

A logical model for needs-based care nurse staffing in Switzerland

Discussion paper

Abstract

Adequate nursing staffing improves patient safety, employee satisfaction, and economic efficiency. Based on literature reviews and practical experiences, APSI developed a differentiated approach to determining needs-based nursing staffing levels to ensure long-term satisfaction for nursing staff and care recipients alike. Moreover, the approach warrants cost efficiency and high quality.

The presented logic model focuses on the most influential factors from the perspectives of the patient, the staff, and the structural framework conditions that define adequate nursing staffing. It also defines desired outcomes and suggests valuable indicators to measure effectiveness.

The aim is to develop jointly with relevant partners and stakeholders a realistic, pragmatic and practical solution (method, tool) to determine need-based nursing staffing that is approved by a wide circle of stakeholders in the healthcare sector.

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1. Introduction

Nurse staffing* significantly impacts the delivery of high-quality patient care¹ and influences care outcomes and employee satisfaction. Higher nurse staffing is associated with improved patient safety^{2,3}, higher job satisfaction⁴ and may have a positive financial impact on the health system⁵. While many Nordic and Anglo-Saxon countries introduced mandatory nurse-to-patient ratio (NPR) for their health care system, Switzerland has not adopted this approach, except only for acute care settings such as intensive care units⁶.

While NPR is a valuable and well-established approach to securing quality and safety in patient care^{5,7,8}, this volume-based approach does not represent a holistic approach to nurse staffing calculation overall⁹. According to the literature reviews (see below), a comprehensive strategy for need-based nurse staff planning must also include patient*¹⁰, nursing staff^{6,11}, and structure-related factors to cover human-centred care*. Such an approach aims to achieve long-term satisfaction for both nursing staff and patients while ensuring cost efficiency and high-quality care.

Therefore, this discussion paper presents a unique approach: a need-based nurse staffing decision-making and calculation model specifically designed for the Swiss healthcare system. We aim to pinpoint the key factors contributing to adequate, high-quality, safe, cost-effective, and human-centred care. By delineating these factors, we aim to establish the foundation of a logical model that determines nursing staffing needs based on patient requirements and contextual factors.

2. Methods

We used a participative approach supported by literature reviews to achieve this goal (figure 1).

Based on the outcome of the first VFP/APSI internal literature research¹², factors to be considered to calculate nurse staffing in different settings were submitted to 10 scientific societies of the Swiss Association for Nursing Sciences (VFP/APSI). These societies represent approximately 300 members, experts in their field of practice, and leaders at a national level. The results were summarised in an unpublished draft paper¹³.

The following steps included two different types of literature reviews: a rapid review of the nurse staffing ratio for long-term elderly and nursing home care facilities¹⁴, presenting recommendations on personal staff allocation in different countries and highlighting the development of digital staff planning tools. The other review was mainly a search for grey literature such as reports, recommendations, governmental policies, and guidelines of other European countries conducted by the authors of this discussion paper.

In consequence, two members of VFP/APSI gathered and analysed all this information to provide an overview of the critical elements to consider (Input) when calculating the nurse staffing dotation. Regarding the complexity of the Swiss healthcare system and the nursing curricula in Switzerland, a logical model was developed to reflect a deeper understanding of the critical elements, the process influencing factors, the outcomes, and the activities to support decision-making. To be congruent with the aim of this work, a proposition of possible impacts and leading indicators were added to the logic model (output).

The final step will be confronting this yet rather theoretical logic model with stakeholders, leaders and managers of the nursing field in Switzerland to revise, further develop and validate it in the framework of the project 'be Personal©', a joint task force of ASI, Swiss Nurse Leaders, and APSI. The aim is to develop a pragmatic and practical model for need-based nurse staffing in agreement with all relevant stakeholders within the Swiss health system.

. Figure 1 presents a synthesis of the whole process.

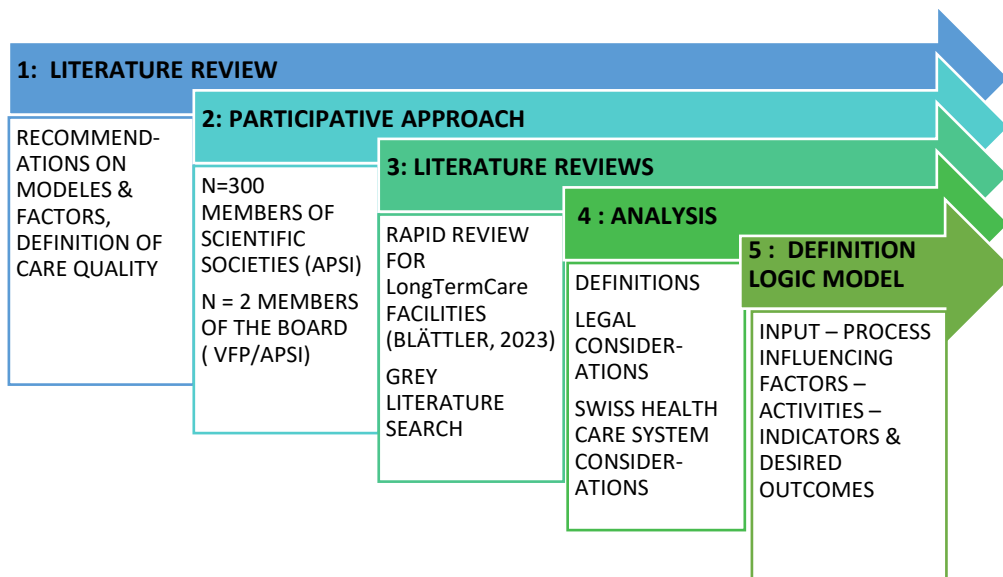


Figure 1: Synthesis of the development process

3. Analysis

Staffing calculation models and influencing factors

The analysis of the literature reviews and contributions from scientific societies confirmed the existence of numerous calculation methods and approaches (incl. digital tools) to determine the nursing workforce¹⁵. However, no existing tool or specific approach can be recommended^{6,8}, implying the need to obtain a model adapted to the Swiss health system considering influencing factors, indicators and desired outcomes. The model must include parameters related to the patient (such as acuity, care setting, functional status, etc.), to the staff (grade mix, experiences, workload, moral stress, etc.) and contextual factors (e.g. setting, required quality level, tariffication structure, infrastructure etc.), (Table 2&3) – hence a combination of different approaches as proposed by Griffiths et al. (2020) for instance (see figure 2). Furthermore, the model has to be built on the fundamental principles of effectiveness, safety, continuous improvement, and human-centeredness. Not least, the model enables adapting to changing requirements and needs¹⁶. The questions remain if variables need to be defined for discipline versus settings.

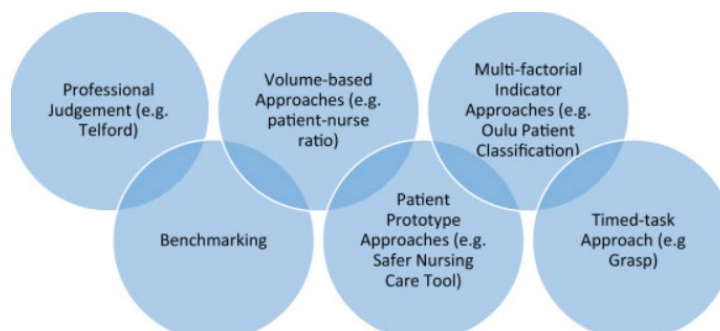


Figure 2 Major approaches for determining nurse staffing requirements. Retrieved from P. Griffiths, C. Saville and J. Ball et al. / International Journal of Nursing Studies 103 (2020) 103487

The literature reviews revealed a strong need for research into new staffing methodologies to assess the appropriate relationship between nurse staffing and outcomes and define appropriate nurse staffing levels for balanced workloads and high-quality or safe care, respectively.

Quality of care

Nevertheless, a central interrogation remains: what is the definition of 'high-quality care' in the Swiss context regarding Article 117b of the Swiss Federal Constitution, which calls for sufficient, high-quality care accessible to all? The 'Swiss' definition must reflect the clinical perspective and consider the nurse's and patient/person's views as one and should be based on the given definitions of the Swiss Quality Commission, which defines or measures quality in Swiss health within the following dimensions: *safe, effective, efficient, patient-centred, in time, equal access and integrated*¹⁷.

In the clinical context, high-quality nursing care is associated with attributes like effectiveness, efficiency, equity, patient safety, staff competency, patient-centred care, and patient involvement in decision-making¹⁸. On the employment level, clinical competency, collaborative relationships, autonomy, supportive management, appropriate staffing, and control of nursing practice are essential¹⁹. Patients evaluate the quality of care based on factors like physical environment²⁰, respect and empowerment²¹, the relationship with the care provider, nursing service²² and patient-centred outcomes (see Figure 3)²³. While patient-centred care is considered essential for good care service, holistic, individualised, and relatives-related care in nursing practice is associated with a very high quality of care.

Table 1 in the Appendix summarises the pillars of care quality and the level of care quality depending on how strongly these are fulfilled. The degree of fulfilment per pillar and clinical setting remains to define 'high-quality care' in the Swiss context.

4. Logic Model

The literature review's results and the input of experts allowed the development of a logical model for nurse staffing calculation, including all nursing levels, to ensure the expected outcome. It is a logic approach and functions as a structured thinking model.

Input as main parameters

The model shown in Figure 3 is a theoretical approach to calculating the required number of nurses based on three core factors (input): nursing staff, patient/person and contextual factors. Each factor has various influencing factors that depend on the clinical setting or discipline.

Influencing factors

The nurse/staffing parameter includes factors such as competencies and requested grade mix of staff, the volume of the continuum of care, work environment/conditions and work culture (incl. leadership & interprofessional collaboration, person-centeredness) and governmental specifications. The patient's/person's aspect covers influencing factors such as acuity and care dependency, the complexity of needed care, clinical setting, clinical indicators, and relatives-related work. Contextual factors are multi-level and encompass aspects such as infrastructure (e.g. spacial factors, ward sizes, distances, etc.), available resources (e.g. finances, technologies, tariffication structures/classification of care expenses, waiting lists etc.), and required regulatory and quality standards. For nurse/staffing and patient/person aspects, we find more evidence-based indicators and validated methods than contextual factors.

The suggested influencing factors for each aspect must be setting-specifically judged, ranked, and evaluated by specialised experts and managers. Tables 2 and 4 (appendix) provide a first non-exhaustive list of possible influencing factors (literature-based and experience-based) for each aspect. The evidence for those factors is summarised in a separate list and is available for further work shortly.

Activities

The activities column operationalises the concepts of influencing factors by proposing elements to be determined according to needs, context, and expected results. For example, it will be appropriate to calculate the number of people with a BSc, MSc or other degrees to achieve the mixed degree required to achieve the desired quality of care. However, these activities are interrelated and must be selected by decision-makers based on their relevance. It is the combination of the results of the various activities that will ensure that the needs and expectations of all stakeholders are met as closely as possible and that indicators reach the objectives (see also tables in the appendix).

Indicators and desired outcomes

Quality indicators may play a crucial role in calculating need-based allocation. However, they are also essential in monitoring the desired outcomes, constantly adapting the model, and re-evaluating the set nurse staffing.

While some indicators like Patient-Reported Outcome Measures (PROMS) and Patient-Reported Experience Measures (PREMS), nurse staff satisfaction, nurse staff turnover, financial sustainability and attractivity can be defined independently of the disciplines or settings, others, such as clinical parameters, require specific definitions and rankings are tailored to the setting. To simplify the model, the final desired outputs still need to be defined and discussed while further developing the model.

Figure 3 (see below) visualises the three main inputs (parameters) and their influencing factors and drafts possible indicators of the desired outcomes congruent with Art. 117b- However, they must be confirmed and extended if necessary. Furthermore, the required activities are defined. The appendix lists specific examples of influencing factors, indicators, and outcomes and possible ways of assessing them in Tables 2, 3, and 4.

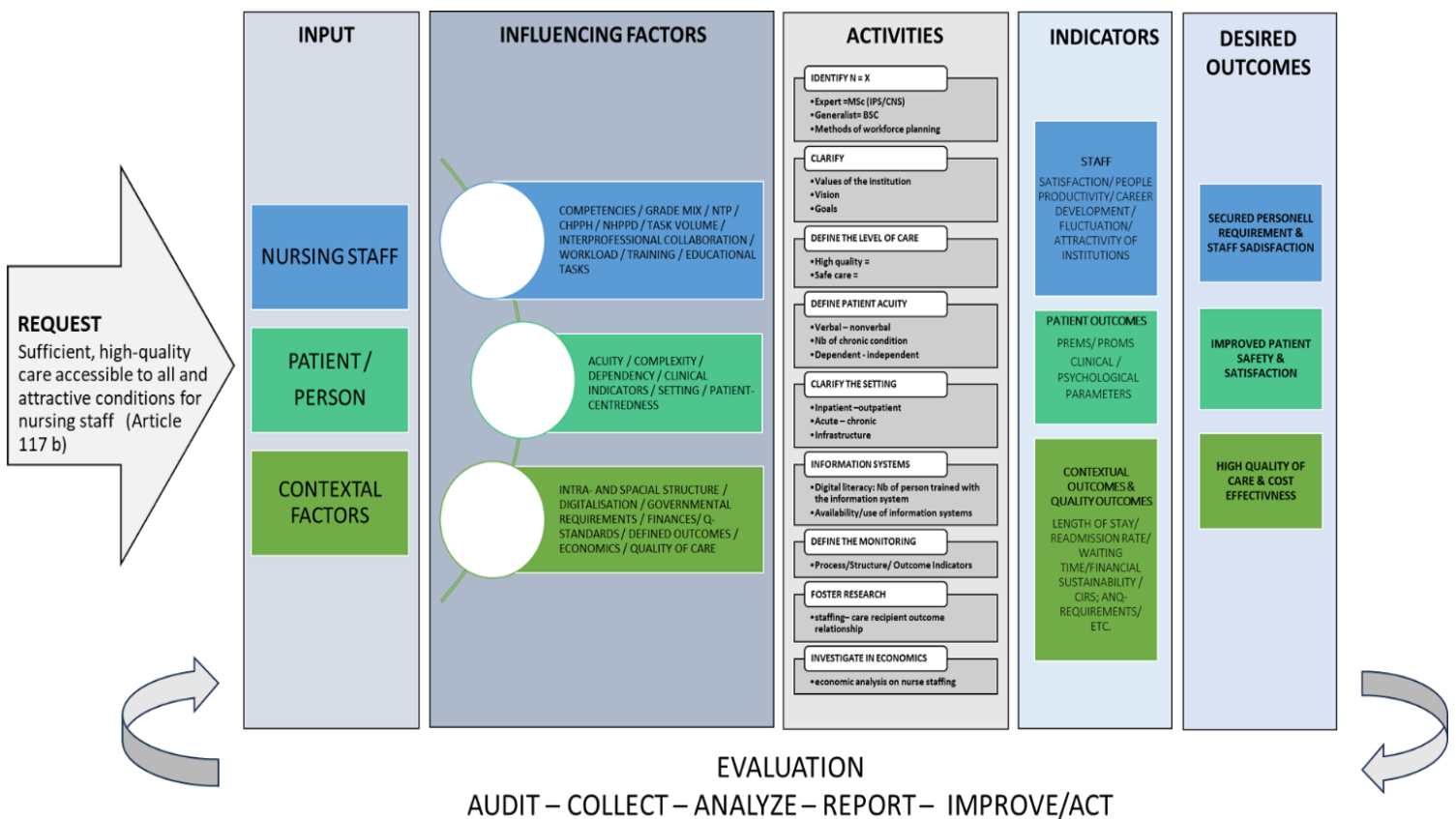


Figure 3: Logic Model for Nurse Staffing Calculation elements of the Nurse staffing calculation Method

5. Conclusion

A key aspect of a functioning healthcare system is developing and implementing an advanced system for calculating and planning an adequate nursing workforce^{24,25,26}. With the proposed model and pre-definition of influencing factors, suggested outcomes and proposed activities, a basis for developing a specific calculation model with a to-be-elaborated algorithm is available. It further provides a good fundamental structure to determine the most influencing factors to be considered to achieve long-term secured personnel requirements with a satisfied staff and guarantee cost-effectiveness and high quality for patients/person, clients and families simultaneously.

However, this model must be discussed, adapted, fine-tuned, and validated in the real world. Furthermore, outcome measurements must be defined, mutually agreed on, and regularly monitored. Therefore, continuous improvement and adjustment of the model are inevitable depending on the monitoring outcomes. Finally, national guidelines on personal allocation, model-based tools, and modern technologies are needed.

6. Acknowledgement

This discussion paper is a joint work of VFP/APSI. We especially thank Nanja Schlup, Livia Martinelli, Christian Saladino, and Annina Fröhlich from the Health Policy Commission for laying the basics of this work, including the tables in the appendix, and Silvia Brunner for the first literature review. We also acknowledge the academic societies' valuable contributions and are grateful for their critical reviews and input throughout the project.

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*Remarks

We use some terms with a broader meaning throughout the text for easy reading. We use them as follows:

- Patient/person includes clients, patients, their relatives, and families simultaneously.
- Human-centered care: the nurse, the patient, and relatives are included and looked at simultaneously.
- Staffing refers only to nurse staffing and does not include any other professionals such as medical doctors or other health professionals. However, including other health professions may significantly impact specific settings, such as rehabilitation, and might need to be considered.

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Appendix

Table 1: Pillars of Care Quality

<p>Safety</p> <p>(Hughes, 2008; World Health Organisation, 2023a)</p>	<ul style="list-style-type: none"> ▪ Avoidance of errors (medication, treatment, diagnosis) / adverse events ▪ Infection prevention and control (hand hygiene, protective equipment, aseptic techniques) ▪ Patient identification (prevent mix-ups) ▪ Risk management (identification, assessment, prevention & mitigation, monitoring, reporting, training/education, compliance with standards/guidelines/laws, communication, quality improvement, financing) ▪ Emergency preparedness (training and equipment for emergencies, advance planning) ▪ Monitoring and early detection ▪ Safe working environment (physical environment of care recipients and care staff, e.g. fall prevention) ▪ Training and further education of nursing staff (safety protocols and best practice / EBN) ▪ Communication (open, effective communication) ▪ Documentation (of all care activities, cross-process) ▪ Dealing with complaints (clearly defined management and addressing them quickly) ▪ Compliance with human rights and professional standards, ethical guidelines, and laws (including data protection) in the healthcare sector
<p>Effectiveness</p> <p>(Buljac-Samardzic et al., 2020; World Health Organisation, 2023a)</p>	<ul style="list-style-type: none"> ▪ Evidence-based practice ▪ Individualised care process, targeted care interventions ▪ Outcome orientation measured by symptom burden, healing rate/recovery, complications, quality of life, satisfaction of care recipients and their relatives and carers ▪ Needs-orientation (recognising and responding to individual needs (including physical, psychological, social, spiritual aspects), consideration of transitions in the course of life (children, young people, adults, older people)) ▪ Timely (unnecessary delays, risk of complications, availability of nursing staff) ▪ Appropriate use of resources (creating added value and avoiding waste; appropriate use of medical and technological resources) ▪ Interprofessional and interdisciplinary collaboration ▪ Continuous improvement (review, adapt, ensure quality improvement, training and further education of care staff)
<p>Patient-centred approach Person-centred approach Human-centredness</p> <p>(America, 2001; Epstein & Street, 2011; McCormack & McCance, 2016; Mead & Bower, 2000)</p>	<ul style="list-style-type: none"> ▪ Respect for the preferences and needs of care recipients, relatives, and carers. ▪ Holistic view: physical, psychological, social, spiritual (incl. interprofessional and interdisciplinary cooperation) ▪ Participation and integration of care recipients and their relatives (shared decision-making) ▪ Individualised care (consideration of cultural differences, consideration of life circumstances) ▪ Promotion of autonomy & support of Self-management Health/illness ▪ Communication and exchange of information (language appropriate to the addressee; clear, comprehensible, and transparent communication) ▪ Emotional and psychological support (empathy, ensuring psychological safety, shaping the care relationship with care recipients and relatives) ▪ Inclusion of family and social networks ▪ Continuity and coordination of care (consistent care across shifts and settings, transition management/discharge planning)

Table 2: Exemplary Influencing factors, described tools and possible indicators to be adjusted or complemented for each setting/discipline.

* references see p.13/14 literature is non-exhaustive

Input	Influencing factors	Established Tools/ Methods used (non-exhaustive, tbc)	Possible Indicators (tbc), non-exhaustive
Nurseing staff			
	Competencies & Professional experience*	no evidence-based tool is available	Staff /Patient satisfaction*, Quality of care
	Grade Mix*	based on the specific care needs of the care recipient and the required skills	Mortality, Patient /staff satisfaction, Quality of care*
	Staffing ratio*	Nurse to patient ratio/ Patient Hours Per Patient Day/ Client hours per patient day; evidence-based calculation systems, triangulation approach (NHS)	Staff satisfaction, quality of care
	Provided care	BESA, interRAI LTCF, RAI-NH- HC, NEMS	People Productivity
	Staff absence	Commercial Staffing tools, Oulu Patient Classification (OPC)	Overtime/ Sick leave should be reduced
	Core tasks and responsibilities /treatment order	Activity analyses	
	Additional responsibilities (incl. social work)	Controlling system for activity analysis with integrated performance recording (e.g. CURAtimes, TACs, LEP etc)	
	Interdisciplinary cooperation*	Assessment of Interprofessional Team Collaboration Scale,	clarified role and competencies, career development, job satisfaction
	Education and training, supervision	internal definitions, national regulations	number of trained people; Nr/h of training/supervision/ teaching provided
	Patient-centeredness*	PREMS etc	PREMS / HCAHPS etc,
	Staff satisfaction *	Staff surveys, employee appraisals	Employee satisfaction, Moral stress, career development, fluctuation
	Quality of care*	definition of safe/good/excellent care	Readmission rate/complications / PREMS/PROMS
Patient/ Person in need of care			
	Acuity*	Patient classification systems/ Safe nursing care tool/Professional judgement (Oulu Patient Classification (OPC)	Mortality, Nosocomial Infects, adequate nursing staffing, readmissions
	Dependency/functional capability*	Professional judgement, ADL / IADL score, Barthel Index, ePAKIDS	PROMS, InterQalLogs
	Complexity*	CHOP codes, COMID	Mortality acquired infections
	Care intensity	Service billing systems (BESA, interRAI LTCF, RAI-NH- HC, NEMS)	
	Diagnostics / Clinical factors	ICD, ICF, ICNP (Diagnostic classifications)	Nursing-sensitive indicators such as MQI, Dehydration, Hospital-acquired infections, falls, pressure, ulcer rates, aggression events, attempted suicide, and number of restricting freedom/movement measurements etc

Input	Influencing factors	Established Tools/ Methods used (non-exhaustive, tbc)	Possible Indicators (tbc), non-exhaustive
	clinical setting /discipline	to be defined for stationary/ ambulatory, long-term, short-term indication	clinical factors according to setting /discipline
	Patient centeredness*	PREMS (NORPEQ, PSCC-G, EORTC IN-PATSAT32) no gold standard	PREMs/clinical factors (Structural validity PREMS such as PEACS and HCAHPS).
Contextual Factors			
Resources	Finances*	DRG, TARPSY, Budgets, economic analysis on nursing staffing, evidence-based PI approach, Systematic reviews. Routine data analysis	Financial reports, economic nurse staffing, economic patient care,
	Technologies	Surveillance systems (Telemedizin /Spital), electronic patient tools	
	Digitalisation	EPD; Mobile apps/ Digital planning/ documentation/ Robotics / Data analysis/ AI	Documentation accuracy, nr trained person, availability of information systems
Infrastructure	Intra and Spacial structures	individually to be defined: E2SFCA method (enhanced two-step floating catchment area method), spacial network analysis	
	Logistic infrastructure incl. transport	individually to be defined (relocations, etc)	
Quality	Standards (inter-national, internal) *	NOSO, Professional associations, Hygiene standards	H + Leistungsvereinbarung, Implementation framework for internal guidelines and standards; Nursing sensitive Indicators, implementation indicators
	Defined Outcomes	individually to be defined	PROMS, s. also Diagnostics/clinical factors/CIRS/ work burden to relatives
	Patient satisfaction*	PREMS	PREMS/ Pat box /CIRRNET
	Quality of care*	Audits, QM Systems, structure, process, outcome measurements, risk adjustments; Monitoring and Reporting	KIPS (ANQ requirements), outcome measurements
Regulations	Governmental Requirements on the national or cantonal level	Analysis, Audits, Reports	Defined outcomes
Research	Research	Outcome research	Publications / Implementation indicators

There are more established or evidence-based tools and indicators available for Nursing staff and patients/people in need of care. Contextual factors need to be established on a national or institutional level. Moreover, further setting/discipline-specific factors may be included.

Table 3: Non-exhaustive list of influencing factors to be considered when determining nurse staffing

	Aspects	Examples
Governmental (Cantonal) requirements	<ul style="list-style-type: none"> ▪ Minimum staffing ratio ▪ Number of diplomas per patient 	<ul style="list-style-type: none"> - Intensive care - Long-term care - Spitex - Psychiatry Germany
Setting/ward characteristics	<ul style="list-style-type: none"> ▪ Treatment order of the ward/unit ▪ Overtime ▪ Waiting lists ▪ Entries and exits, transfers ▪ Skill and degree mix ▪ Professional experience ▪ Further education and training, supervision ▪ Additional tasks ▪ Additional expenses ▪ Interdisciplinary cooperation (division of labour?) ▪ Structural requirements/infrastructure as a factor in the working environment ▪ Technologies 	<ul style="list-style-type: none"> - Vocational training, ward management, professional development - Case discussions, audits, QM, development - Special therapies, social work - Travelling times, single/multi-bed rooms - Modern monitoring equipment
Classification of the (care) Expenses	<ul style="list-style-type: none"> ▪ Tarif structures ▪ Diagnostic classification systems ▪ Assessment of functional capability ▪ Illustration of care intensity (care requirement level) ▪ Time specifications for activities/differentiation of activities 	<ul style="list-style-type: none"> - TARPSY, DRG - ICD, ICF, ICNP - ADL / IADL score, Barthel Index, ePAKIDS - BESA, interRAI LTCF, RAI-NH- HC, NEMS - LEP, TACS
Clinical indicators	<ul style="list-style-type: none"> ▪ Infection, fall and pressure ulcer rates ▪ Aggression events ▪ Suicides; attempted suicides (if surveyed) ▪ Number of measures restricting freedom/movement ▪ Dehydration ▪ Burden on relatives ▪ Complexity ▪ Benchmark ▪ MQI (polymerisation, malnutrition, pain, BEM) 	<ul style="list-style-type: none"> - ANQ data - HCD data - Complexity detection, CHOP codes, COMID
Subjective assessments	<ul style="list-style-type: none"> ▪ Workload / Workload ▪ Quality of care ▪ Complexity 	

	Aspects	Examples
	<ul style="list-style-type: none"> ▪ Satisfaction of care recipients ▪ Satisfaction of relatives ▪ Employee satisfaction ▪ Moral stress among employees 	
Quality indicators	<ul style="list-style-type: none"> ▪ Hygiene standards ▪ CIRS ▪ Medication management ▪ Documentation accuracy ▪ Implementation framework for internal guidelines/standards ▪ PREMS ▪ PROMS 	

Table 4 Matrix for the temporal consideration of data sources

	Long term	Short term
Prospective	<ul style="list-style-type: none"> ▪ Operation classification of the effort involved in treatments (e.g. CHOP code in combination with care service classification system) ▪ Independence assessment (e.g. ADL score) ▪ Service accounting systems (e.g. BESA) ▪ Care needs assessment (e.g. ePAKIDS, NEMS, PPP-RL model or new platform model?) ▪ Number of people on the waiting list ▪ Cantonal requirements for staffing ratios ▪ Tariff systems (e.g. TARPSY, platform model) 	<ul style="list-style-type: none"> ▪ Planned admissions. ▪ Planned relocations
Retrospective	<ul style="list-style-type: none"> ▪ Activity analyses (e.g. CURAtime, TACS) ▪ Care service classification (e.g. LEP) ▪ Subjective analyses ▪ Diagnostic classifications (e.g. ICD 10, ICF, ICNP) 	<ul style="list-style-type: none"> ▪ Number of overtime hours ▪ Short-term admissions ▪ Short-term relocations

Table 5 Description of the data source and its influence on personnel calculation

Data source	Description of the	Influence on personnel calculation
Operation classification of the effort of treatments (e.g. CHOP code)	Classification of operations and surgical procedures.	Determines the need for surgical, operating theatre nursing, and aftercare staff.
Care service classification (e.g. LEP)	System for classifying care services and interventions.	Helps to assess patients' care needs and allocate appropriate staff resources.
Tarif systems (e.g. TARPSY)	Tariff system for psychiatric services and therapy requirements. Staff calculation system: PsychPV, which is replaced by the PPP-RL and subsequent platform model to calculate minimum staffing requirements	Supports personnel planning in psychiatry by analysing therapy requirements.
Diagnostic classifications (e.g. ICD, ICF, ICNP, NANDA-I, NIC, NOC)	Classifications for identifying health conditions, function, disability and health, including care diagnoses.	Assists with staff allocation based on disease burden and treatment requirements, including rehabilitation & care needs.
Independence assessment (e.g. ADL score)	Assessment of a person's ability to perform basic daily activities.	Determines a patient's individual care needs and helps with staff allocation.
Service billing systems (e.g. BESA, interRAI LTCF/ RAI-NH- HC)	Instruments for assessing the condition and needs of care recipients.	Supports personnel and resource planning in long-term care facilities.
Care needs assessment (e.g. . ePAKIDS , NEMS, PsychPV)	System for assessing the need for care and the intensity of care in different contexts. BESA and RAI are basic assessments for evaluation	Enables an assessment of care intensity and helps allocate nursing staff.
Activity analyses (e.g. CURAtime, TACS)	Controlling system for activity analysis with integrated performance recording	Supports personnel planning for various areas.
Cantonal requirements for staffing ratios	Guidelines at a cantonal level for personnel planning.	Takes regional or local regulations and standards into account when calculating personnel.
Number of overtime hours	Staff overtime statistics.	Helps to assess the workload and can contribute to better staff distribution.
Number of entries and re-entries	Statistics on patient admissions and readmissions.	Influences staff planning by analysing patient volume and continuity of care.
Relocations	Number of patient transfers between departments or facilities.	This may indicate staffing and resource requirements for transport and transitional care.
Number of people on the waiting list	Number of patients on waiting/admission lists for specific services or treatments.	Helps to predict future personnel and resource requirements.
Subjective analyses	Qualitative evaluations and assessments by staff or patients. Quantitative approaches are also possible here (e.g. via NASA-TLX or Moral Distress Thermometer, or PROMs for patients)	It can be used to supplement quantitative data to provide a more comprehensive picture of staffing needs.

References List to Appendix Table 2: **Exemplary Influencing factors, described tools and possible indicators to be adjusted or complemented for each setting/discipline.**

Marked with* in the table 2, literature is non-exhaustive

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Figure 3: Logic Model enlarged (p. 4)

