

A gap between need and reality: neonatal nursing staff requirements on a German intensive care unit

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Abstract

Recently, new staffing rules for neonatal nurses in intensive care units (ICU) were issued in Germany, using categories of care of the British Association of Perinatal Medicine as blueprint. Neonates on intensive care require a nurse-to-patient ratio of 1:1, on intensive surveillance (high dependency care) of 1:2. No requirements exist for special care, transitional care, and pediatric ICU patients. Using these rules, nursing staff requirement was calculated over a period of 31 consecutive days once a day in a combined pediatric and neonatal ICU of a metropolitan academic medical center in south-west Germany. Each day, 18.9±0.98 patients (mean±standard deviation) were assessed (14.26±1.21 neonatal, 4.65±0.98 pediatric). Among neonates, 9.94±2.56 received intensive therapy, 3.77±1.85 intensive surveillance, and 0.65±0.71 special care. Average nursing staff requirement was 12.10±1.81 full time equivalents (FTE) per shift. Considering additional pediatric patients in the ICU and actual nursing staff availability (8.97±0.87 FTE per shift), this ICU seems understaffed.

Introduction

Beginning from 2014, a neonatal intensive care unit (NICU) in Germany for the first time has to cope with staffing rules for nurses which have been imposed by the German Federal Joint Commission (Gemeinsamer Bundesausschuss, G-BA) as part of new regulations of quality management in neonatology (for more information please refer to Supplementary Material, part 1).¹ These staffing rules define that preterm infants

requiring neonatal intensive therapy - having complex and eventually life-threatening health problems - need a one-to-one nurse-to-patient ratio (one nurse per shift shall care for one patient). Preterm infants needing neonatal intensive surveillance require a one-to-two nurse-to-patient ratio (one nurse per shift may care for two such patients). Every perinatal centre (PNC) must provide qualified pediatric nursing staff in a sufficient number to address the nursing requirements of all term and preterm infants actually admitted to its NICU. In addition, 40 per cent of the nurses in PNC level 1 NICUs and 30 per cent of those in PNC level 2 NICUs must be qualified by special training in neonatal intensive care or must have at least 5 years' experience in this field.

Neither *neonatal intensive therapy*, nor *neonatal intensive surveillance* has been further defined by the G-BA. The expert panel (executive working group) of the G-BA refers to guidelines of the German Society of Neonatology and Pediatric Intensive Care and indicates the categories of care used in the United Kingdom as blueprint for these categories.^{2,3} The assessment system of the British Association of Perinatal Medicine (BAPM) comprises 4 categories of neonates with different nursing requirements.⁴ Patients in need of neonatal intensive care may thus be allocated to BAPM category 1 (intensive care) and patients under neonatal intensive surveillance to category 2 (high dependency care). No specific staffing for two additional patient categories defined by BAPM, *special care* and *transitional care*, is requested by the G-BA, and the rules are restricted to preterm neonates.

Immediately after publication of the new staffing rules for NICUs by the G-BA, neonatologists and hospital administrators in Germany blamed that the regulations were inappropriate - both not necessary and not practical - for German NICUs.⁵ To our knowledge, actual information on nurse staffing in German NICUs is not available in the literature. We therefore calculated the neonatal nursing staff requirement for all NICU patients following the new staffing rules of the G-BA and compared it to the actual availability of nurses in a typical academic medical center in a metropolitan area in south-west Germany.

Materials and Methods

The University of Heidelberg Hospital in Mannheim hosts a PNC which offers the highest level of neonatal care together with additional specialized services such as surgical repair of congenital malformations and pediatric extracorporeal membrane oxygenation (ECMO). In its combined neonatal and pediatric ICU, the BAPM assessment system published in 2010⁴

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Contributions: CP performed the assessment of patients, documentation, data analysis, and wrote the first draft of the manuscript; TB participated in study design, data interpretation, and writing of the manuscript; TS initiated and designed the study, supervised assessment of patients together with MS, JR, SH and SD, and was involved in data interpretation, and writing of the manuscript.

Conflict of interests: TB is regularly performing expert testimony for statutory health insurance funds in Germany and was part of the expert panel of the G-BA on quality management in neonatology in Germany. All other authors declare no potential conflict of interests.

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and translated into German (kindly provided by R. Rossi, Berlin, personal communication) was used over a period of 31 days (from March 14th, 2013 to April 13th, 2013) to allocate term and preterm neonates to one of four categories of care (Table 1).

All neonatal and pediatric ICU patients were assessed every day by an external auditor [CP] once during the morning shift. Simultaneously, all nurses present during the shift were counted. For each shift, the *neonatal nursing staff requirement* was calculated in *full-time equivalents* (FTE) using the nurse-to-patient ratios defined by the G-BA: one neonatal nurse FTE was required for each NICU patient in category 1, one for every two NICU patients in category 2, and none for NICU patients in categories 3 and 4; patients admitted to the pediatric ICU were not included in the calculation. The following formula was used:

$$\text{Neonatal nursing staff requirement} = a * X1 + b * X2 + c * X3 + d * X4$$

The variables a, b, c, and d correspond to the nurse-to-patient ratios defined for each category as follows: a (category 1)=1, b (category 2)=½, and c (category 3) as well as d (category 4)=0 each. X1 to X4 correspond to the number of patients allocated to each of the categories 1 to 4.

The *nursing staff availability* on the ward was calculated for each shift as the sum of all nurses present during the shift and was also expressed as FTE. After the end of the assessment period, mean neonatal nursing staff requirement and nursing staff availability per shift and their variation from day to day were calculated using MS Excel 2003.

Results

During the observation period of 31 consecutive days, on average 18.9±0.98 patients (mean±SD) were treated in the ICU. The neonates (14.26±1.21) were allocated to BAPM categories of care as follows: 9.94±2.56 received intensive therapy (category 1), 3.77±1.85 were under intensive surveillance (category 2, high dependency care), and 0.65±0.71 received special care (category 3); no patient receiving transitional care (category 4) was admitted to the ICU. Average neonatal nursing staff requirement was 12.10±1.81

FTE per shift. In addition, each day 4.65±0.98 pediatric patients were treated in the ICU.

Due to the day-to-day variability of the number of neonatal patients in the ward and their allocation to different categories of care (Figure 1), neonatal nursing staff requirement varied between a minimum of 9 and a maximum of 15 FTE per shift (Figure 2). Especially in periods with high volumes of neonatal patients requiring intensive therapy (e.g., 14 patients in category 1 between day 27 and 29) the calculated neonatal nursing staff requirement (15 FTE per shift) exceeded the actual nursing staff availability, which was on average 8.97±0.87 FTE per shift (Figure 2). The

Table 1. Categories of care. Adapted from British Association of Perinatal Medicine (BAPM).³

Category of care	Description by BAPM
Intensive care	NICU patients who are the most unwell or unstable and have the greatest needs in relation to staff skills and staff to patient ratios need intensive care.
High dependency care	NICU patients who require highly skilled staff but where the ratio of nurse to patient is less than intensive care need high dependency care.
Special care	Special care is provided for NICU patients who require additional care delivered by the neonatal service but do not require either intensive or high dependency care.
Transitional care	NICU patients usually do not receive transitional care because <i>per definitionem</i> the mother must be resident with her baby and providing care, usually with support from a midwife/healthcare professional who needs no specialist neonatal training.

NICU, neonatal intensive care unit.

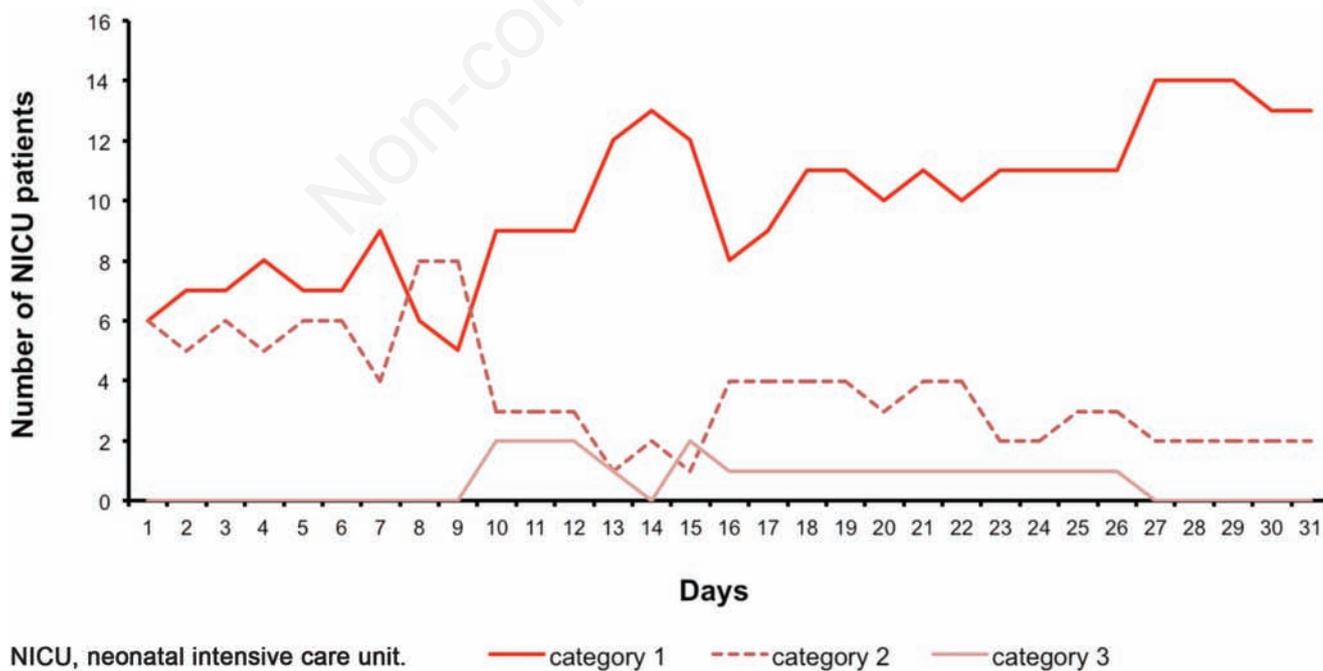


Figure 1. Total number of neonatal patients in British Association of Perinatal Medicine (BAPM) category of care 1 to 3 per day. There were no patients in category 4 during the time of data acquisition.

number of pediatric ICU patients varied from a minimum of 3 to a maximum of 7 leading to a relatively low day-to-day variability in combined NICU and ICU patient volume between 17 and 21 patients per day (Figure 2).

Discussion and Conclusions

To our knowledge, this is the first study on the potential consequences of the application of neonatal nursing staffing rules in a pediatric ICU in Germany. The introduction of standardized nursing staffing ratios is a topic of high research interest internationally.⁶ It seems to be specifically important for neonatal intensive care units in order to guarantee the availability of professional nursing skills 24 hours a day.⁷ NICU staffing rules have been developed in the UK and the US,^{3,4,8-10} but in the German health care system they have never been adopted before.

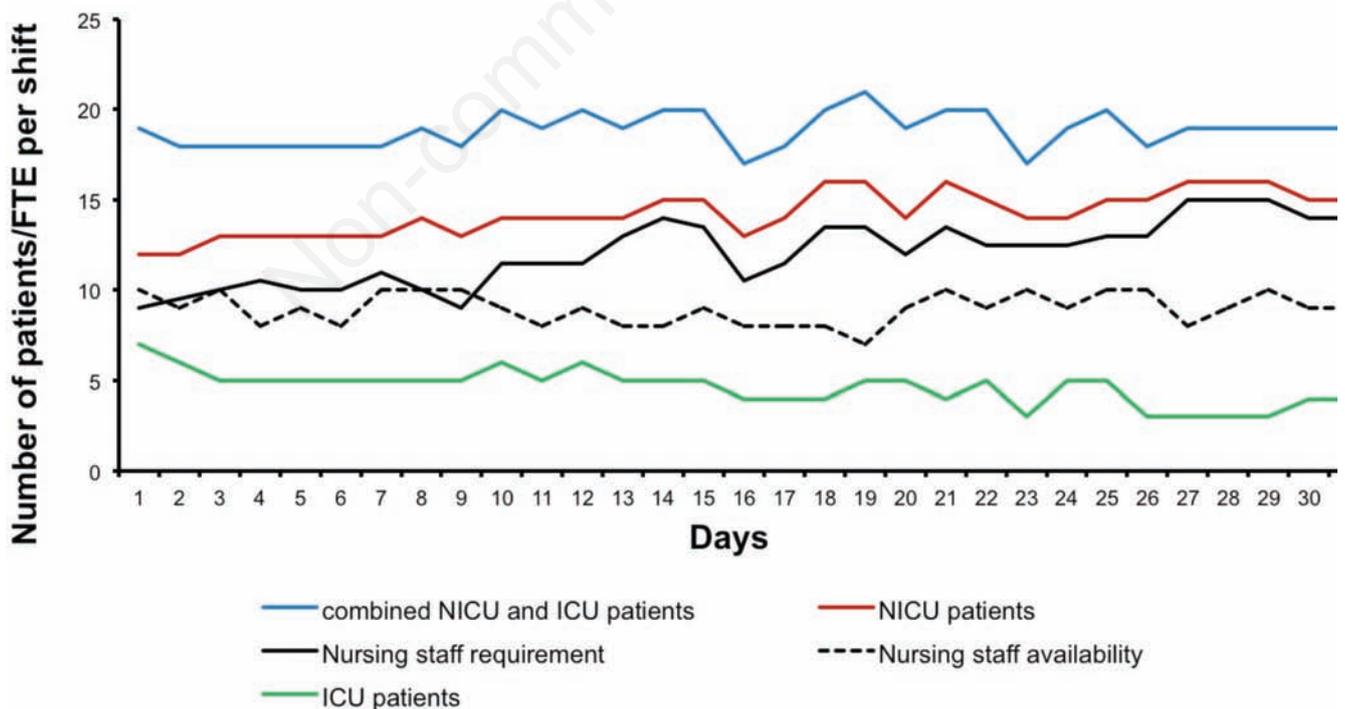
Studies in the UK and in Australia have shown that risk-adjusted survival of extremely low birth weight infants is inversely related to the number of qualified neonatal nurses per shift.^{7,11} NICU understaffing increases the risk of nosocomial infection,¹² and it may increase morbidity associated with inappropriate control of oxygen supply such as retinopathy of

prematurity and bronchopulmonary dysplasia.¹³ In an understaffed NICU, nurses required for developmental care especially of extremely preterm infants may not be available or may not have enough time to involve parents in the care of their children, thus compromising a positive developmental outcome in these vulnerable infants.¹⁴

Our observations clearly show that a combined neonatal and pediatric ICU in a German university hospital may appear severely understaffed when the neonatal nursing staff requirement is calculated using BAPM categories of care and the new pre-defined nurse-to-patient ratios of the G-BA. In our study we assessed neonatal categories of care based on the criteria published in 2010.⁴ In the year 2011, the indicators used to assess the category of an individual patient changed slightly.³ BAPM's Neonatal Data Analysis Unit has calculated that patient distribution over the different categories should not be significantly influenced by these changes.¹⁵ This connotation was confirmed by comparative analysis of single patients assessed using both the 2010 and 2011 indicator lists (see Supplementary Material, part 2). The G-BA refers to the indicator list updated in 2011,³ but we believe that our study would not have yielded different results if we had used this updated version instead of the 2010 version.

The decision of the G-BA to refer to the BAPM categories of care is not universally accepted in Germany. On the other side, no data are available from German hospitals which could be used to define national staffing rules which take into account the specific training and level of experience in neonatology, which is required by nurses in a German NICU. Thus, it is not known whether the ICU in our study is really understaffed. However, unpredictable changes in patient volume and nursing requirements lead to day-to-day variations in neonatal nursing staff requirement between 100 and 170% of the routine staffing volume of a NICU. Thus, there is a clear requirement for more flexibility in staffing in order to avoid understaffing in critical situations. In order to comply with the new staffing rules, each NICU must develop a management concept which should not simply rely on a fixed number of nurses present on the ward. A NICU manager must be able to either recruit qualified nurses from other wards or nurses on-call in case of need, or it must be possible to transport patients with less intensive nursing requirements to other wards in the hospital. It might even be necessary to manage the NICU with its own staff independently from the pediatric ICU.

Most PNC in Germany have lower patient volumes and offer less specialized and less



FTE, full time equivalent; ICU, intensive care unit; NICU, neonatal ICU.

Figure 2. Comparison of the calculated daily mean nursing staff requirement per shift based on the number of neonatal patients in British Association of Perinatal Medicine (BAPM) category of care 1 and 2 and the actual nursing staff availability per shift.

interdisciplinary treatment than the one studied here. These PNC may try to comply with the minimum requirements for nurse staffing in their NICU on a formal level. Calculations of neonatal nursing requirements are based on 2 categories of preterm infants with the highest nursing intensity – term infants and all other patients which are admitted to the ward are systematically ignored. As shown for the combined ICU of a German pediatric university hospital in our study, either staff numbers or patient volume must change if the staffing required by the G-BA - to address the nursing requirements of all term and preterm infants actually admitted to the NICU - shall be respected. If the hospital were not able to comply at least on a formal level with the rules, every unfavorable outcome in a patient on the ward would imply the risk for medico-legal consequences and lawsuits.

The National Ministry of Health obliged the G-BA to clarify relevant issues related to practical implementation of its neonatal nursing staffing rules in German hospitals until 2016.¹⁶ In the meantime, more observational studies in German hospitals are needed to answer the following questions: i) Can the results of studies performed in the US, Australia, and the UK be used to draw significant conclusions for staffing requirements in a neonatal and pediatric ICU in Germany? ii) Are our observations from a university hospital offering high level neonatal care together with specialized services such as neonatal and pediatric surgery and neonatal and pediatric ECMO valid also for smaller NICUs in Germany? iii) How reliable and valid are the instruments used to assess neonatal nursing requirements? iv) Does intensified developmental care for extremely preterm infants and the increased involvement of parents in the care of their children necessarily lead to higher nursing staff needs?

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