Classifying the organization of nursing in Norwegian hospital wards: Self-identification versus observation.

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Word count: 3831
Words in abstract: 347
No of figures: 3
No of tables: 3

Keywords

- Organization model
- Nursing
- Nursing service delivery
- Attributes of nursing environment
- Workplace variables
- Cluster analysis
- Primary nursing
- Team nursing
Abstract (347 words)

Background
The organization of nursing services is a much discussed matter in ward administration. It is assumed to be related to quality of patient care and staff satisfaction, and is therefore a potentially important characteristic of nursing practice environment. There is no agreed upon nomenclature on the organization of nursing services. The objective of the present study was to classify general hospital wards based on data describing organizational traits, as reported by the wards’ nurse manager, for subsequent use in constructing a variable useful in practical research. Also, we wanted to compare the empirical classification with the self-identification of the ward organization models.

Methods
In a cross-sectional postal survey, 93 Norwegian ward nurse managers provided information about the organization of nursing at their wards and what they called the organization model in use in their wards. We used K-means cluster analysis to classify the wards according to the pattern of activities attributed to the different registered nurse roles and discriminant analysis to interpret the solutions. Cross-tabulations were used to check the consistency of the solutions and to compare the self-identification with the empirical classification. Bootstrapping was used to assess the generalizability of the cluster solution.

Results
The cluster analyses produced two alternative solutions with two and three clusters, respectively. We considered the three-cluster solution to be the best representation of the organization models: 32 team leader-dominated wards; 23 primary nurse-dominated wards, and 38 wards with a hybrid or mixed type of organization. The
correspondence between the three-cluster solution and the self-identification was moderate. The cross-tabulations supported the empirical classifications as being representative for variations in nursing service organization. Of the bootstrap replications, 94% showed the same pattern as the cluster solution.

**Conclusions**
An empirical cluster solution yielded a classification of wards that had a meaningful interpretation, **though it was only moderately consistent with the ward’s self-identification.** We believe the three-cluster solution can be useful for comparisons of ward organization and **can be generalized to Norwegian hospitals today.** The **procedure used in the study** could be **developed** into a **standardized method** to classify hospital wards across health systems.
Background

Hospital wards can be structured and organized in different ways, and the organization, staffing, and management of nursing vary considerably between health systems and different cultures. In the literature, nursing service organization is often described in relation to three generic types: (1) *Functional nursing*. Tasks are allocated by principles similar to production lines. For example, one registered nurse (RN) is responsible for infusion therapy for all patients, while another dresses wounds; (2) *Team nursing*. A small group of nurses with different qualifications is responsible for the care to several patients, thus making the number of interpersonal contacts more manageable and the lines of responsibility clearer. An RN is team leader and supervises the work of less qualified personnel; (3) *Primary nursing*. One RN carries out all care to a strictly limited number of patients. Primary nursing is conducive to the idea of holistic care and is also assumed to lead to a good work environment [1-4]. In everyday practice, however, the organization of nursing services is influenced by local conditions such as staffing, workload, ward size, interdisciplinary co-operation, working hours, and regulatory environment.

Researchers have used different approaches to classify the organization at the ward level. In a study to identify factors affecting staff nurses’ perception of staffing adequacy, Kramer and Schmalenberg used questionnaire items to collect staff nurses’ description of the organization models in use at their units. The presence of six different models was measured using the following labels: New team, Total patient care, Modified primary, Old team, True primary, and Varying from day to day. In this approach the wards were classified by the number of and which of the models that were concurrently in use [5]. The Revised Nursing Work Index is a questionnaire presented by Aiken and Patrician to measure characteristics of professional nursing
practice environments [6]. Here, the organization of nursing services in the wards was described by asking staff nurses how much they agreed to each of the following statements: “Team nursing is the nursing delivery system”; “Total patient care is the delivery system”; and “Primary nursing is the delivery system”. In a study that used nursing shortage as outcome variable, Seago et al. used organization model as a predictor with three values; Primary /Total; Team / Functional; and Modular / Case management [7]. A recent review by Kane et al. of studies on nurse staffing and quality of patient care used five categories to illustrate alternative models: Patient focused care; Primary nursing; Total nursing care; Team nursing; and Functional nursing [8]. Further, a study by Adams et al. collected data about organizational traits from ward nurse managers and then used cluster analysis to construct classes of wards. They identified three classes of organization models; Devolved; Two-tier; and Centralized. The classes were subsequently compared on characteristics of the practice environment as perceived by staff nurses, such as job satisfaction and intra-ward co-operation [1].

The alternative organization models varied in numbers from three to six between the studies above. The names differed, and so did the approach by which the models were identified. This illustrates the lack of consensus in the classification and nomenclature of nursing organization at the ward level. Models with the same name may be operationalized in very different ways [9]. Therefore, it has been suggested to avoid using self-identification to describe nursing organization [3]. Mary Manthey, who was involved in the development of primary nursing, stated that the name does not matter. “What does matter is that all patients who need an RN, have an RN: an RN who has accepted responsibility for managing and coordinating patients’ care in the hospital and do their discharge plans , an RN that patients, their families, the health
care team, and the rest of the staff can identify as having the responsibility and
authority for care planning [10] (p.370).

Common labels used for self-identification in Norway are: primary nursing,
patient responsible nursing, modified primary nursing, team nursing, or group
nursing. Only licensed nursing personnel are employed in Norwegian hospitals.
Registered nurses with three years of college education are in majority, and the rest
are licensed practical nurses qualified by vocational training.

The organization model shapes the collaboration and communication in a
ward, and is an element of the process of the service provision. A recent review of
studies on hospital organization recommended that future research should
incorporate structure, process, and outcome components. In particular, the
authors recommend development of standardized instruments for common
process variables, to ease the collection of primary data [11]. The choice of
organization model may imply differences in service delivery, with potential
relations to the quality of patient care, as the prioritizing of patient continuity
vary between models. The choice is also assumed to be related to skill-mix, staff
flexibility, and job satisfaction, with potential consequences for human
resources’ cost. Finally, the choice of organization model has consequences for
the co-ordination between nurses and other professionals in patient care. To be
used in a nursing administration study of wards in acute general hospitals we needed a
simple and valid classification system to categorize the nursing service organization
models in use at ward level. A valid classification would be useful for dividing
ward samples into subsamples for comparison, or as a covariate in multivariate
analysis.
We assumed that relying on local labels for the organization model would lead to inconsistency and lack of reliability. Therefore, the aim of this study was to construct a variable to classify the ward organization models for use in practical research in a sample of hospital wards, based on reported ward data. Furthermore, we wanted to compare this empirical classification with the self-identification of the wards.

**Methods**

**Study design and sample**
The study was part of a larger cross sectional postal survey that comprised a broad set of measures; a survey of patients’ experiences and of staff nurses’ perception of the practice environment, and data on staffing and bed occupancy. The primary sampling unit was wards, and the size of the sample was estimated on the basis of statistical power considerations relating to the patient experiences questionnaire [12]. The required sample size was estimated to 100, including an expected ten percent drop-out rate. The present study is an analysis of a part of the data that was collected from the wards’ nurse managers and relating to ward nursing service organization.

We first identified and collected background information about all wards in Norway with \( \geq 18 \) beds in public general hospitals that performed acute, somatic care for adult patients 24 hours per day, 7 days per week. Maternity wards and wards with intensive or intermediate care beds were excluded. In total 156 of 243 eligible wards consented to be included in the study. We randomly selected 100 of the wards for the postal survey, which was conducted in 2005. Data from five wards were incomplete and two wards were reorganized during the period between the population census and the data collection, hence we had complete data from 93 wards for further analysis.
**Questionnaire**
The wards’ nurse managers responded to a self-completion questionnaire which contained items about ward organization. This was based on an approach and questionnaire items used in four previous studies. In one of these studies, the selection of questionnaire contents was based on a literature review that identified the main discriminating features of organizational models. The questionnaire was then tested in a sample of ward nurse managers and modifications were suggested. Four wards in this study sample had two nurse leaders who responded to the questionnaire, and the agreement in responses from the four pairs was excellent [13]. A later study used a similar questionnaire. The scores were collected by interviewing one staff nurse, and the resulting categorization was confirmed or disconfirmed by asking the ward nurse manager to select the one out of three descriptions of work organization that resembled the ward’s practice best. The categorization based on the staff nurse’s scores and the description selected by the nurse manager concurred in 28 out of 32 wards [14]. The approach has been modified and used in later studies [1,15].

We selected items for the present study from the studies above, and translated and adapted them to the Norwegian context. To secure a relevant and short questionnaire, nursing service leaders and nurse researchers took part in the final item selection and adaptation process. We collected descriptions of the organization at the wards by asking who usually was responsible for seven listed important RN activities, with response options that included six different RN roles in the ward (Appendix 1.A).

In the questionnaire we also asked the ward nurse managers to report the name they used locally to identify the organization model. Finally, we asked for supplemental data about the practice of medication administration, patient and work allocation, and shift duty scheduling (Appendix 1.B).
Data analysis

Variables and coding

We assigned each RN role a score that represented the number of activities attributed to it, using a scale ranging from 0 (no activities) to 7 (all listed activities) (Appendix I.A).

The six RN roles were:

- Any RN dealing with the patient
- Any RN in the patient’s team
- Team leader
- Primary nurse
- RN in charge of shift
- Ward nurse manager

The seven activities were:

- Write and revise the nursing plan
- Report follow up in the nursing plan
- Take part in the pre-round meeting with the physicians
- Accompany physicians on round
- Liaise with other professions in the hospital
- Contact patients’ relatives
- Plan patients’ discharge

For example, a score of seven on the team leader scale indicated that the team leaders usually performed all the listed activities, hence had extensive responsibilities.

For consistency assessment we used in cross tabulations, and without modification, the label they used locally to identify the organization model, along with the supplemental data that had not been used in the cluster analysis.
**Classification of wards**
We used cluster analysis to group wards into homogenous groups based on the scale scores described above. We used a non-hierarchical clustering procedure, K-means clustering. Ideally, the clusters should show high within cluster homogeneity and high between cluster heterogeneity. K-means cluster analysis requires the number of clusters to be specified by the researcher. We tried two, three and four cluster solutions. Our interpretation of the clusters and assessment of the separation between them was based on a profile diagram and discriminant analysis. The resulting discriminant functions give a low dimensional representation of the multidimensional arrangement of data points and clusters. For a concise visual representation we used the plot of the two first functions [16].

**Statistical analyses**
To check for potential sampling bias we used t-test and $\chi^2$ test to compare background data for wards in the study sample with those that did not consent to participate.

To assess criterion validity we checked whether the proposed clustering was consistent with the self-identification and with the supplemental data about work organization. We used Fisher’s exact test for pairwise comparisons to assess differences between the clusters. Because of multiple testing we chose a 1% significance level.

A priori, we expected the self-identification to correspond with cluster membership. We expected wards with extensive responsibilities for the primary nurse to have a larger proportion of the patients allocated to a named / primary nurse, and that administration of oral medication and allocation of work would be performed by primary nurses rather than team leaders, in contrast to wards with a prominent team leader role. Further, we expected that shift duty scheduling would prioritize continuity of individual RN-patient relationships in primary nurse-dominated wards.
The bootstrapping technique [17] was used to assess the generalizability of our findings. In the replications, the minimum number of wards per cluster was set to 20.

The software we used was SPSS version 15 (SPSS Inc., Chicago, Ill.) for all analyses except for the bootstrapping, for which the R software was used. The study was approved by the Regional Committee for Medical Research Ethics and The Ombudsman for privacy in research at Norwegian Social Science Data Service.

**Results**

**Descriptive statistics for the wards**
There were no differences in geographic region, type of care provided, or bed capacity between the sampled wards and the wards that did not consent to take part. The non-consenting wards belonged to somewhat larger hospitals (Table 1).

**Classification of hospital wards**
The two-cluster solution produced one cluster consisting of 70 wards and one with 23 wards, whereas the three-cluster solution yielded Cluster A with 32 wards, Cluster B with 23 wards, and Cluster C with 38 wards. The two-cluster solution was closely related to the three-cluster solution, as the largest cluster was split into two (Clusters A and C) in going from two to three clusters. In the four-cluster solution, cluster sizes varied from 7 to 34. The partitioning going from three to four clusters was induced by the scores on the Any RN in the ward scale.

**Interpretation of the clusters**
The interpretation is presented for the three-cluster solution. Cluster A wards had a high mean score on the Team leader scale and a low mean score on the Primary nurse scale (Figure 1). Accordingly, we called this cluster Team leader-dominated wards. Cluster B wards had a high mean score on the Primary nurse scale and a low mean score on the Team leader scale, and thus called Primary nurse-dominated wards. The wards of Cluster C had a mean score on the Team leader scale that was comparable to
Cluster A, and a mean score on the Primary nurse scale that was comparable to Cluster B. Initially then, Cluster C seemed to be Hybrid wards. In this interpretation, 32 of the wards had a team leader-dominated organization, 23 had a primary nurse-dominated organization, and 38 had characteristics from both of the other types.

Based on the discriminant function coefficients (Appendix 2), we interpreted the first two discriminant functions as Team orientation and Nurse orientation. The Team leader and Primary nurse scales had the highest coefficients. Any RN in team’s and Any RN in ward’s scales also contributed somewhat to the cluster discrimination.

In the discriminant function plot (Figure 2), the centroid of the 32 Team leader-dominated wards of Cluster A had the highest value on Function 1: Team orientation and the lowest value on Function 2: Nurse orientation. The centroid of Primary nurse-dominated wards of Cluster B had lowest value on Function 1: Team orientation and intermediate value on Function 2: Nurse orientation. The centroid of Cluster C had intermediate value on Function 1: Team orientation and highest on Function 2: Nurse orientation. There was a continuous transition between Cluster A and Cluster C.

Figure 3 presents the result from 400 replications. In the bootstrap samples, there is a pattern similar to those of Clusters A and B of the study sample, as observed in Figure 1. However, for the third cluster the scores for Any RN in the ward, Any RN in the patient’s team, Nurse in charge of shift and Ward nurse manager were on the average higher. This led us to interpret Cluster C as containing wards intermediate between Clusters A and B, as well as mixed wards where activities were more evenly allocated to the nurse roles. Further analysis showed that 94% of the bootstrap replications were consistent with this interpretation.
**Consistency with other variables**
The cross-tabulation showed that for 78% of the Team leader-dominated wards the self-identification was “Team or group nursing” and for 74% of Primary nurse-dominated wards “Primary nursing” or “Modified primary nursing” (Table 3). In Hybrid / mixed wards the self-identification varied. Only one ward used a label that explicitly reflected the hybrid nature of the organization model. Hence, the correspondence between observations and self-identification was moderate.

We then compared the clusters on supplemental data from the questionnaire, data that had not been used in the cluster analysis (Table 3). There was a significant difference between Primary nurse-dominated wards on one hand and Team leader-dominated and Hybrid / mixed wards on the other hand in administration of oral medication (p<0.001). Team leaders allocated daily work in almost all of the Team leader-dominated and the Hybrid / mixed wards, in contrast to the Primary nurse-dominated wards (p<0.001). **The differences were the same when Team leader dominated and Hybrid/ mixed wards were merged into one class, as in the two-cluster solution.**

**Discussion**
In a representative sample of Norwegian general hospital wards there was a moderate association between the empirical classification and the self-identification of the organization model. In many wards, the self-identification indicated a team or primary nursing organization, while the data suggested that they functioned in hybrid or mixed modes. By using cluster analysis for data reduction, we classified the internal ward organization based on a set of self-reported data, instead of relying on a somewhat ambiguous terminology. This is an example of using cluster analysis to categorize cases where no a priori categories exist, which is often the case in health care organizations.
In the present study, the cluster analysis in itself can be used to justify both the two-cluster and three-cluster solution. However, the degree of separation between the clusters, as indicated by the discriminant functions plot, supported a three cluster solution. Also, we regarded the more detailed description of a three-cluster solution as more coherent with theory and previous research, and as more useful in practical research. However, the three classes of nursing organization were not identical to the generic types presented in the introduction.

The three-cluster solution in the present study was consistent with the distribution of supplementary variables from the questionnaire, not used in constructing the clusters. However, these supplementary variables did not differ between the Team leader-dominated wards and the Hybrid /mixed wards. Our interpretation is that the additional variables only reflected limited aspects of the organization, while the variables used in the clustering procedure by design give a more comprehensive description of the organization at the level of patient-nurse interface.

Primary and team nursing organization are the main principles in ward organization, and local adjustments have probably resulted in intermediate solutions. During the last two decades, RNs have replaced practical nurses in many Norwegian hospitals. Therefore, teams now consist mainly of registered nurses, reducing some of the previous differences between team and primary nursing, as observed in the hybrid / mixed cluster.

The differences in Shift duty scheduling and Patient allocation were not statistically significant. However, Shift duty scheduling may not be a good variable for checking the consistency of the clusters. For example, the choices that are made in
shift scheduling may depend more on for example night staffing, than on what is best from a strictly organizational point of view.

The bootstrap analysis led to a revised interpretation of the solution and supported generalization to the population of wards.

In the study of Adams et al., a similar clustering procedure identified three organization models [1]. In one of the clusters, labeled by the authors as Devolved nursing, responsibilities were to a large degree assigned to individual nurses. Another cluster, the Two-tier-cluster, was characterized by team work and a prominent role for the nurse manager. The third cluster was labeled Centralized nursing, with less team work and more control in the hands of the ward nurse manager. This classification has traits similar to that of the present study; however we think that there is an important difference between the role of the ward nurse manager, which can be explained by differences in settings and cultures.

Some methodological issues should be raised. Cluster analysis is a method for describing characteristics of a given set of observations. The generalizability depends on the representativeness of the sample. We do not believe that the consideration of sampling variability would lead to substantially different conclusions. Further, we do not think that the necessary consent of the ward managers to be included in the sampling frame caused sampling bias.

The results of cluster analysis depend on the researcher’s choice and the scaling of input variables. Hence, it should be viewed as an exploratory technique suggesting cluster partitions that eventually must be validated by other means. We feel that the evidence for our results was strengthened by the use of theory and previous findings for variable construction and by avoiding further scaling of the variables in the present study. In retrospect, some of the questions could have been
modified to optimize the relevance for contemporary practice in Norway. For example; the ward nurse manager could have been left out from the response options, as this function is less prominent in clinical practice now than it was before. The lack of pilot testing is a limitation to the present study. However, we think this limitation is mitigated by the use of previous instruments developed for this field of investigation. The item that covered nursing assessment and planning, “write and revise the nursing plan”, could have been supplemented with an item covering “hands on” implementation of nursing interventions in the final set of items.

The various classifications should be used with caution in research, decision-making and management. Differences between health care systems and countries limit the generalizability of the classes identified in the present study. Also, because of the continuous organizational changes in hospitals at both local and national levels, the validity of any classification should be considered as time-limited. However, the procedure used for classification in the present study is generally applicable.

Descriptive studies that compare existing variation are often the only feasible option in studies of organization [18]. Using cluster analysis, we have reduced a large set of ward characteristics to a variable with three values. Cluster analysis is a useful tool to provide groups in study units where no systematic differences are apparent [19-24]. Our resulting classification can be used for comparisons of wards, for instance to study the association of patient- or personnel-related outcomes with different organization models.

Field observation studies and staff nurse surveys are potential alternatives to the approach that were used in the present study for collecting data on organization models. However, these methods would require more resources than the approach used in the present study.
Future studies can make use of the presented procedure. With further improvement and data from several health systems the procedure could be used across time and countries. To have an empirically-based and standardized classification system could ease comparisons between studies of intra-ward nursing organization.

Conclusions
In a representative sample of Norwegian general hospital wards, cluster analysis yielded three fairly distinct classes of wards, according to organization model: team leader-dominated wards; primary nurse-dominated wards, and hybrid/mixed wards. We think that the derived ward clusters provide a classification that can be useful in comparison of patient and quality of care outcomes between different organization models. It differed from the self-identification, but implies a verifiable approach to variable construction. However, one should be cautious about generalizing the findings to other countries, but the procedure may be developed and standardized for use across time and health care systems.

Competing interests
The authors declare that they have no competing interests.

Authors' contributions
ISS initiated the study, participated in the design, data collection, data analysis and the drafting and revisions of the manuscript. JH gave statistical advice and took part in the revisions of the manuscript. KS was involved in designing the study, drafting the paper and critically commented on the manuscript. All authors read and approved the final manuscript.
Acknowledgements
We thank the ward nurse managers for participation in the study and Saga Høgheim for assistance with data entry.

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Figures and legends
(the figures are also submitted as separate files in PNG-format)

LEGEND:

Figure 1. Cluster profile diagrams on variables used in the clustering procedure. Three-cluster solution.
LEGEND:

![Figure 2. Discriminant functions plot. Three-cluster solution.](image-url)
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Figure 3. Boxplot of 400 bootstrap replications. Three-cluster solution.
## Tables

### Table 1. Sample characteristics and comparison to non-consenting wards

<table>
<thead>
<tr>
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<th>Wards in the sample</th>
<th>Wards that did not consent to participate</th>
<th>p</th>
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<tr>
<td></td>
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<td>%</td>
<td>n</td>
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<td>15</td>
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<td>Western Norway</td>
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<td>Eastern Norway</td>
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<tr>
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<td>5</td>
<td>5</td>
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<tr>
<td>Mixed and Gynecology</td>
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<tr>
<td>Total</td>
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<td>100</td>
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<td>Hospital bed capacity</td>
<td>312</td>
<td>226</td>
<td>403</td>
<td>314</td>
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<td>Ward bed capacity</td>
<td>25.2</td>
<td>4.9</td>
<td>25.5</td>
<td>4.2</td>
<td>0.694 b</td>
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a: $\chi^2$ test, b: t-test
# Table 2. External criteria by assigned cluster membership

<table>
<thead>
<tr>
<th>Assigned cluster membership</th>
<th>A; Team leader dominated wards (n=32)</th>
<th>B; Primary nurse dominated wards (n=23)</th>
<th>C; Hybrid / Mixed wards (n=38)</th>
<th>p &lt;sup&gt;b&lt;/sup&gt;</th>
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</thead>
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<tr>
<td></td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
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<tr>
<td>Self-identification</td>
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<tr>
<td>Primary- or Modified primary nursing</td>
<td>7</td>
<td>22%</td>
<td>17</td>
<td>74%</td>
</tr>
<tr>
<td>Team- or Group nursing</td>
<td>25</td>
<td>78%</td>
<td>6</td>
<td>26%</td>
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<tr>
<td>Combined team- and primary nursing</td>
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<td>0%</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>No model stated</td>
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<td>0%</td>
<td>0</td>
<td>0%</td>
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<tr>
<td>Total</td>
<td>32</td>
<td>100%</td>
<td>23</td>
<td>100%</td>
</tr>
<tr>
<td>Administration of oral medication&lt;sup&gt;a&lt;/sup&gt;</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Team gives out to team’s patients</td>
<td>30</td>
<td>94%</td>
<td>6</td>
<td>26%</td>
</tr>
<tr>
<td>Primary nurse gives out to her/his patients</td>
<td>3</td>
<td>9%</td>
<td>17</td>
<td>74%</td>
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<tr>
<td>Work allocation&lt;sup&gt;a&lt;/sup&gt;</td>
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<tr>
<td>Team leader allocates work</td>
<td>30</td>
<td>94%</td>
<td>9</td>
<td>39%</td>
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<td>Each RN decides on care to her/his patients</td>
<td>6</td>
<td>19%</td>
<td>12</td>
<td>52%</td>
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<tr>
<td>Scheduling for each team</td>
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<td>28%</td>
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<td>30%</td>
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<tr>
<td>Scheduling to support patient-RN continuity</td>
<td>1</td>
<td>3%</td>
<td>3</td>
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<tr>
<td>Patient allocation</td>
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<td></td>
</tr>
<tr>
<td>All patients are allocated to a team</td>
<td>21</td>
<td>66%</td>
<td>12</td>
<td>52%</td>
</tr>
<tr>
<td>All patients are allocated to a primary nurse</td>
<td>1</td>
<td>3%</td>
<td>4</td>
<td>17%</td>
</tr>
</tbody>
</table>

<sup>a</sup>: The numbers of the two rows below do not add up to the N of the column header, as characteristics are confirmed by answering two separate questions, not mutually exclusive.

<sup>b</sup>: Pairwise comparisons, Fisher’s exact test
### Appendix 1

#### A. Variables used in the cluster analysis

Number of activities usually performed, represented by scores from 0 to 7, by each of the below RN roles in the ward:

- a Any RN dealing with the patient
- b Any RN in the patients' team
- c Team leader
- d Primary nurse
- e The RN in charge of shift
- f The ward nurse manager

Scores from 0 to 7 was coded for each RN role (a-f) by adding activities that it usually performed (Yes=1; No=0)
- write and revise the nursing plan
- report follow up in the nursing plan
- take part in the pre-round meeting with the physicians
- accompany physicians on round
- liaise with other professions at hospital
- contact patients' relatives
- plan patients' discharge

#### B. Variables used in consistency assessment

<table>
<thead>
<tr>
<th>Question</th>
<th>Response options and coding</th>
</tr>
</thead>
<tbody>
<tr>
<td>How do you label the model of nursing service organization at the ward?</td>
<td>No fixed response option</td>
</tr>
<tr>
<td>How is oral medication administered at the ward?</td>
<td>- Each team gives out to the teams' patients (Yes=1; No=0)</td>
</tr>
<tr>
<td></td>
<td>- Each primary nurse gives out to her/his patients (Yes=1; No=0)</td>
</tr>
<tr>
<td></td>
<td>(more than one response option may apply)</td>
</tr>
<tr>
<td>Who allocate direct nursing tasks at the start of a shift?</td>
<td>- Team leader allocates tasks (Yes=1; No=0)</td>
</tr>
<tr>
<td></td>
<td>- Each RN decides on care to her/his patients (Yes=1; No=0)</td>
</tr>
<tr>
<td></td>
<td>(more than one response option may apply)</td>
</tr>
<tr>
<td>How is the shift duty scheduled?</td>
<td>- It is done for each team (Yes=1; No=0)</td>
</tr>
<tr>
<td></td>
<td>- It is done to ease primary nurse practice (Yes=1; No=0)</td>
</tr>
<tr>
<td></td>
<td>(more than one response option may apply)</td>
</tr>
<tr>
<td>How many of the patients are allocated to a team?</td>
<td>none; 1 to 33%; 34 to 65%; 66 to 99%; and All (All=1; Else=0)</td>
</tr>
<tr>
<td>How many of the patients are allocated to a primary nurse?</td>
<td>none; 1 to 33%; 34 to 65%; 66 to 99%; and All (All=1; Else=0)</td>
</tr>
</tbody>
</table>
### Appendix 2

Table 3. Discriminant function coefficients. Three-cluster solution

<table>
<thead>
<tr>
<th>RN roles</th>
<th>1: Team orientation</th>
<th>2: Individual nurse orientation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any RN in ward</td>
<td>-.174</td>
<td>.350</td>
</tr>
<tr>
<td>Any RN in the patient’s team</td>
<td>.290</td>
<td>-.160</td>
</tr>
<tr>
<td>Team leader</td>
<td>.910</td>
<td>.414</td>
</tr>
<tr>
<td>Primary nurse</td>
<td>-.482</td>
<td>.919</td>
</tr>
<tr>
<td>RN in charge of shift</td>
<td>-.037</td>
<td>.168</td>
</tr>
<tr>
<td>Ward nurse manager</td>
<td>-.085</td>
<td>.104</td>
</tr>
</tbody>
</table>
Figure 1

Cluster mean number of activities attributed to RN roles

- Team leader dominated wards
- Primary nurse dominated wards
- Hybrid/mixed wards
Figure 2
Figure 3