skill mix

The present study adopts the model of Buchan, Ball, and O´May (2000). As part of that investigation, the authors examined various potential factors that might have an influence on grade and skill mix projects, and developed the conceptual model illustrated in Figure 1 to support future research work.

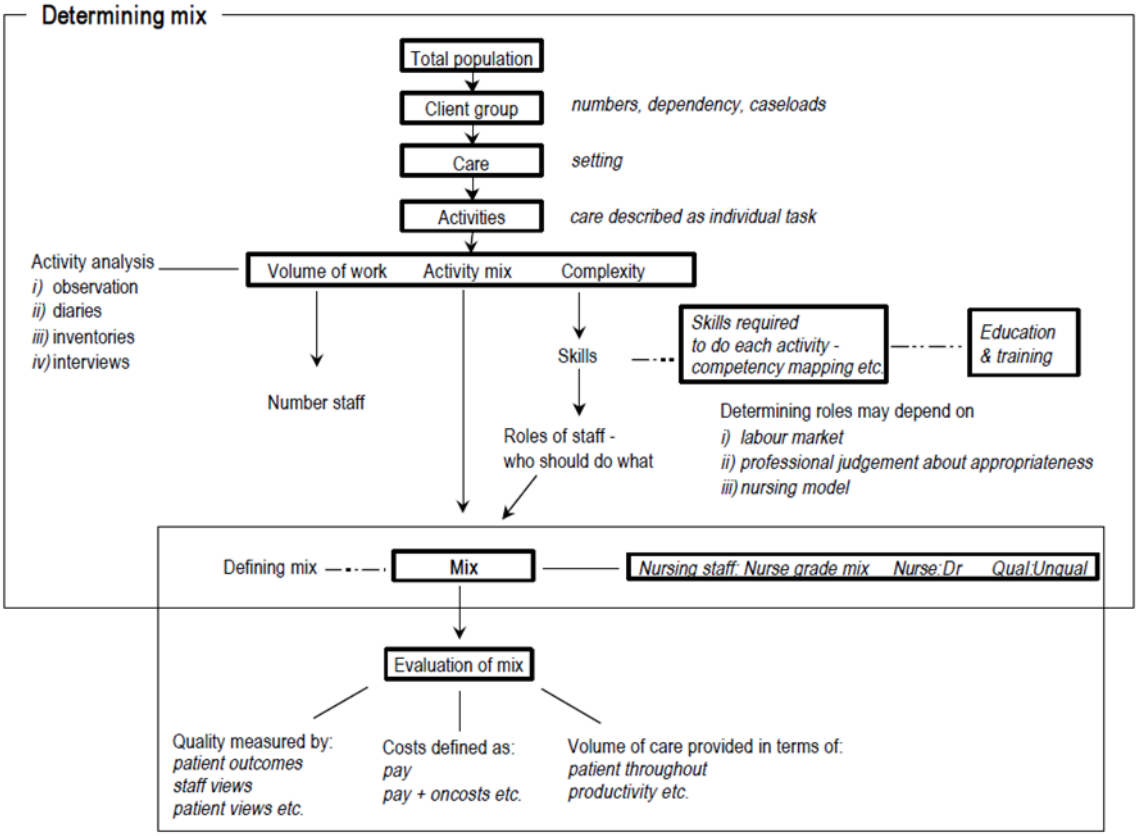

Figure 1: Conceptual model for grade and skill mix (Buchan et al., 2000)

The model is classified according to data collection methods and different methodological approaches (qualitative or quantitative methods). For example, an activity analysis may be conducted using observations, self-collected records, or interviews. Besides theoretical considerations, the context (e.g. the underlying statutory and organisational framework) and the practice (e.g. core processes or nursing model) must also always be taken into account. The authors describe both activity analyses on the basis of defined and/or measurable activity profiles, and the calculation of staff costs per minute per occupational group as a commonly used method. They mention a number of different steps: (1) determination of the current situation, i.e. which activities are done when, by whom, how often and for how long; (2) cost calculation, i.e. costs per activity based on the corresponding staff costs, task time and frequency; and (3) data analysis, interpretation and discussion by an appropriate group of experts, consisting e.g. of nursing and staff management teams. In addition, the categorisation of patient groups must be described, e.g. according to medical diagnoses (Diagnosis Related Groups, or DRG), in order to determine case or treatment complexity. Using only a single method is often viewed very critically, since such approaches tend to focus on just one aspect and neglect other influencing factors. To avoid these limitations as much as possible, a combination of the various methods is recommended, as long as the resulting approach is logical and comprehensible. Ideally, both the cost-effectiveness of a qualification mix and its impact on patient results should be evaluated (Buchan et al., 2000).

It is also recommended in the literature that changes to the grade and skill mix be examined from the perspective of the corresponding workflows as well (Zulehner, 2016). It cannot be assumed that any shift in the distribution of activities that makes sense in terms of cost calculations will also actually fit with an organisation's work procedures. An adapted version of Zulehner's (2016) model was used in the present study for our process-oriented analysis of the distribution of qualifications. The basic concept involves a graphical representation of processes using so-called swimlane diagrams, in which occupational groups are represented in different horizontal lanes. This allows use to visualise which occupational group is responsible for which activities in which part of the process (see Figures 11 and 12), which in turn allows for an analysis of the following three parameters: (1) number of interfaces, (2) number of process interruptions and (3) number of participating occupational groups (grades).

3. Methodology

For the present study, we conducted a quantitative exploratory study with a descriptive design (Burns & Grove, 2014).

The calculation methods were reviewed based on the nursing interventions from LEP Nursing 3. To do this, routine data were generated from patient documentation from a Swiss healthcare organisation. To examine questions of grade mix in the context of Austrian law, it was necessary to map the individual nursing interventions from LEP Nursing 3 to the occupational groups defined in the Health and Nursing Care Acts (GuKG) of 1997 and 2016.

3.1. Normative mapping under GuKG

The individual nursing interventions from LEP Nursing 3 were mapped to the occupational groups defined in the Health and Nursing Care Act (GuKG) of 1997, namely (i) Nursing Assistance (PA) (formerly Nursing Support) and (ii) Registered Healthcare and Nursing Service (DGKP) staff; and to the groups defined in the Health and Nursing Care Act (GuKG) of 2016, namely (i) Nursing Assistance (PA) (formerly Nursing Support), (ii) Professional Nursing Assistance (PFA) and (iii) Registered Healthcare and Nursing Service (DGKP) staff. For each intervention, this normative mapping took case complexity into account (stable, at-risk and unstable patients). Concretely, this means e.g. that Subcutaneously administering an injection for a stable patient was assigned to the minimum qualification of Nursing Assistance, whereas for an unstable patient, this activity falls under the DGKP competency area (as defined in GuKG 2016). In total, six different normative mappings were developed, based on the three identified categories of case complexity (stable, at-risk and unstable patients) and the two iterations of the law (GuKG 1997 and GuKG 2016).

These normative mappings were applied with support from the literature (Gesundheits- und Krankenpflegegesetz, 2016) Pflegeassistenzberufe-Ausbildungsverordnung, 2016; (FH-Gesundheits- und Krankenpflege-Ausbildungsverordnung, 2008; Weiß & Lust, 2014) and were subsequently validated in an expert consultation session with two nursing care managers, in which any discrepancies were discussed and resolved by consensus.

3.2. Routine data from patient documentation

With the agreement of our colleagues on the management team at the Swiss healthcare organisation, a data set from 2015 was used for the present study. The data set contains information that can be divided into three types: (i) data on the service itself, e.g. Subcutaneously administering an injection, with regard to the time spent and the time and place it was performed; (ii) information about the service recipient (case); and (iii) information about the service provider (nurse). The recorded data thus indicate what services were provided where, for whom and by whom. Table 1 shows the attributes that were present in the data set. Variables 2–6, 9 and 10 provide information about the service. Variable 1 is an attribute of the case (service recipient), and variables 7 and 8 are attributes of the nurse (service provider).

Abbreviation		Description
1	FID	Anonymous service recipient identification number
2	oper_date	Date when the intervention was performed
3	IID	Content number of the LEP Nursing 3 intervention
4	LEP_Min	Time spent in minutes (LEP minutes)
5	Anz_PP	Number of nurses involved in performing the intervention
6	Fachgeb	Areas of specialisation from LEP
7	Personal_ID	Anonymous service provider identification number
8	PersKat	Staff category from LEP
9	oper_time	Time when the intervention was performed
10	Anz_Int	Number of nursing interventions (usually 1)

Table 1: Attributes in the data set

3.3. Nursing interventions from LEP Nursing 3

The nursing interventions were recorded with reference to the "Patient documentation with LEP" guidelines (Baumberger et al., 2016). Following the definition set by the International Classification of Health Interventions (ICHI), an LEP intervention is defined as an activity performed for, with or in the interest of a person or population group in order to improve, evaluate or modify health, functional capabilities or health conditions (WHO-FIC Family Development Committee, 2012). Services without case assignment (Baumberger et al., 2016; Morris, MacNeela, Scott, Treacy, & Hyde, 2007), which may for example be performed as part of training activities, e.g. Conducting/organising internal continuing training, were not considered in this study.

The data analysis was conducted on the basis of LEP Nursing 3.3.1, with the amount of time spent on each service being calculated from the recorded nursing interventions and their LEP minute values.

3.4. Staff categories from LEP

For our analysis, the staff categories from LEP were mapped to their Austrian designations as follows:

- Nursing assistant = Nursing Assistance (PA)
- Healthcare specialist = Professional Nursing Assistance (PFA)
- Registered nurse with additional training = Registered Healthcare and Nursing Service (DGKP)
- Midwife = Midwife
- Management staff = Nursing Management (Pflegemanagement / PM)

3.5. Classification of case complexity

For the present study, the complexity of each case was rated as follows, based on the case identification number (FID):

- Case complexity A (stable patients) = DGKP/LEP minutes, total/day/patient < 0.25
- Case complexity B (at-risk patients) = DGKP/LEP minutes, total/day/patient ≥ 0.25
- Case complexity C (unstable patients) = DGKP/LEP minutes, total/day/patient ≥ 0.5

Patients were reclassified each day, based on their total LEP minutes and the proportion of DGKP services.

3.6. Merging the data set with the nominative mappings

The six different normative mappings were merged with the data set from the Swiss healthcare organisation, and the cases were assigned a complexity rating for each day based on the case identification number (FID). The result of this rating subsequently determined which normative mapping was chosen. Table 2 below provides a simplified illustration of this merger.

Data from the data set				Data from the normative mappings		
FID	**oper_date**	**LEP Nursing 3 intervention**	**Case complexity rating**	**Minimum qualification**		
				DGKP	**PFA**	**PA**
20000001	09/06/2015	Subcutaneously administering an injection	A (stable)	X	x	x
20000001	09/06/2015	xxx	A (stable)	X	x	
20000001	10/06/2015	Subcutaneously administering an injection	C (unstable)	X		
20000001	10/06/2015	xxx	C (unstable)	X		

Table 2: Simplified presentation of the process used to merge the normative mappings with the data set

If the patient was classified as case complexity A (stable), the data were merged with the normative mappings from GuKG 1997 and GuKG 2016 for stable patients. In this example, the LEP nursing intervention Subcutaneously administering an injection for a stable patient requires a minimum qualification of Nursing Assistance (PA). If the situation is classified as unstable, the activity of Subcutaneously administering an injection requires a minimum qualification of Registered Healthcare and Nursing Service (DGKP) Patients were reclassified each day, and the data set was linked with the appropriate normative mapping.

3.7. Data preparation and analysis

For our analysis, the data were cleaned up using previously defined criteria and transformed accordingly. After this data preparation phase, the activity analyses were performed in accordance with the models of Buchan et al. (2002) and Zulehner (2016), then reviewed from the perspective of workflow design.
The data were analysed using R (R Core Team, 2016). The results were presented using absolute and percentage-based frequency distributions, as well as average LEP hours.

Methodological approach for activity analysis
In the present study, a combined methodological approach (activity analysis incorporating case complexity) was selected, in accordance with the model of Buchan et al. (2002). The activity anal-yses were conducted based on the service time in LEP hours by occupational group, service level and case complexity. This study did not examine the effects on patient results or evaluate costs.

The results were analysed and presented based on absolute and percentage-based frequency distributions. This made it possible to identify changes between occupational groups, as well as shifts in activities and competencies between GuKG 1997 and GuKG 2016.

Methodological approach for process-oriented analysis
To investigate which occupational group is responsible for which activities in which part of the process, the service time in LEP hours was analysed according to occupational group, service level and case complexity. Alongside the absolute and percentage-based frequency distributions, we also performed time series analyses based on a simple descriptive method (average LEP minutes per month or day) (Backhaus, Erichson, Plinke, & Weiber, 2011).

For the analysis of individual cases, the individual LEP nursing interventions that were performed were analysed by case and by day, taking the service level as defined in GuKG 1997 into account. This approach allows for a review of the calculation methods for workflow analysis (number of interfaces, number of process interruptions and number of participating occupational groups). Cases were randomly selected to help visualise differences using concrete examples.

4. Results

The data analysis focuses on the calculation methods used to characterise the current situation and a future distribution of qualifications, and to illustrate shifts in activities and competencies between GuKG 1997 and GuKG 2016. Process-oriented aspects are also presented in connection with the distribution of qualifications.

4.1. Normative mappings – LEP nursing interventions / GuKG occupational groups

The normative mappings were used to classify the LEP nursing interventions by case complexity into so-called Level 1 (Nursing Assistance [PA] as minimum qualification) and Level 2 interventions (Registered Healthcare and Nursing Service [DGKP] as minimum qualification) under GuKG 1997, and into Level 1 (PA as minimum qualification), Level 2 (Professional Nursing Assistance [PFA] as minimum qualification), and Level 3 interventions (DGKP as minimum qualification) under GuKG 2016.

The results of the normative mappings showed that the LEP classification of nursing interventions could be directly used to characterise nursing care in Austria under GuKG 2016, with no need for adaptation. For example, new activities that fall under nursing care competencies in GuKG 2016, such as Administering blood substitutes or administering a blood transfusion, are already coded as nursing interventions in LEP Nursing 3, thus allowing for a characterisation of nursing care in accordance with GuKG 2016.

4.2. Study population

The data are from the period from 1 April to 30 September 2015. In this six-month period, a total of 789,723 LEP nursing interventions with case assignment were documented, with a total time value of 73,160 LEP hours (4,389,622 LEP minutes). The data set contains a total of 4,390 cases (22,412 case days) which were included in the calculation. These nursing interventions were documented by a total of 258 nursing staff working in various departments.

4.3. Case complexity

Based on the case ID, the cases were assigned a case complexity per case and per day. The analysis of Figure 2 shows the LEP hours for each case complexity category, both as an absolute number of hours and as a percentage of all hours for the facility (4,390 cases and 22,412 case days, for 73,160 total LEP hours).

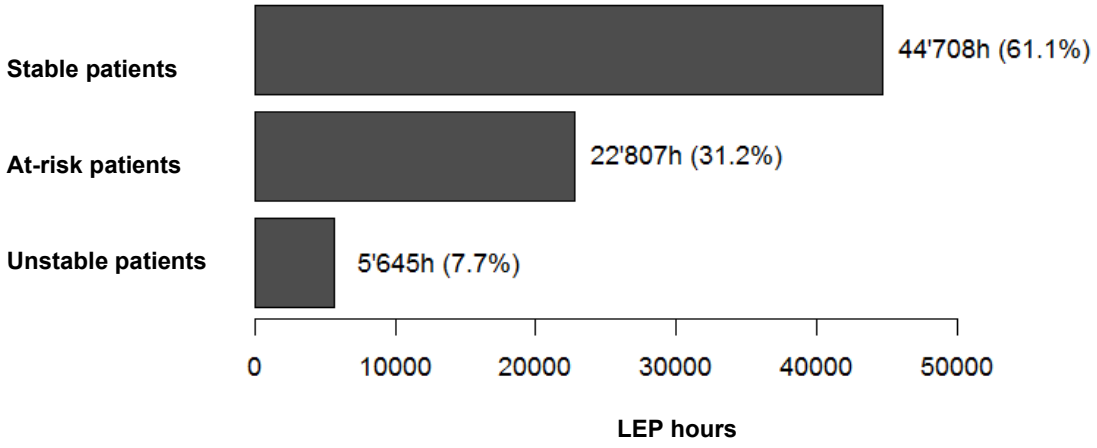

Figure 2: Service time in LEP hours by case complexity for the facility under study (n=4390)

4.4. Staff categories

The total service time per staff category for the facility under study is illustrated in Figure 3. 28.7% of services were provided by trainees (16.9% PFA trainees; 11.8% DGKP trainees), and 44.5% of services were provided by DGKP staff. However, it is important to note here that the training services provided by DGKP staff in training situations, which are documented as services without case assignment, were not considered in this analysis.

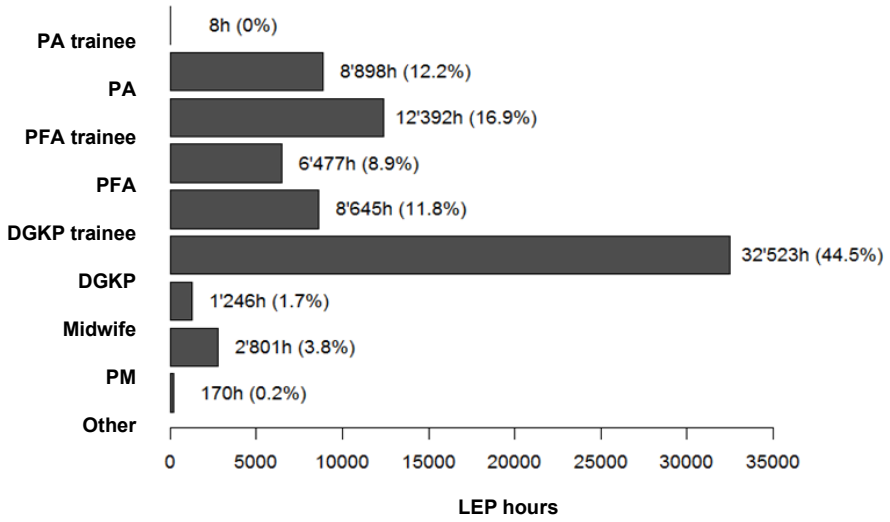

Figure 3: Service time by staff category for the facility under study (73,160 LEP hours)

4.5. Comparison of results for GuKG 1997 and GuKG 2016

Comparing service times by service level under GuKG 1997 (Level 1 = Nursing Assistance [PA] as minimum qualification, Level 2 = Registered Healthcare and Nursing Service [DGKP] as minimum qualification, and Physician = physician-level competencies) with the corresponding figures from GuKG 2016 (Other = patient services, Level 1 = Nursing Assistance [PA] as minimum qualification, Level 2 = Professional Nursing Assistance [PFA] as minimum qualification, and Level 3 = Registered Healthcare and Nursing Service [DGKP] as minimum qualification) reveals a shift in service levels under the new competency areas (Figure 4). 1.3% of the services that originally fell under physician-level competencies have shifted to the DGKP competency area under GuKG 2016. While 53.4% of services were categorised as DGKP under GuKG 1997, only 29.9% of services now fall under the DGKP competency area under GuKG 2016. Under GuKG 2016, 13.2% of services fall into the PFA category, 48.7% of services are in the PA category, and 8.2% of services can be handled by domestic services (patient services).

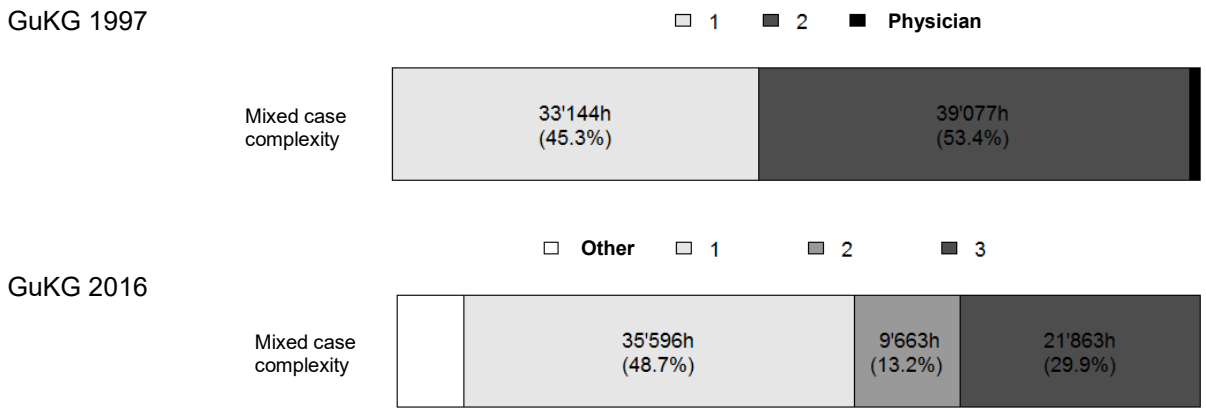

Figure 4: Service times by GuKG 1997 service level (top bar) and GuKG 2016 service level (bottom bar) based on case complexity rating for the facility under study (73,160 LEP hours)

The analyses in Figure 5 show a comparison of service times by service level (case complexity rating) under GuKG 1997 and GuKG 2016, broken down by department. The overall picture indicates a shift in competencies from DGKP services to PFA and PA services. In geriatrics, for example, the proportion of DGKP services declines dramatically (39.4% under GuKG 1997, 12.4% under GuKG 2016). In contrast, the proportion of DGKP services declines only slightly in specialist fields, e.g. by 12.1% in intensive care or by 7.8% in nephrology.

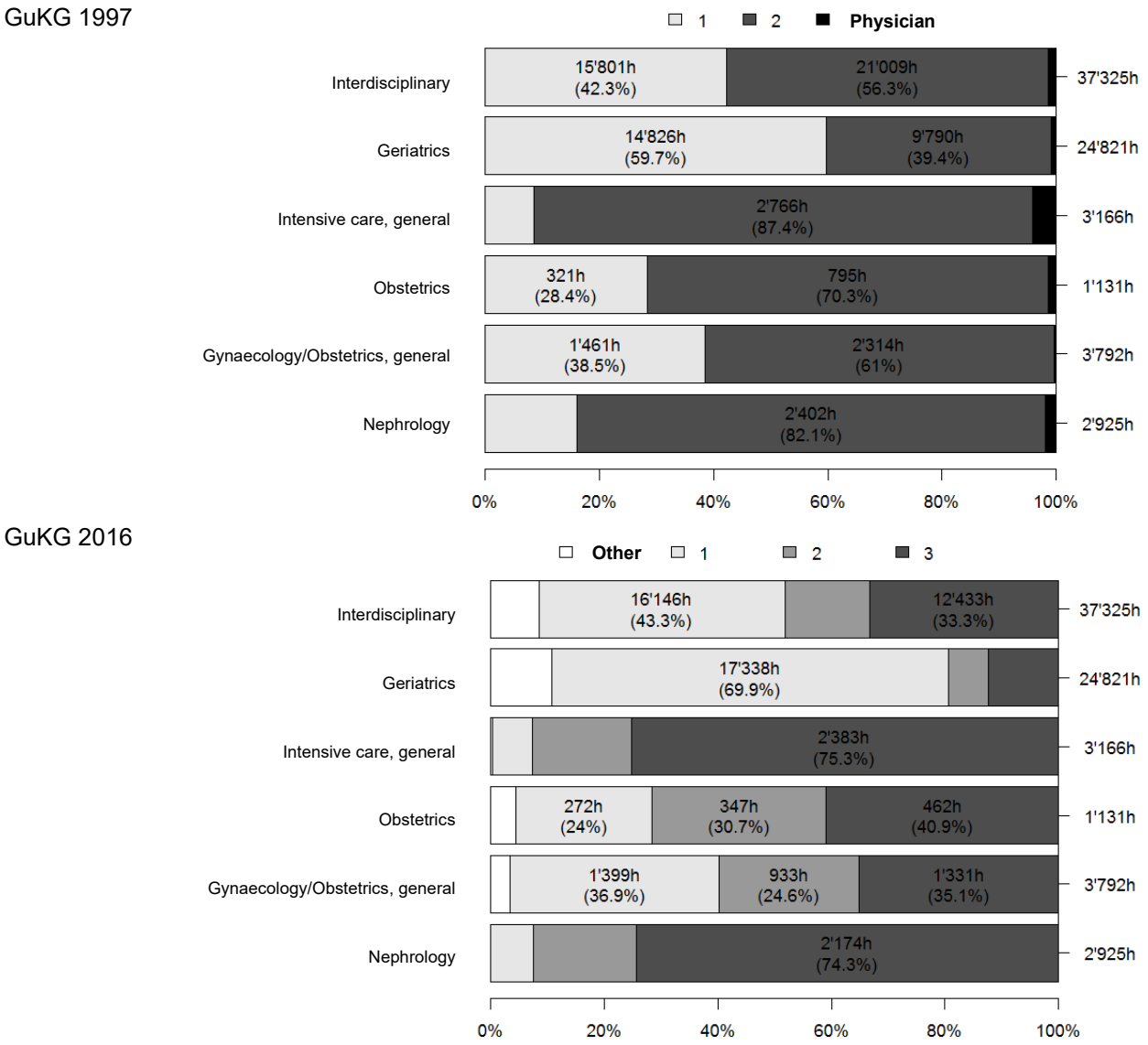

Figure 5: Service times by GuKG 1997 service level and GuKG 2016 service level for the facility under study (73,160 LEP hours)

Figure 6 presents a comparison of service level (case complexity) distributions by areas of responsibility under GuKG 1997 and GuKG 2016. The first category (indep't+shared) contains interventions that cannot be clearly assigned to a single area of responsibility, such as Measuring blood pressure or Changing wound dressing. Under GuKG 1997, 83% (21,797 LEP hours) of services from §15 (shared only) are DGKP services and 3.6% are physician services. Under GuKG 2016, these physician services are included in the DGKP competency area, which declines to a total proportion of 41.8%.

Looking at §14 (indep't only), the proportion of DGKP services declines from 31.3% (under GuKG 1997) to 21.3% (under GuKG 2016). These results should be seen as an opportunity for the professionalisation process in the nursing sector. They can be used to define nursing professionals' area of independent competency and responsibility, while also serving to define the body of knowledge that underlies the profession and to justify the need for highly qualified personnel and highly specialised training.

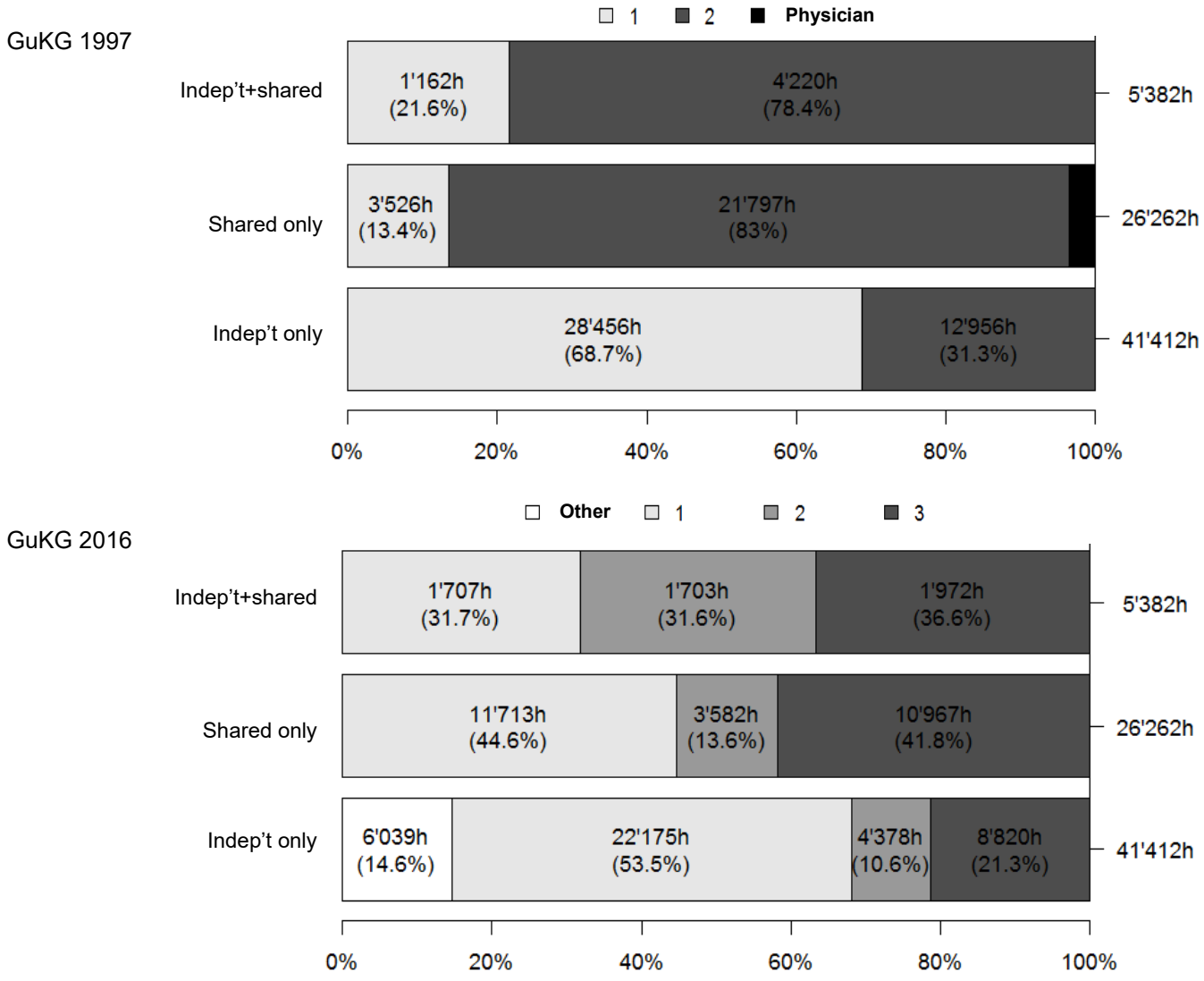

Figure 7: Service times by service level and areas of responsibility under GuKG 1997 (top three bars) and GuKG 2016 (bottom three bars) for the facility as a whole (73,055 LEP hours)

4.6. Process-oriented distribution of qualifications

Figure 7 depicts service times by occupational group and service level under GuKG 1997, taking case complexity into account. This offers an overview of which occupational groups are performing which activities at which service levels.

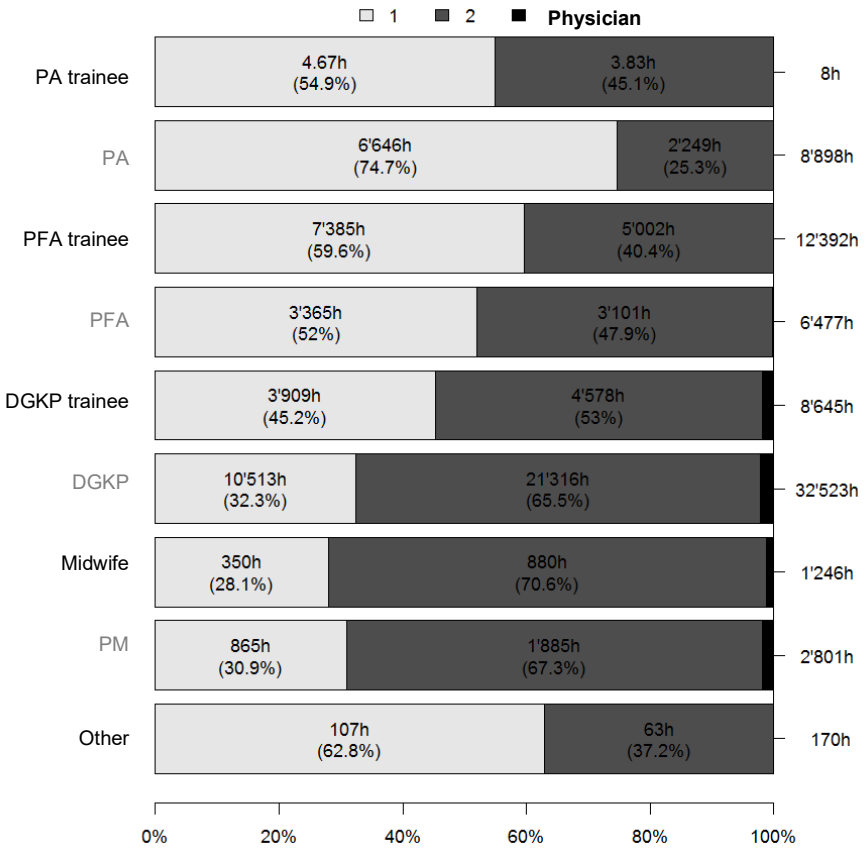

Figure 8: Service times by occupational group and service level under GuKG 1997 (1 = Nursing Support as minimum qualification, 2 = DGKP as minimum qualification, and Physician = physician-level competencies) at the facility under study (73,160 LEP hours)

It is evident from the figure that the time spent on services that fall under the DGKP competency area (Level 2) increases with increasing occupational-group qualifications (PA → PM), and that it is greatest for midwives, at 70.6% of their total service time. Taking process-related workflows into account, we can conclude from these results that the various occupational groups are indeed working in accordance with their different competencies.

4.7. Time series analysis

Figure 8 shows how the average LEP hours varied over 6 months (April to October). One striking aspect of this figure is the massive fluctuation of LEP hours over time (smallest quantity of services provided: 281 hours; greatest quantity of services provided: 496 hours). There were substantially more LEP hours recorded on weekdays than on weekends. The orange trend line shows a constant increase in services provided up until mid-June. The greatest quantity of services provided was between June and July, after which the quantity of services provided declines again.

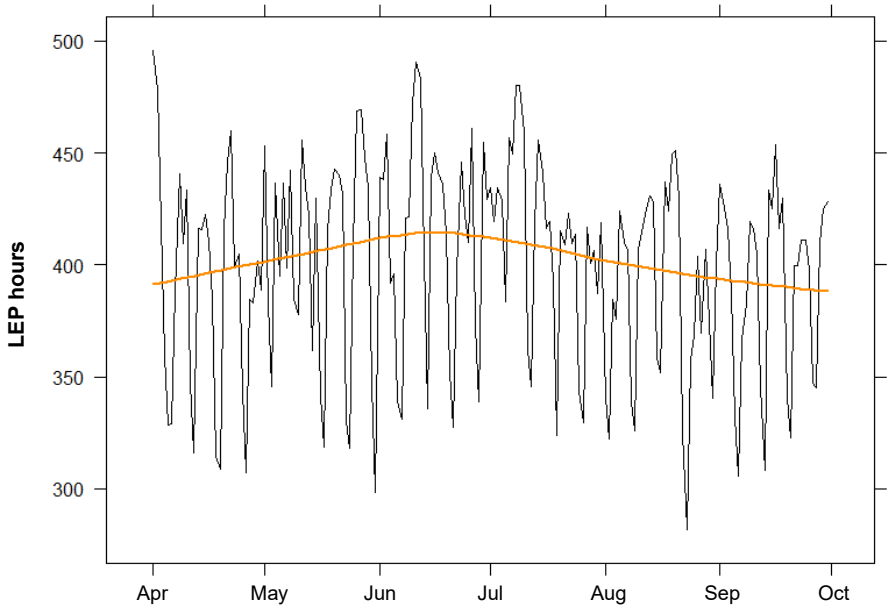

Figure 9: Average LEP hours per day of the week (black line) over a 6-month period with smoothed component (orange line) for the facility under study

Breaking these services down by department over a 2-month period reveals certain patterns, as seen in Figure 9. In the interdisciplinary department (acute care wards such as Surgery and Internal Medicine), for example, which has the highest total quantity of services provided, the highest value occurs in week 2, at 281.9 hours, while the lowest value of 111.4 hours occurs in week 3. The difference within these two weeks is enormous, at 137.5 LEP hours. In geriatrics, we observe a continuous increase in services over this period, with a significantly larger drop in services at weekends 2, 4, 6 and 7 (grey vertical lines) than for the other weekends.

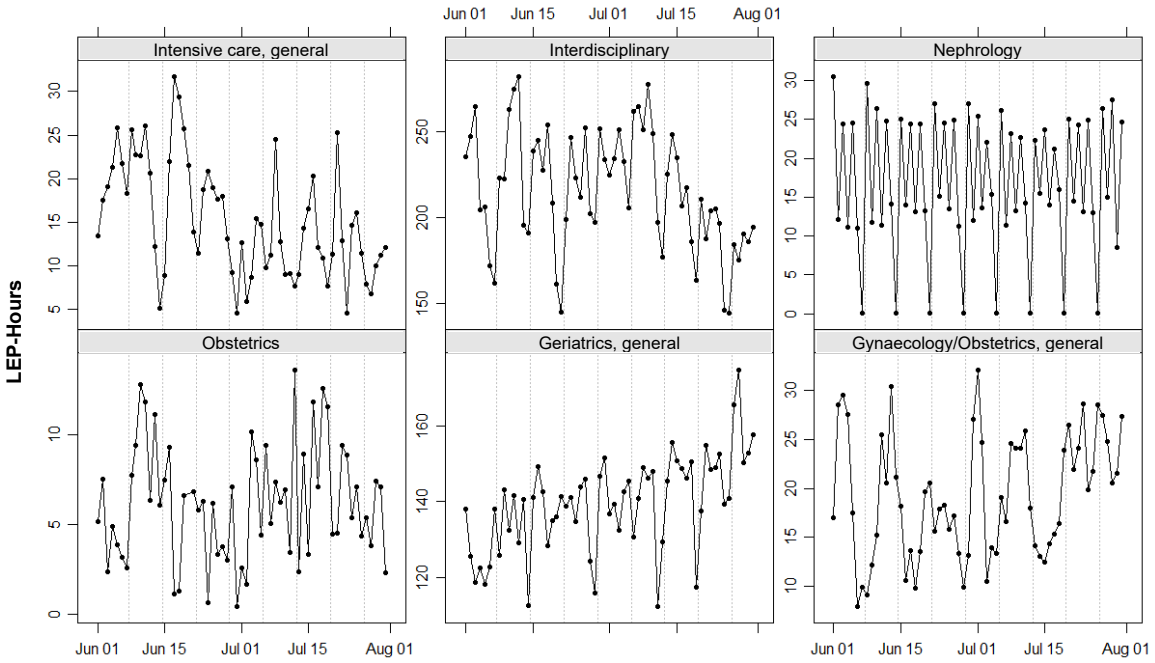

Figure 10: Average LEP hours per day of the week over a 2-month period with weekends (grey vertical lines) and individual days (•) by department

Breaking this time series analysis down by services provided per occupational group (Figure 10), we can see in the interdisciplinary department that the DGKP group is the most active occupational group. However, this group's share of services declines at the weekends (grey vertical lines). The results show that the services provided by the PFA trainee group is noticeably higher in weeks 5 and 6 than in the rest of this period. In geriatrics, we see a thoroughly heterogeneous situation in terms of the distribution of qualifications over the period in question. It is apparent that PFA trainees and Nursing Assistance (PA) staff are the two most active occupational groups here, although the quantity of services provided and the distribution of qualifications shows massive fluctuations. For example, there are huge peaks in Nursing Assistance (PA) hours in weeks 2 (85 hours) and 4 (79.1 hours). In this connection, it might be interesting to examine how individual case management is incorporated into this department's processes and structures.

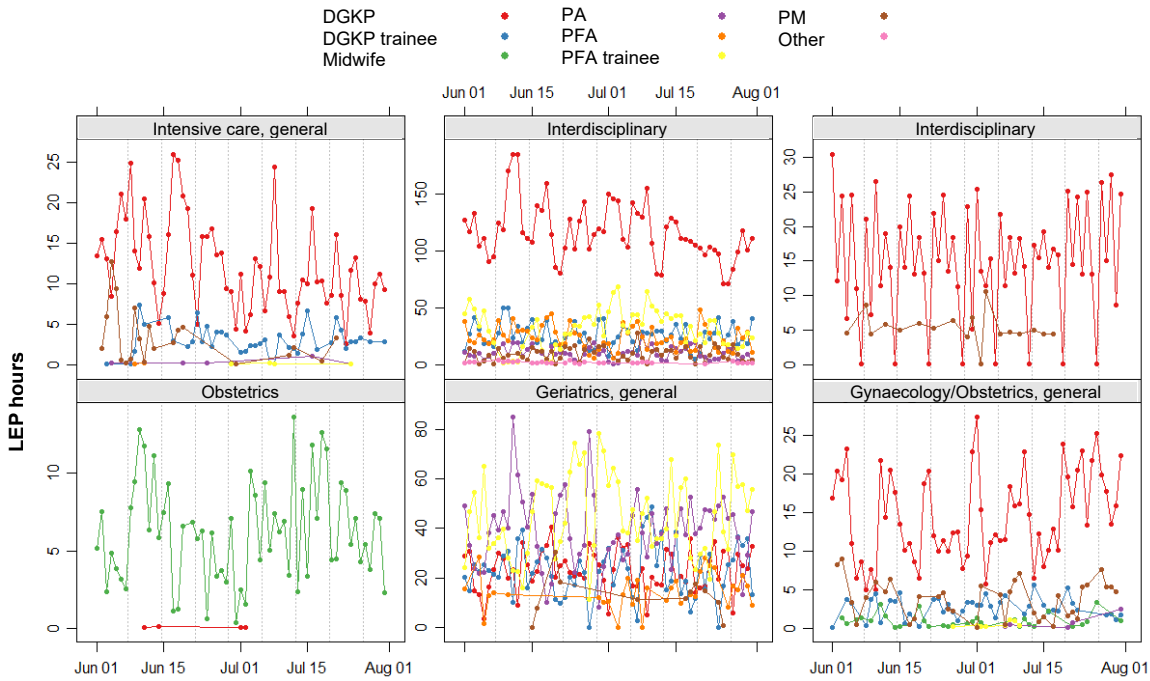

Figure 11: Average LEP hours per day of the week over a 2-month period with weekends (grey vertical lines) and individual days (•) by occupational group and department

4.8. Individual case analyses

As seen in Figure 11, three individuals from one occupational group (DGKP = Registered Healthcare and Nursing Service and PM = Nursing Management or ward manager) mainly performed Level 2 interventions (DGKP as minimum qualification), with a clear distinction between day, evening and night shifts. Looking at this distribution of activities from a workflow perspective (interfaces, process interruptions and participating occupational groups), this case would appear to represent an optimal treatment process.

Figure 12: Individual case analysis 1: Activities performed per case and 24-hour period by occupational group and service level as defined in GuKG 1997 (1 = Nursing Support as minimum qualification, 2 = DGKP as minimum qualification, and Physician = physician-level competencies)

In the individual case analysis in Figure 12, we see that a total of ten individuals from four different occupational groups performed activities on this case. Based on the lack of night shift activities before 6:00 a.m., it may be inferred that this individual case analysis likely involved an intake situation. The individual activities performed by DGKP-10, DGKP-6, DGKP-8 and DGKP-9 are interesting in this connection. Either these are organisational activities carried out as part of an intake process, such as Organising patient appointment; or perhaps activities such as Stoma or diabetes counselling were performed as part of a nursing care consultation. Another possibility is that individual activities like Preparing an assessment/case history or Maintaining patient documentation were performed here. From this individual case analysis, we might infer that a functional nursing approach (distribution of individual activities to specific functions) was in use here.

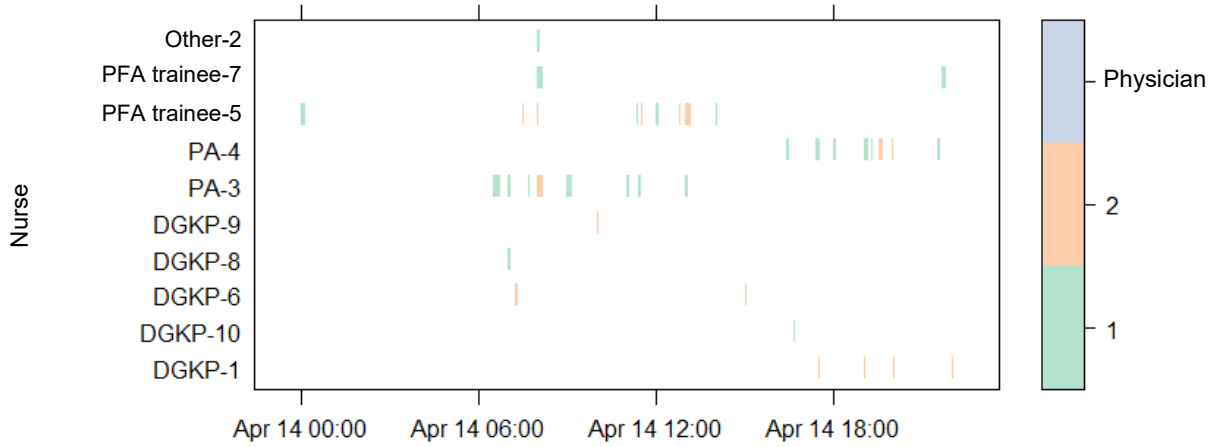

Figure 13: Individual case analysis 2: Activities performed per case and 24-hour period by occupational group and service level as defined in GuKG 1997 (1 = Nursing Support as minimum qualification, 2 = DGKP as minimum qualification, and Physician = physician-level competencies)

5. Discussion and outlook

To answer our first research question, we drew on the normative mapping of nursing interventions from LEP Nursing 3 to the occupational groups from GuKG 1997 and GuKG 2016. The results show that the LEP classification of nursing interventions can be used to characterise nursing care in Austria under GuKG 2016, with no need for adaptation. In addition, LEP nursing interventions can support a data-driven decision process aimed at achieving an optimal grade mix in nursing.

To answer the second research question about a demand- and competency-based distribution of qualifications, we analysed routine data from patient documentation from a six-month period at a Swiss healthcare organisation. In this period, a total of 789,723 LEP nursing interventions with case assignment were documented, with a total time value of 73,160 LEP hours (4,389,622 LEP minutes). Cases were rated by complexity for purposes of data analysis, resulting in an analysis for the facility under study of 61.1% stable patients, 31.2% at-risk patients, and 7.7% unstable patients.

Examining the service time (in LEP hours) per staff category for the facility under study reveals that trainees cover 28.7% of all services (21,037 LEP hours), while DGKP staff cover 44.5% of services (32,523 LEP hours). On the one hand, this may indicate high productivity for trainees, but it may also reflect a failure to account for services without case assignment, the category used to record training services provided as part of training activities.

Looking at the service time in LEP hours by service level (GuKG 1997, GuKG 2016), we see that 53.4% of services (39,077 LEP hours) are DGKP interventions under GuKG 1997, and that this proportion drops dramatically under GuKG 2016, to 29.9% (21,863 LEP hours).

Comparing service times by areas of responsibility as defined in §14 and §15 of GuKG 1997 vs. GuKG 2016 shows that a total of 31.3% of services from §14 in GuKG 1997, versus 21.3% in GuKG 2016, fall under the DGKP competency area. For services from §15, the results show that 83% are classified as DGKP interventions in GuKG 1997, whereas this proportion drops to 41.8% in GuKG 2016. In the Austrian nursing care context, this aspect should be seen as an opportunity to define the body of knowledge that characterises the nursing profession.

The results of the process-oriented analyses presented here identify aspects that could be examined in the future to support an optimal calculation of grade mix. For example, one striking finding was the fluctuation in daily service hours, which was at times very pronounced, with a maximum between-day difference of 137.5 LEP hours over the 6-month study period (Figure 9). It is worth examining whether and to what extent service times can be optimised over such extended periods by means of timing adjustments (intakes, planned interventions or discharges). The time series analyses also reveal a recurring decline in services at the weekend (Figure 9). To identify so-called “routine” tasks or activities, the spectrum of services should be reviewed to determine whether the decline in services at the weekend may have an impact on nursing care outcomes. Individual case analyses might make it possible to identify both optimal support processes and functional nursing approaches. As part of the process of optimising the calculation of grade mix, these types of workflows should be examined more closely with reference to nursing care outcomes and patient satisfaction. The results also suggest that the day of intake, and/or other days with particular events (interventions, discharges, etc.), might offer particularly strong potential for the development of a standard target process (e.g., reduction in process steps, reduction in number of participating occupational groups).

5.1. Strengths and weaknesses of the present study

Given the lack of curriculum for the training of Professional Nursing Assistance (PFA) staff, the normative mapping method selected in this study to map nursing interventions from LEP Nursing 3 to the PFA category may have led to inaccurate mappings in certain cases, although the applicable training regulation (Pflegeassistenzberufe-Ausbildungsverordnung, 2016) – which includes a relatively detailed description of a PFA’s task responsibilities – was consulted in applying the mapping. In addition, the process by which the experts came to their consensus on the normative mapping may have been influenced by the fact that both experts work in nursing management. Therefore, it is advisable that an expert group drawing from other fields – from nursing education, human resources management, and other fields as well as nursing management – be consulted to verify the normative mapping.

Despite the goal of generating a data set from patient documentation from an Austrian healthcare organisation, the present study instead had to use routine data from a Swiss healthcare organisation. This was appropriate given the objective of the study and the fact that it is the first of its kind; nevertheless, the data set should be expanded, e.g. by incorporating Patient Clinical Complexity Level (PCCL; (Holzer, 2013)) to calculate case complexity or data about skills.

The combined methodological approach (activity analysis incorporating case complexity and process orientation) based on the conceptual model of Buchan et al. (2000) can be identified as a strength of the study, because it allows for various aspects relating to an optimal grade mix to be incorporated in a reasonable way. This study also used process-oriented analyses (number of interfaces, process interruptions and participating occupational groups) of the grade mix (Zulehner, 2016), providing access for the first time to new perspectives and discussions around the topic of grade and skill mix and examining the day-to-day viability of shifts in how different activities are carried out. In addition, this study showed how routine data from nursing documentation can be used to provide data-driven support FOR decision-making processes aimed at achieving a demand- and competency-based grade mix in accordance with GuKG 2016.

5.2. Comparison with previous research results

The grade mix in the Swiss healthcare organisation shows that trainees cover a relatively high proportion of services, at 28.7%. On the one hand, this high proportion may be attributable to a failure to document services without case assignment in connection with training activities; but on the other hand, it may also indicate that trainees are being asked to cover an enormous number of services. The SAMS study (Schülerinnen/Schüler Aufwand Messsystem, or Student Work Measurement System; Kuster and Bamert, 2013) showed similar results, with all trainees showing very high productivity (amount of services provided) depending on their training course and year. To quantify the support provided to trainees by DGKP staff and determine the relationship between trainees' productivity and the supervisory services performed by DGKP staff, it will be necessary to document not only services with case assignment, but also services without case assignment. These should at least be documented on a periodic basis and incorporated into such analyses via weighting.

5.3. Generalisability of research results

In this study, our focus was on calculation methods for a grade mix based on routine data from patient documentation. The calculation tools that were used and reviewed in this study can also be used with routine data from patient documentation from other healthcare organisations or to characterise the distribution of qualifications in other countries. This would require taking the relevant country-specific framework conditions into account.

5.4. Unanswered questions and new questions

The data set should be expanded to help answer certain questions about the calculation of case complexity. As suggested by Buchan et al. (2002), relevant factors may include age, sex or medical diagnoses of cases and the Patient Clinical Complexity Level (PCCL) (Holzer, 2013) from the G-DRG or SwissDRG system. New questions could also be explored, relating to possible impacts of changes in grade mix on nursing care outcomes (Aiken, Clarke, Sloane, Lake, & Cheney, 2008; Butler et al., 2011) or costs (Buchan et al., 2000). The study results presented here provide a good starting point for examining such questions.

6. Conclusions

This study presented methods that can be used to calculate the grade mix based on routine data from nursing documentation in the form of nursing interventions from LEP Nursing 3. Alongside activity analyses incorporating case complexity, it also reviewed process-oriented aspects of grade mix. For the first time, this provided a data-driven basis for discussions around a demand- and competency-based grade mix in Austria, illustrating shifts in activities and competencies in combination with processes and responsible occupational groups (grades). These calculation tools can also be used and further developed with more extensive routine data from patient documentation from other healthcare organisations, and applied to other countries in accordance with their specific statutory frameworks.

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