

# Evaluation of the Availability of Nursing Quality Indicators in German FHIR Implementations

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**Abstract.** Standardized nursing data sets facilitate data analysis and help to improve nursing research and quality management in Germany. Recently, governmental standardization approaches have favored the FHIR standard and helped to define it as the state of the art for healthcare interoperability and data exchange. In this study, we identify common data elements used for nursing quality research purposes by analyzing nursing quality data sets and databases. We then compare the results with current FHIR implementations in Germany to find most relevant data fields and overlaps. Our results show that most of the patient focused information has already been modelled in national standardization efforts and FHIR implementations. However, representation of data fields describing nursing staff related information, such as experience, workload or satisfaction, is missing or lacking.

**Keywords.** FHIR, interoperability, nursing informatics, nursing quality indicators

## 1. Introduction

As in many industrialized countries, Germany has been struggling with the nursing shortage, not least since the corona crisis. The topic of nursing research can help to fight this phenomenon, reduce nursing workload and hereby improve the overall patient care. Well-structured and harmonized data sets in high quality and high quantity are required in order to achieve the comprehensive and in-depth analyses. The FHIR standard is the established state of the art for new data exchange projects in the German healthcare system in recent years. With the help of FHIR, standardized healthcare related information can be exchanged between different systems, regardless of the different data storage formats. The legal basis for this has been created (see Digital Care and Nursing Modernization Act) and the first official implementations have been published [1, 2]. This fact promises a potentially high amount of structured and harmonized data sets to be available in the near future.

In this study, we identify data elements, so called nursing quality indicators, relevant to nursing research and match them with current FHIR implementations within the German health care system.

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## 2. Methods

### 2.1. Analysis of nursing quality data sets

The identification of relevant nursing data elements has been performed in three different steps. **(1)** A literature review has been conducted to identify relevant sources to track nursing care quality. We included both already implemented databases as well as developed datasets related to nursing care quality. **(2)** All data elements of the identified sources have been analyzed in order to identify and group similar data elements across the different sources. **(3)** All grouped data elements were then summed up and sorted according to their frequency.

### 2.2. Comparison with current FHIR implementations

The following steps were performed to compare common nursing quality indicators with current FHIR implementations in Germany. **(1)** We examined nursing related FHIR projects in Germany. We therefore mainly used the FHIR registry SIMPLIFIER.NET. **(2)** We compared all data elements, that occurred at least in three out of the 11 identified sources, to the FHIR implementations.

## 3. Results

### 3.1. Analysis of nursing quality data sets

As result of our literature search, we identified 11 datasets as sources from the USA [3-8], Canada [9, 10], Austria [11], Germany [12] and Switzerland [13]. After grouping similar data elements, a total of 45 different nursing indicators resulted. Table 1 shows a sorted list of the 14 nursing indicators that occurred at least three times.

The full table with all data elements can be found on: <https://github.com/frankkramer-lab/Nursing-Quality-Indicators-in-German-FHIR-Implementations/>.

**Table 1.** Frequency of nursing indicators in common nursing quality databases and initiatives

Indicator	# out of 11 (total)	# out of 8 (North America)	# out of 3 (Europe)
Pressure Ulcer	11	8	3
Falls	10	8	2
Use of restraints	8	5	3
Nursing hours (per patient day)	6	6	0
Pain	5	2	3
Staff/skill mix	5	5	0
Nurse turnover rates	5	5	0
Loss of weight	4	1	3
Instrumental activities of daily living	4	2	2
Staff experience, skills, expertise	4	4	0
Patient satisfaction with care	3	2	1
Staff satisfaction and well-being	3	3	0
Urinary catheter associated infections	3	3	0

### 3.2. Comparison with current FHIR implementations

We performed a comparison of the care indicators shown in table 1 with German FHIR implementations. For Germany, generally applicable medical information objects are defined by the National Association of Statutory Health Insurance Physicians (KBV) and implemented in FHIR. Furthermore, the National Agency for Digital Medicine (gematik GmbH) is developing profiles for the exchange of information between hospital and nursing information systems.

For the evaluation, we therefore included all current projects of the two organizations. This concerns the medical information objects, in particular the care transition report PIO Überleitungsbogen (KBV) (<https://simplifier.net/organization/kassenrztlichebundesvereinigungkbv>) as well as the ISIK and ISIP (expected to be finalized by 2025) projects by the Gematik (<https://simplifier.net/organization/gematik>). All projects are published on the publicly accessible FHIR-registry SIMPLIFIER.NET (<https://simplifier.net/>).

**Table 2.** Comparison of the 14 identified nursing indicators to German FHIR-implementations

Indicator	Standard	Profile
Pressure Ulcer	MIO/ISIK	KBV_PR_MIO_ULB_Condition_Medical_Problem_Diagnosis/ISiKDiagnose
Falls	MIO	KBV_PR_MIO_ULB_Observation_Falls_Last_6_Months
Use of restraints	MIO	KBV_PR_MIO_ULB_Observation_Deprivation_Liberty_Measures
Nursing hours (per patient day)	-	-
Pain	MIO	KBV_PR_MIO_ULB_Obervation_Pain
Staff/skill mix	KBV	KBV_VS_Base_Practitioner_Speciality
Nurse turnover rates	-	-
Loss of weight	MIO/ISIK	KBV_PR_MIO_ULB_Observation_Body_Weight/ISiKKoerpergewicht
Instrumental activities of daily living	MIO	KBV_PR_MIO_ULB_Composition.section:funktionsbeurteilungen
Staff experience, skills, expertise	-	-
Patient satisfaction with care	-	-
Staff satisfaction and well-being	-	-
Urinary catheter associated infections	MIO/ISIK	KBV_PR_MIO_ULB_Condition_Medical_Problem_Diagnosis/ISiKDiagnose

Table 2 shows the comparison of the 14 identified indicators with the implementations of the KBV and gematik GmbH. All indicators that are directly connected to patient outcome and can be modelled with medical diagnosis (pressure ulcer, infections) or care related observations (falls, restraints, weight, functions) could be found. Except for the actual occupation, staff specific information, as working hours, turnover rates or experience, and data covering satisfaction of staff and patients is not yet implemented.

## 4. Discussion

All indicators connected to patient related outcomes, are already implemented. Therefore, the standard MIO by the KBV, which also inherits a definition for care transition records (ULB), covers all of the identified patient related indicators. Staff related information, such as experience or working hours, and satisfaction rates are not covered, since it does not fit the purpose of the implementation. Furthermore, other projects related to these topics, could not be identified.

## 5. Conclusions

Our results demonstrate that many of the data elements that are relevant for nursing research and quality purposes have been already implemented within the latest FHIR implementations for the German healthcare system and can be potentially used in the near future. However, the identified implementations focus on the topic of direct patient supply. Elements that focus on the structure quality (e.g. staff experience or contract related information) have not been implemented yet.

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