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# Changes in patients' need of nursing care reflected in the Zebra system

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LEVENSTAM A.-K. & BERGBOM I. (2002) *Journal of Nursing Management* 10, 191–199

## Changes in patients' need of nursing care reflected in the Zebra system

During 1995–97, many head nurses stated that they had perceived an increase in patients' need of nursing care. A questionnaire was designed to determine the reasons for this. The purpose of the investigation was to answer two questions, 'What were the reasons for head nurses perception of an increase in patients need of nursing care from 1995 to May 1997?' and, 'Does patient classification in the Zebra system reflect the underlying changes in patients' need of nursing care? The results show that there are several reasons behind changes in the patients need of nursing care. The main reasons are a decreased general level of health among patients and that treatments are more time-consuming. After comparing statistics concerning patient classification with the answers received from the questionnaire, a good level of agreement could be seen in these.

*Keywords:* nursing, patient classification, workload, Zebra system

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## Introduction

During Spring 1997 many of the head nurses at the University hospital of Lund, Sweden, stated when discussing their workload that patients' need of nursing care had increased since 1995. No obvious reason or contributing factor for this change was mentioned. It was therefore of interest to investigate the reasons for this perceived increase in nursing care needs. The concept, 'nursing care' includes both direct nursing care activities and non-direct nursing care activities. Today, when resources are becoming more limited there is a need for systematic and reliable statistics concerning patients need of nursing-care levels. As well, how these needs change so that the resources available can be used in the most efficient way. This article should be regarded

as a first attempt to investigate the reasons behind the perceived increase of nursing care, and if that increase is reflected in the statistics of the Zebra system.

## Background

### The patient classification system

The Zebra system is a patient classification system previously described by Levenstam and Bergbom Engberg (1993, 1997). This classification method comes from the Hospital Systems Study Group's system, described by Jackson and McKague (1979). The activity study, which is the validation method, comes from the Public Health Service Patient Classification System, Lake (1982). The two parts have been shown to be

usable together, (Roehrl 1979). There are today two additional parts of the Zebra system, i.e. (a) the recording of the staffing situation, both actual and required and (b) recording deficiencies in the quality of nursing care when understaffed. The last part was used more frequently after 1998. The two latter parts of the Zebra system have been developed in Sweden by the first author. Patient classification, and the activity study in the Zebra system meets the quality requirements for patient classification systems as defined by De Groot (1989).

The patient classification measures direct nursing-care activities (in which both the patient and the nursing staff are present when the activity is performed) given to each patient per 24 hours. The patient classification has six components of direct nursing care. Each component has one to three determinators (A, B and C) reflecting the level of care given (the dependency level). As an example (Figure 1): 'Hygiene A' means that the patient does not need any help with his/her hygiene, 'Hygiene B' means that the patient needs some help with his/her hygiene and 'Hygiene C' means that the patient needs total help with his/her hygiene. For at least three of the components of care (hygiene, observation and mobilization), one of these determinators must be checked. Each combination of determinators is referred to one of the four categories of direct nursing care. Each category of care represents a range of direct nursing-care activities, as several different combinations of determinators belong in each category, except category 1 which has only one combination of determinators (hygiene: A, observation: A and mobilization: A). Patients in category 1 have a minimal need of direct nursing care. They can manage their daily activities but need information, attention, medication and treatment. Patients in category 2 need some help with their daily activities and also need information, medication and treatment. Patients in category 3 usually need extensive help with their daily activities and have an increased need of

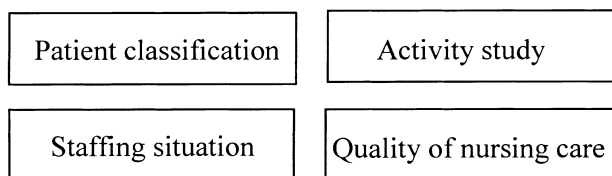
information, medication and treatment. Patients in category 4 have an intensive need of direct nursing-care intervention in most of the components of care. Each patient is classified each day and noted in one of the four categories of care (Figure 1). The determinators, as well as the care categories do not reflect the nursing time required.

Each day the staffing situation, both actual and estimated, together with the number of patients admitted and discharged are registered. At the end of the month, the average number of patients per category of care and per day is calculated per unit (the patient profile) and month, as well as the average staffing situation per day and shift, both actual and required. The occupancy rate and the turnover per bed are calculated per month. From these, graphs are drawn for the units in the department/clinic (Figures 2 and 3). The graphs are sent to the head nurses and the clinical manager each month. It is the same information given in Figure 2, but drawn up for each unit per month and shows both previous and current years.

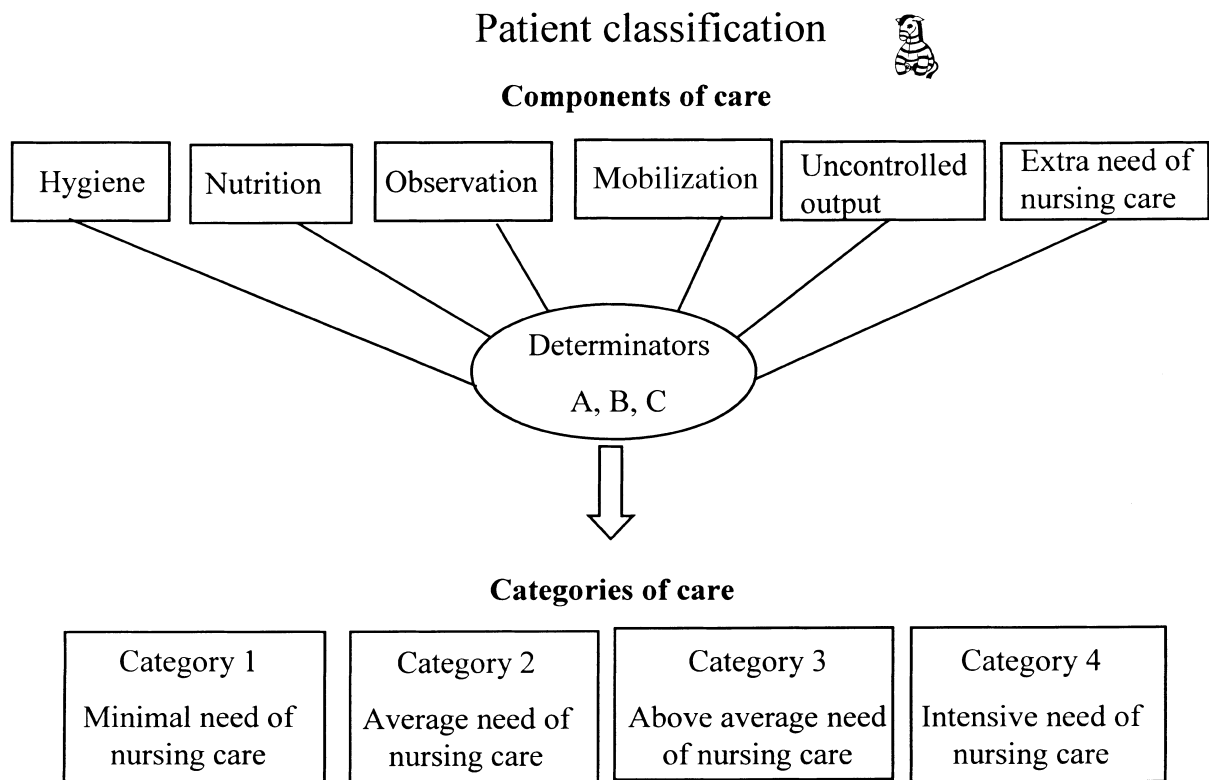
Changes in patient profiles can be the result of changes in the definitions of the determinators. In January 1993, a change in one of the components of care was made which affected the patient distribution in the four categories of care. It was presumed that the number of patients in category 1 would decrease by about 10%, and the number of patients in category 2 would increase by the same amount. This actually took place. Some other changes occurred before 1995 but they did not, in any major way, affect the patient profile. In 1995, another change occurred in the components of care, which could have had a slight effect on patient distribution in categories 2 and 3 in some of the units. Changes in the definitions of the determinator could not therefore be the reason for changes in the patient profile, which were seen during 1995 to May 1997. To find articles explaining the reasons for this perceived increase in patients' need of nursing care as related to patient classification systems, a literature search in MEDLINE and CINAHL was carried out. However, no articles on this subject were found.

To control the consistency of the interpretation of definitions of determinators in patient classification, reliability should be tested once a year, i.e. interrater reliability tests. During recent years, economic restrictions in the hospital budget have meant that tests were not able to be conducted every year. However, in Spring 1995 and in late Autumn 1998 tests were carried out. The test in Spring 1995 included 18 written cases which the staff had to classify individually. The same test was

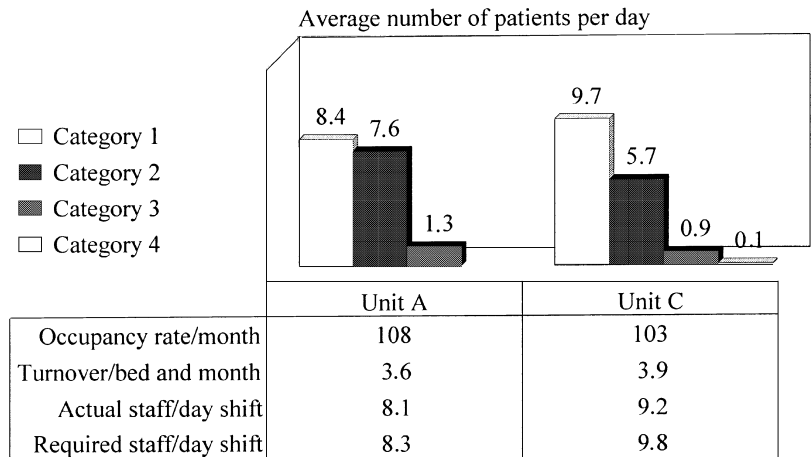
## The Zebra system



**Figure 1**  
The Zebra system.



**Figure 2**  
The patient classification part of the Zebra system.



**Figure 3**  
The patient and staff situation during 1 month in two units.

performed in Autumn 1998, with an additional two cases.

### Purpose

The main purpose of this study was to determine: 'What are the reasons for head nurses perceptions of an increase in patients need of nursing care from 1995 to May 1997?' The secondary purpose was: 'Does the patient classification of the Zebra system reflect the perceived reasons for changes in patients' need of nursing care?'

### Method

#### Data collection

Two data collection methods were used: (a) a questionnaire and (b) statistics from the Zebra patient classification system.

#### The questionnaire

To investigate the reasons for head nurses' perceptions of an increase in patients' needs of nursing care, a questionnaire was designed by the first author. No

validity and reliability tested instruments or questionnaires measuring or investigating the problem could be found. One of the senior nurses, having wide experience both in nursing care and use of the Zebra system, reviewed the questionnaire and confirmed that the questions reflected the area of interest and were relevant. The questionnaire consisted of 21 questions of which 17 were closed-ended but gave possibilities to make comments. Eight of these 17 questions were multiple choice, i.e. several alternatives could be checked. Nine of the 17 questions had several alternatives, but only one could be checked. Four questions were open-ended. The questions concerned four basic themes. They were:

- General information concerning the number of beds, the staffing and the work situation.
- Administration of patient classifications.
- Changes in patient distribution and the reasons for this.
- Perceived changes in the quality of care.

In this article answers specifically concerning themes 1 and 3 are presented.

The questionnaire was sent, in May 1997, to the head nurse of each unit ( $n = 26$ ) where the Zebra system was used. They were asked to consider the period from January 1995 to May 1997.

Twenty-six questionnaires were distributed and 22 (85%) were answered and returned. The four units who did not return the questionnaire were all internal medical units. One of the units, not answering the questionnaire, had started to use the Zebra system 1997. Table 1 indicates which departments answered the questionnaire and when they started to use the Zebra system.

#### *Statistics from the patient classification system*

Statistics from the same units regarding daily patient classification, were collected during the period January

1995 to July 1997. The information obtained was the level of category of care. Other parts of the Zebra system were not used, as they did not affect patient distribution in the four categories of care.

### Processing the collected data

The answer obtained from the closed-ended questions in the questionnaire were uniquely coded. They were then analysed, question by question. Comments from the questions with closed-ended answers together with answers from the open-ended questions were categorized into main groups. The daily patient classification from each of the units was summarized and the average number of patients per category of care and month was calculated as illustrated in Figure 4.

## Results

### From the questionnaire

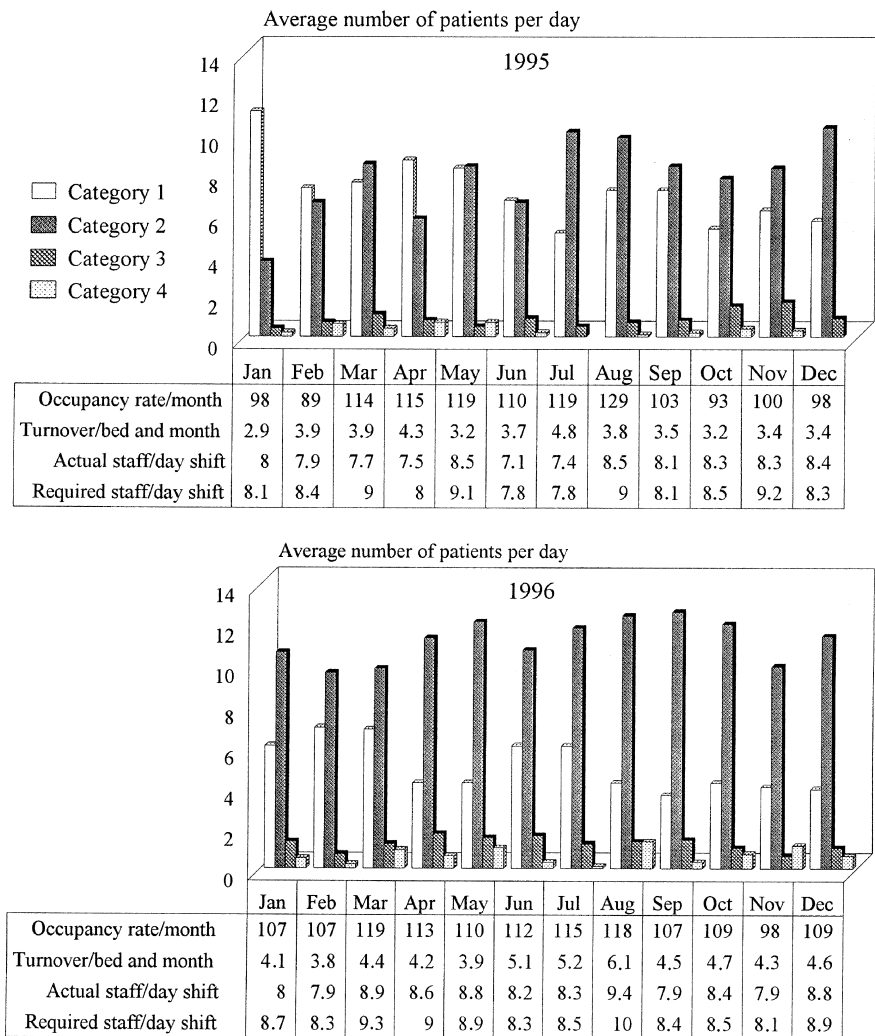
#### *Changes in the work situation and the patient profile*

References to 1997 in the text below covers the first 5 months of 1997. One of the questions was: 'Has the working situation changed during 1995-97?'. The alternatives were 'yes' or 'no'. Twenty-one units answered 'yes' and one unit did not answer. The respondents were also asked to comment on how the working situation had changed. These were grouped into some main groups such as: (a) patients more sick; (b) more intensive treatments, demanding increased staff presence; (c) higher patient turnover per bed, meaning more patients per period of time and (d) an increase in documentation requirements. The next question was: 'Has the number of patients per category of care (the patient profile) changed during 1995-97?'. This question was also a 'yes' or 'no' alternative. Seventeen of the 22 head nurses answered 'yes' and five answered 'no'. Those replying 'yes' were

**Table 1**

Units using the Zebra system and number of units responding to the questionnaire

Department	Year in which the units started to use the Zebra system	Number of units using the Zebra system during the period ( $n = 26$ )	Number of units that answered the questionnaire ( $n = 22$ )
Infectious diseases	1985	2	2
Gynaecology	1989	1	1
Medicine	eight units 1994; two units 1997	10	6
Neurology	1993	2	2
Neurosurgery	1988; one unit stopped in 1997	2	2
Oncology	1993	4	4
Psychogeriatric ward	1996	1	1
Rheumatology	1992	2	2
Cardiothoracic surgery	1996	2	2



**Figure 4**  
The patient and staff situation per month during 2 years in one unit.

asked to answer the next question: 'How has the patient profile changed?' This question was closed-ended with multiple choices. The respondent had to check in which of the categories of care there had been an increase or decrease of patients. Sixteen of the 17 units answered this question. From Table 2 it can be seen that in 14 of the 16 units, the number of patients in category 2 had increased. In 10 of the units the number of patients in category 1 had decreased. The conclusion is that of these 14 units, increase in workload is in direct nursing care activities.

Three of the five units which replied, that the patient profile had not changed, mentioned that re-organization of the unit was the reason for the increase in workload.

*Changes within components of care*

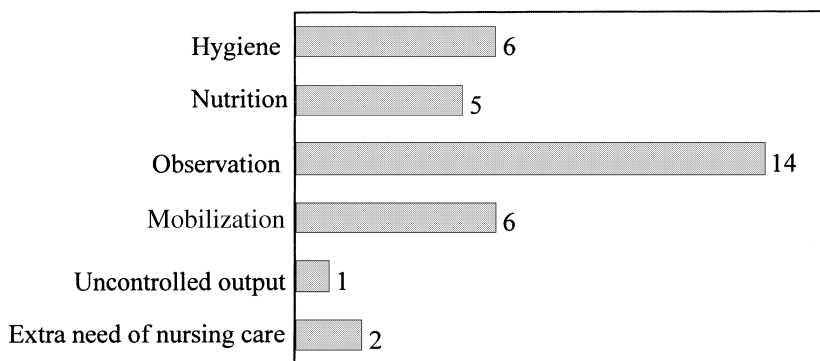
The question: 'Have changes occurred within one or more of the components of care?' was to be answered by all head nurses. This is because a change of determinant can take place without changing the patient's

category of care. A wide variety of combinations of determinators belong to the same category of care, with the exception of category 1, which has only one combination of determinators. Those who answered 'yes' ( $n = 15$ ) to this question were asked to check which of the components of care had changed.

Figure 5 shows the number of checks per component of care, i.e. Hygiene, Nutrition, Observation and so on. Fourteen of the 15 units checked Observation. Most of

**Table 2**  
Perceived changes in number of patients per category of care. The figures show number of units per alternative ( $n = 16$ )

Category of care	Type of changes	
	More patients in	Less patients in
Category 1	3	10
Category 2	14	1
Category 3	4	2
Category 4	2	2



**Figure 5**  
Number of checks per component of care.

the units checked more than one of component. Table 3 shows the different combinations of checks.

#### *Changes in the choice of determinators*

The next step was to determine those changes resulting from the choice of determinator per component of care. This means which of the components of care had contributed to a change from A to B, from B to C or vice versa, i.e. from no need to more extensive need of help. Two of the 15 units answering the question checked both, a change from 'A' to 'B' and from 'B' to 'C' for the same component of care. In Table 4 it can

**Table 3**  
Checked combinations of changes in the components of care ( $n = 15$ )

Checked combinations of changes in the components of care	Number of units
Hygiene, nutrition, observation, mobilization	1
Hygiene, nutrition, observation, mobilization, uncontrolled output	1
Hygiene, observation	2
Hygiene, observation, mobilization	1
Hygiene, observation, mobilization, extra need of nursing care	1
Nutrition, extra need of nursing care	1
Nutrition, observation	1
Nutrition, observation, mobilization	1
Observation	5
Observation, mobilization	1

**Table 4**

Number of changes in the choice of determinator per component of care. Fifteen units answered this question, which allowed multiple choices

Components of care	Number of checks per component of care and determinator			
	From A to B	From B to C	From B to A	From C to B
Hygiene	6	–	–	–
Nutrition	2	2	–	1
Observation	12	3	–	–
Mobilization	4	4	–	–
Uncontrolled output	–	1	–	–
Extra need of nursing care	–	1	–	1

be seen that the most frequent change in the choice of determinator is generally from A to B and mostly the component Observation was checked. Mobilization is the most frequently checked component of care for the shift from 'B' to 'C'. The shift of determinator from A to B explains the increase of patients in category 2 and the decrease of patients in category 1. Category 1 has only one combination of determinators and that is 'A' for Hygiene, 'A' for Observation and 'A' for Mobilization (Table 4).

In order to examine the reasons for these shifts in determinators, the following statements were made:

'Increase in patients age', 'Decreasing general level of health', 'Staff have more time to be with the patients', 'Treatment demanding more time with the patient' and/or 'Other reasons – make your own comments'. Questions could be answered by multiple choice. The two most common answers (Table 5) were 'Decreasing general level of health' and 'Treatment demanding more time with the patient'. 'Others' included statements such as 'Patients are being now discharged earlier from the ICU' and 'The staff on the unit have to transfer patients to other departments for treatment'.

#### *Changes in the number of beds*

Could a change in the number of beds in the units affect the patient profile? The answers to the question: 'Has the number of beds in your unit changed during 1995–97?'

**Table 5**Reasons for changes in the choice of determinators. Number of checks per statement ( $n = 15$ )

	<i>The patients are older</i>	<i>Decreased general level of health</i>	<i>Staff have more time to be with the patients</i>	<i>Treatment demanding more time with the patient</i>	<i>Others</i>
Number of checks per statement	4	8	1	8	6

were co-ordinated with the answers to the question about changes in patient profiles. One of the 22 units did not respond to this question. The result in Table 6, shows that a decrease in the number of beds is not a reason for a change in the patient profile, as there are just as many units without a change in the number of beds showing a change in the patient profile.

#### *Changes in ratings*

Could the changes in patient profiles be the result of changes in staff ratings of the patients? In respect to that question, five units answered 'yes', 13 units answered 'no' and four units did not answer. Those who answered 'yes' were asked, in the next question, to choose one or more statements which reflected reasons for changes in the ratings of the patients. The head nurses could also make their own comments. When analysing responses from units answering 'yes', the conclusion is that classification has become more accurate because nurses and practical nurses are responsible for classification. Direct nursing-care activities performed during both day- and night shifts are also reflected and recorded in a better way. The increased quality shown in the ratings probably depends on the choice of the determinator for Observation. The determinator 'A' has become 'B'. All five units that answered 'yes', had previously replied that the patient profile had changed. Therefore, in these units the increased quality in the ratings could, to some extent, have affected the patient profile, but this is not certain as several different combinations of determinators belong to each category of care, with the exception of category 1.

When analysing the results obtained from the individual interrater reliability tests conducted in 1995 and 1998, it can be seen that a small decrease in the percentage of correctly classified patients has occurred from 1995 to 1998. In 1995, the average of correctly classified patients was 90% and in 1998, this had dropped to 86%.

### **Comparing the answers obtained from the questionnaire and the Zebra statistics**

#### *Units with no perceived changes in patient profiles*

Responding to the question about changes in the patient profile, five units answered 'no'. When analysing the

statistics from the patient classification in Zebra system for these five units it can be seen that in four of these five units, there was an increase of patients in category 1 during the period under investigation. In the fifth unit a decrease was seen. In three of these five units, there was a decrease of patients in category 2. In the fourth unit there was no change, and in the 5th unit an increase of patients in category 2.

#### *Units with perceived changes in the patient profile*

Four units answering 'yes' to the question about changes in patient profiles, had not stated, in the following question, the changes which had taken place in category 1.

#### *Changes in category 1*

When comparing the statistics, and the answers from the 13 units, indicating changes in the number of patients in category 1, it can be seen that there is agreement in eight of the 13 units (Table 7). In the six units in which the statistics showed a decrease of patients in category 1, all of the units had also answered that in the question. In category 1, agreement of 62% is shown between statistics and answers received.

#### *Changes in category 2*

Comparing the statistics and the answers from the questionnaire from the 15 units indicating changes in the number of patients in category 2, it can be seen that agreement exists in 11 of the 15 units (Table 7). The agreement between the statistics and the answer given is thus 73%.

**Table 6**

Collation of answers from the questions about changes in number of beds and changes in the patient profile

	<i>Changed patient profile</i>	
	<i>Yes</i>	<i>No</i>
Units with decreased number of beds ( $n = 9$ )	8	1
Units with unchanged number of beds ( $n = 9$ )	8	1
Units with increased number of beds ( $n = 3$ )	1	2

**Table 7**

Comparison of statistics from the patient classification with the responses to the question about changes in the number of patients per category of care

Results from the statistics Number of units	Changes in the number of patients in category 1 and 2. Number of units			
	Category 1 (n = 13)		Category 2 (n = 15)	
	Increased	Decreased	Increased	Decreased
Increased	2	4	10	0
Decreased	0	6	2	1
No change	1	0	2	0

## Discussion

The statistics from the four units not answering the questionnaire show the same changes in the number of patients in category 1 and 2 as the statistics from the other units. It is unlikely therefore that the answers from these four units would have been very different from those units which did answer the questionnaire.

As no other instruments for investigating these questions were available, a questionnaire had to be designed. The questionnaire used has not been tested for validity or reliability. However, the questions used were judged by an experienced head nurse to be relevant, easy to understand and respond to.

The purpose was to investigate: 'The reasons for the head nurses' perception of the increase in patients' need of nursing care from 1995 to May 1997?' and 'Does the patient classification in the Zebra system reflect the changes in patients' need of nursing care?' The conclusion, which can be seen from the answers to the questionnaire, is that there is more than one reason for the decrease of patients in category 1, and the increase of patients in category 2.

Reasons mentioned in the free comments encouraged in the question concerning the work situation, were 'increased turnover per bed', which demands shorter time (days) per stay and 'increased level of illness among patients'. The latter reason could be a result of the first as patients could be discharged too early. Another factor could be the increase in treatment available to patients. In Table 5 it can be seen that one of the most frequently checked reasons for changes in the choice of determinant is 'Decreased general level of health', which can be interpreted as 'increased level of illness among patients'. These patients probably need some help with their daily life, giving a shift in the determinators from 'A' to 'B' in one or more of the components of care concerning daily-life activities. This results in a shift from category 1 to category 2. The other most checked reason (Table 5) was 'Treatment demanding more time with the patient'. Treatments are activities

under 'Observation', which was the component of care that received the most checks as to which component of care changes had most importance (Table 3). The most common shift of the determinant was from 'A' to 'B'. This could be another reason for the increased number of patients in category 2. It is probably a combination of the above two reasons which is responsible for the increase of patients in category 2 and the decrease in category 1. The reason, 'patients are older' was only checked four times (Table 5), which is surprising, as it is an argument used regularly when talking about the increased workload. Ageing however, is not an illness. Many old people stay healthy up to the end of their lives. Nurses may consider that the elderly need more help and attention and that other problems such as confusion and dysfunction are seen more frequently among these patients than among younger patients.

The increased quality in the ratings could, to some extent, have affected the patient profile, but this is not certain, as several different combinations of determinators belong to each category of care, with the exception of category 1.

When comparing the statistics with the answers to the question regarding changes in the patient profile and how these had occurred it can be seen that there are some discrepancies. In the five units answering that there had been no change in patient profiles, the statistics showed only small changes, which could be the reason that these units did not perceive any change. In the other 17 units there is agreement between the perception of change and the statistics from patient classifications. In category 1 it can be seen that in 62% of the units there is agreement between the answers to the questionnaire and the patient classification statistics. For category 2 this figure is 73%. Why there is a higher level of agreement between the answers to the questionnaire and the statistics for category 2 is difficult to determine. One reason could be that it is easier to perceive an increase in workload, which an increase in category 2 reflects. The statistics from the patient classification system do not show in detail the reasons for

any changes in the patient's category of nursing care. However, when we examine the shift in the choice of determinators, some conclusions may be drawn, i.e. a shift from 'A' to 'B' in Hygiene or Mobilization is probably because of a decrease in the general state of health. Likewise, a shift in the same direction in Observation probably depends on treatment requiring more time with the patient.

## Conclusion

One conclusion which may be drawn is that the perceived increase in workload is likely to be dependent on several factors such as, increased patient acuity and new treatments demanding increased patient care time. An expansion of outpatient clinics, home care services and reductions in hospital budgets are other possible reasons for the shift in the patient profile. Another conclusion is that the patient classification as applied in the Zebra system is sensitive to changes in patients' needs of direct nursing care. A reliable patient classification system is an important method in documenting and

describing changes in demands on nursing-care requirements in order that available resources may be distributed in an efficient and equitable way and the quality of nursing is maintained.

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