

Paediatric bed capacity in Swiss hospitals: a comprehensive analysis

Juliane Wurm^{1,2}, Christoph Berger³, Vera Bernet⁴, Simon Fluri⁵, Magali Gauthey⁶, Peter Gessler⁷, Matthias V. Kopp⁸, Juan Llor⁹, Vincent Muehlethaler¹⁰, Klara M. Posfay-Barbe^{11,12}, Guido F. Laube¹³, Roger P. Lauener^{14,15}, Bjarte Rogdo¹⁶, Rotraud K. Saurenmann¹⁷, Giacomo D. Simonetti^{18,19}, Fabian Spigariol²⁰, Maren Tomaske²¹, Rodo O. von Vigier²², Abdelaziz Zemouri²³, Petra Zimmermann^{1,24}, Urs Zimmermann²⁵, Henrik Koehler^{26,27,28}, Nicole Ritz^{2,28,29,30}

- ¹ Department of Paediatrics, Fribourg Hospital, Fribourg, Switzerland
- ² Paediatric Infectious Diseases Unit, Department of Paediatrics, Children's Hospital, Cantonal Hospital Lucerne, Lucerne, Switzerland
- ³ Division of Infectious Diseases, University Children's Hospital Zurich, University of Zurich, Zurich, Switzerland
- ⁴ Department of Neonatology, Hospital Zollikerberg, Zollikerberg, Switzerland
- ⁵ Department of Neonatology, Hospital Centre of Oberwallis Visp, Visp, Switzerland
- ⁶ Department of Paediatrics, Hôpital de la Tour, Meyrin, Geneva, Switzerland
- ⁷ Department of Paediatrics, Cantonal Hospital of Thurgau, Muensterlingen, Switzerland
- ⁸ Department of Paediatrics, Inselspital, Bern University Hospital, University of Bern, Bern, Switzerland
- ⁹ Department of Paediatrics, Sion Hospital, Centre Hospitalier du Valais Romand, Sion, Switzerland
- ¹⁰ Department of Paediatrics, Hospital of Jura, Delémont, Switzerland
- ¹¹ Division of General Paediatrics, Department of Woman, Child and Adolescent, University Hospitals of Geneva, Geneva, Switzerland
- ¹² Faculty of Medicine, Geneva, Switzerland
- ¹³ Department of Paediatrics, Hospital Baden, Baden, Switzerland
- ¹⁴ Children's Hospital of Eastern Switzerland, St. Gallen, Switzerland
- ¹⁵ School of Medicine, University of St. Gallen, St. Gallen, Switzerland
- ¹⁶ Department of Paediatrics, Cantonal Hospital of Graubünden, Chur, Switzerland
- ¹⁷ Department of Child and Adolescent Care, Cantonal Hospital of Winterthur, Winterthur, Switzerland
- ¹⁸ Institute of Paediatrics of Southern Switzerland, Ente Ospedaliero Cantonale, Bellinzona, Switzerland
- ¹⁹ Research Unit Institute of Paediatrics of Southern Switzerland, Università della Svizzera Italiana, Bellinzona, Switzerland
- ²⁰ Department of Paediatrics, Neuchâtel Hospital Network, Neuchâtel, Switzerland
- ²¹ Department of Paediatrics, Stadtspital Zurich Triemli, Zurich, Switzerland
- ²² Paediatric Clinic, Wildermeth Children's Hospital, Biel-Bienne, Switzerland
- ²³ Department of Paediatrics, Hospital of Morges, Vaud, Switzerland
- ²⁴ Department of Community Health, Faculty of Science and Medicine, University of Fribourg, Fribourg, Switzerland
- ²⁵ Clinic of Neonatology and Paediatrics, Hospital Buelach, Buelach, Switzerland
- ²⁶ Children's Hospital Aarau (KSA), Aarau, Switzerland
- ²⁷ University Children's Hospital Basel, Basel, Switzerland
- ²⁸ Faculty of Health Science and Medicine, University Lucerne, Lucerne, Switzerland
- ²⁹ Department of Clinical Research, University of Basel, Basel, Switzerland
- ³⁰ Mycobacterial and Migrant Health Research, University Children's Hospital Basel, Basel, Switzerland

Summary

BACKGROUND: Switzerland's decentralised healthcare system delegates responsibility for paediatric hospital infrastructure to individual cantons. To date, official statistics on the number and types of paediatric hospital beds are lacking.

OBJECTIVE: This study sought to fill this gap by collecting and analysing data from all paediatric hospitals in Switzerland.

METHODS: A nationwide cross-sectional e-mail survey was conducted in January 2023. Data on both structurally available and operated beds were collected and descriptively analysed.

RESULTS: The survey identified a total of 1751 beds in 29 paediatric hospitals or departments, of which 85% were operated. Of the total beds, 112 were paediatric intensive care unit beds (80% operated) and 339 were neonatol-

ogy beds (86% operated). Significant regional disparities in bed availability were identified: the Lake Geneva region has the highest bed-to-child ratios, while Central Switzerland, Eastern Switzerland and Ticino show notably lower ratios.

CONCLUSION: These findings highlight the current distribution of paediatric beds, the considerable proportion of non-operated beds, and the importance of continued, comprehensive data collection to inform healthcare planning.

Introduction

Switzerland has a decentralised healthcare system, with each canton being responsible for its own healthcare services and hospital infrastructure [1, 2]. Paediatric services in Switzerland are delivered through several models: standalone children's hospitals, which focus exclusively on paediatric care; children's hospitals integrated within larg-

Prof. Dr Nicole Ritz
Paediatric Infectious Dis-
eases Unit
Department of Paediatrics
Children's Hospital
Cantonal Hospital Lucerne
CH-6000 Lucerne
nicole.ritz[at]luks.ch

er (university) hospitals that operate as a specialised hospital within the broader hospital network; and integrated paediatric departments within cantonal and regional hospitals. While the system ensures wide access, challenges such as staffing shortages, infectious diseases waves and regional disparities may become more important in the future. In addition, ongoing developments, including the construction of new children's hospitals [3], aim to enhance capacity, integrate services and improve access to advanced care for children across the country.

While countries like the United States and Germany have seen significant reductions in paediatric inpatient units and hospital beds [4, 5], Switzerland lacks official statistics on paediatric inpatient capacities. The Federal Office of Public Health maintains a database of hospital statistics, including speciality clinics; however, for paediatrics, only the three standalone children's hospitals are included [6]. This absence of complete data on paediatric hospital beds complicates efforts to efficiently manage and optimise paediatric healthcare on a national level.

We therefore aimed to fill this gap and systematically collected and analysed data on paediatric hospital beds in Switzerland, offering important insights into the current state of paediatric care infrastructure.

Methods

In this cross-sectional study, an e-mail survey was designed and distributed in January 2023 to all paediatric hospitals in Switzerland, requesting detailed information on bed availability. The distribution was coordinated by *pädiatrie schweiz*, which is the official professional association for paediatrics in Switzerland. Bed capacity data were self-reported by the heads of departments or chief physicians at each hospital. While no standardised bed definitions were provided in advance, we aimed to capture routine institutional reporting practices. The responses were gathered by February 2023, with follow-up inquiries completed by June 2023. The survey included data on the number of structurally available beds (SB) and operated beds (OB) across various categories, including paediatric units, paediatric intensive care units (PICU), neonatal special care units, intermediate care (IMC) units, short-stay and daycare units. "Other beds" mainly included psychiatric and psychosomatic beds. PICU bed data were self-reported, with information on official accreditation included in the analysis [7]. Neonatal special care units were classified into levels 2a, 2b and 3, with level 3 representing the highest level of care, according to the standards for neonatal care in Switzerland published and accredited by the Swiss Society of Neonatology [8].

Each response was reviewed for completeness and consistency. In cases of missing or unclear information, follow-up contact was made with the respective hospital. While no formal validation against external sources was performed, data cleaning and plausibility checks were applied to identify and resolve obvious inconsistencies. Final data were compiled in a central database and descriptive analyses and visualisation were done using R [9]. The full analysis code is available at: <https://doi.org/10.5281/zenodo.15346080>, archived via Zenodo. For each hospital, the total number of structurally available and operated beds was summarised by bed category (e.g. paediatric, PICU, neonatology). Ag-

gregated totals were calculated at the national and regional levels. Proportions of non-operated beds were calculated for each bed type and reported descriptively. To provide context for the findings, population data on children aged 0–15 years from the Swiss Federal Statistical Office were used to analyse variations in bed availability across the seven major regions defined by the Swiss Federal Statistical Office [10]. The number of beds per 10,000 children in each major region was computed. For international comparison, paediatric bed data from Germany was obtained from the Federal Statistical Office and the Society for Children's Hospitals and Paediatric Departments (GKiND e.V.).

Results

Responses were received from all 29 paediatric hospitals or departments across 32 locations in Switzerland, including Children's Hospital Aarau (KSA), Cantonal Hospital Baden (KSB), University Children's Hospital of Basel (UKBB), University Children's Hospital of Bern (Insel), Children's Hospital Wildermeth Biel (SZB-CHB), Hospital of Bülach (SpiBue), Cantonal Hospital Graubünden Chur (KSGR), Hospital of Jura Délémont (H-IU), Fribourg Hospital (HFR), University Children's Hospital of Geneva (HUG), University Children's Hospital of Lausanne (CHUV), Cantonal Hospital Lucerne (LUKS), Hospital La Tour Meyrin (Latour), Hospital of Morges (EHC), Cantonal Hospital Münsterlingen (STGAG), Neuchâtel Hospital Network (RHNe), Hospital of Nyon (GHOL), Intercantonal Hospital of Broye Payerne (HIB), Hospital of Riviera-Chablais Rennaz (HRCR), Hospital of Oberengadin Samedan (SpO), Hospital of Valais Sion (HVS), Eastern Switzerland Children's Hospital St Gallen (KispiSG), Hospital Centre of Oberwallis Visp (SOV), Cantonal Hospital Winterthur (KSW), Hospital of Yverdon-les-Bains (EHNv), Hospital of Zollikerberg (SpZo), City Hospital Zurich Triemli (STZ), University Children's Hospital Zurich (Kispi). In Ticino, the four locations (Bellinzona, Lugano, Mendrisio and Locarno) of the Paediatric Institute of Italian-speaking Switzerland (EOC) were reported as a single centre. The survey identified a total of 1751 beds in paediatric hospitals or departments across the country, of which 1481 (85%) were operated at the time of data collection. The majority of the beds is concentrated in larger children's hospitals, with the highest numbers of structural and operated beds, in Kispi (SB: 263, OB: 241), followed by HUG (SB: 256, OB: 146), CHUV (SB: 172, OB: 148), Insel (SB: 159, OB: 151), UKBB (SB: 137, OB: 119) and LUKS (SB: 110, OB: 108). For further details, see figure 1.

Paediatric Intensive Care Unit (PICU) beds

Across Switzerland, eight hospitals have an official PICU accreditation [7]. At the time of data collection, these hospitals reported a total of 112 PICU beds, with 90 beds (80%) being operated. More than ten structural PICU beds were reported from Kispi (SB: 25, OB: 21), CHUV (SB: 16, OB: 12), UKBB (SB: 16, OB: 12), HUG (SB: 13, OB: 7), Insel (SB: 12, OB: 10) and LUKS (SB: 11, OB: 9). For further details, see figure 2. Additional beds in this category were reported at KSA (SB: 6, OB: 6), STGAG (SB: 2, OB: 2) and KSW (SB: 6, OB: 5).

Neonatology beds

A total of 339 neonatology beds were reported in the following categories.

A total of 35 level 2a neonatology beds were available across EHC, EHNv, GHOL, HIB, H-IU, HRCR and La-tour. A total of 97 level 2b neonatology beds are available across EOC, HFR, HVS, KSB, KSW, SpZo, RHNe, SpiBue, STZ, STGAG and SZB-CHB. A total of 207 level 3 neonatology beds were available across CHUV, HUG, Insel, Kispi, KispiSG, KSA, LUKS and UKBB.

On average, 14% of the neonatology beds were not operated, with level 2a units experiencing the highest rate at the time of reporting. For further details, see figure 3.

Notably, some hospitals (e.g. KSGR) care for neonates in their PICU wards, which were not included in this section.

IMC beds

A total of 127 IMC beds were reported, of which 17% were not operated. Over ten structural IMC beds were recorded at KispiSG (SB: 27, OB: 27), Kispi (SB: 16, OB: 12), CHUV (SB: 12, OB: 10), LUKS (SB: 11, OB: 11) and KSW (SB: 11, OB: 9). In many instances, IMC beds also include neonatology beds (see appendix figure S1).

Paediatric beds, surgical beds, short-stay beds, day-care beds and other beds

The survey identified 581 paediatric beds with 18% not being operated, 274 surgical beds with 17% not being operated, 44 short-stay beds with 17% not being operated, 168 daycare beds with 1% not being operated, and 200 other

Figure 1: Absolute numbers of total structural and operated hospital beds in paediatric hospitals or departments across Switzerland with structural beds depicted on a map.

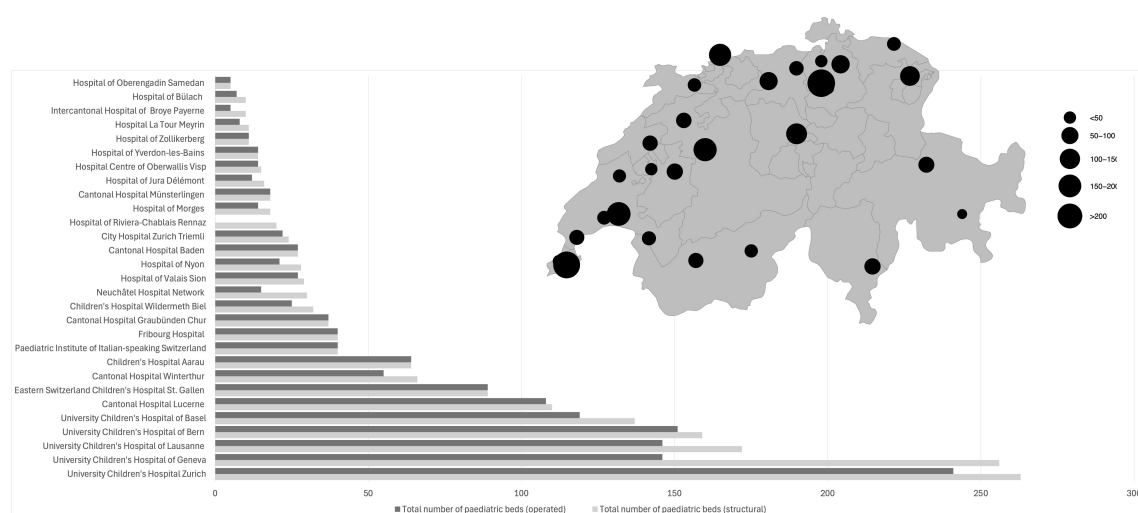
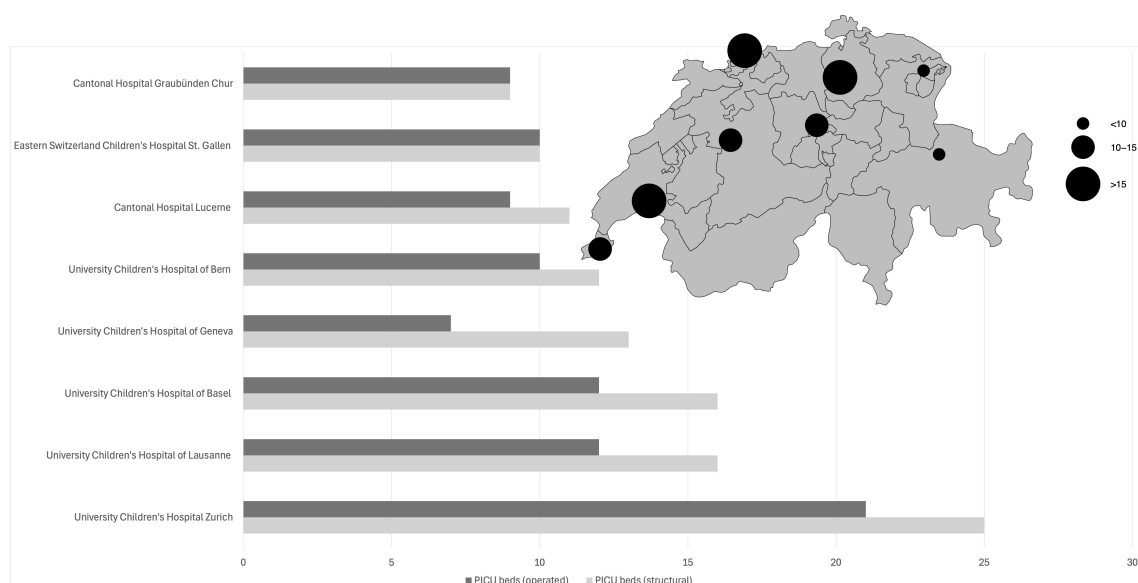


Figure 2: Absolute numbers of structural and operated paediatric intensive care unit (PICU) beds across Switzerland with structural beds depicted on a map. Cantonal Hospital Graubünden Chur, Eastern Switzerland Children's Hospital St Gallen, Cantonal Hospital Lucerne, University Children's Hospital of Basel: includes neonatal/NICU beds; University Children's Hospital of Basel: distribution of PICU beds can be regulated by demand. Children's Hospital Aarau, Cantonal Hospital Münsterlingen and Cantonal Hospital Winterthur are not shown in this figure.



beds with 25% not being operated (see appendix figures S2–S6).

Regional disparities in bed availability

Overall, the total of 1751 beds corresponds to 13 beds per 10,000 children in Switzerland. The Lake Geneva region has the highest bed-to-child ratio, with 20 beds per 10,000 children. In contrast, Eastern Switzerland, Ticino, Espace Mittelland and Central Switzerland have lower ratios. For further details, see table 1.

Comparison with Germany

Germany submitted a summary report, listing a total of 18,696 beds, which corresponds to 13 beds per 10,000 children. Of these, 1718 are PICU beds, with 43% not being operated, and 2068 are neonatology beds, with 30% not being operated at the time of data collection.

Discussion

This study is the first systematic effort to gather and analyse data on bed capacity in Swiss paediatric hospitals or paediatric departments. The study shows that there were 1751 self-declared beds of which 85% were being operated in early 2023. The data also reveals variability in capacity

across different care types. PICU beds, comprising 112 beds at an 80% rate of operated beds, are critical yet fewer in number. Patients requiring these beds have complex and life-threatening conditions resulting in high staffing requirements and turnover rates. Access to PICU beds may directly influence outcomes, particularly in emergency situations where rapid admission can reduce mortality and morbidity rates among critically ill children. Neonatology beds, of which there are 339 with 86% in use, are similarly essential for providing care to preterm and critically ill newborns. The fact that these specialised units are not operated at full capacity is concerning, as it may limit access to critical care for infants and children with severe medical conditions.

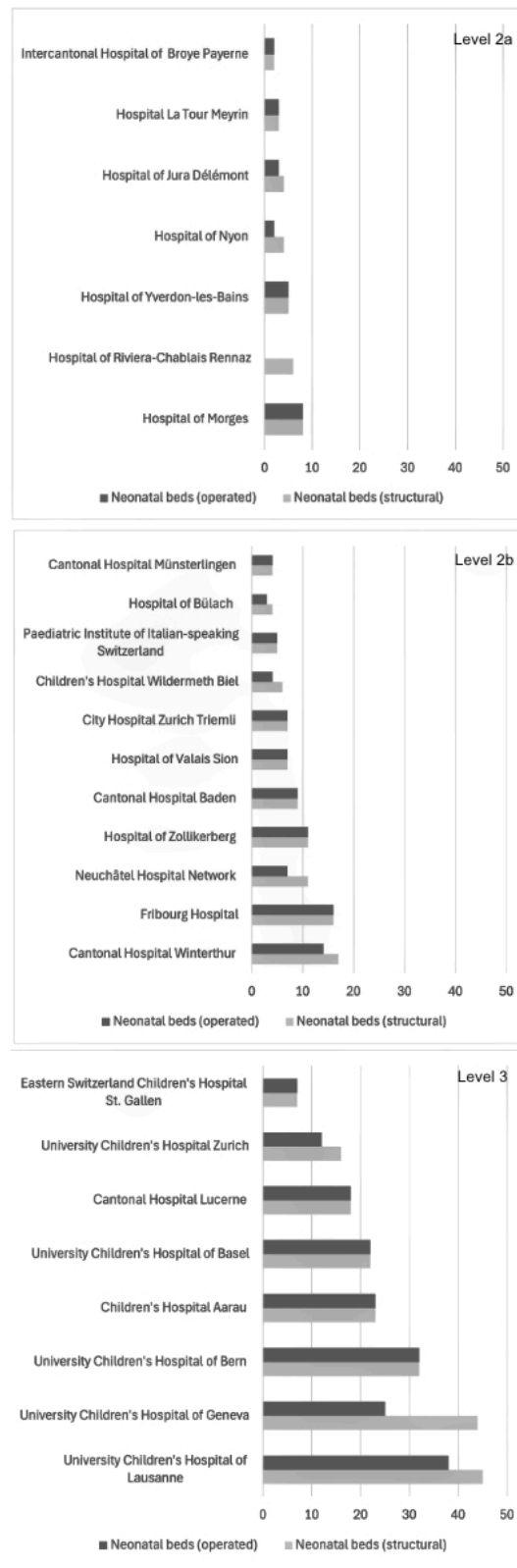
Non-operated beds

The non-operated beds are an indication that paediatric departments and hospitals are no longer able to fully operate structural beds or that these beds are not required. While the bare numbers of available beds alone cannot answer why some beds are not operated, this could be due to several reasons. One important factor is the ongoing health-care staff shortage in Switzerland, which has been a growing concern in recent years. According to a recent report by a company specialised in accounting, consulting and advisory services, the Swiss healthcare system is heading to-

Table 1:
Total structural beds per region.

Hospital	Region	Total structural beds per hospital	Number of children (0-15 years) per region	Total beds per region	Total beds per 10k children
University Children's Hospital of Bern	Midland Region	159	304,918	277	9
Children's Hospital Wildermeth Biel		32			
Hospital of Jura Délémont		16			
Fribourg Hospital		40			
Neuchâtel Hospital Network		30			
University Children's Hospital of Geneva	Lake Geneva Region	256	284,185	573	20
University Children's Hospital of Lausanne		172			
Hospital La Tour Meyrin		11			
Hospital of Morges		18			
Hospital of Nyon		28			
Intercantonal Hospital of Broye Payerne		10			
Hospital of Riviera-Chablais Rennaz		20			
Hospital of Valais Sion		29			
Hospital Centre of Oberwallis Visp		15			
Hospital of Yverdon-les-Bains		14			
Children's Hospital Aarau	Northwestern Switzerland	64	191,083	228	12
Cantonal Hospital Baden		27			
University Children's Hospital of Basel		137			
Cantonal Hospital Graubünden Chur	Eastern Switzerland	37	165,851	149	9
Cantonal Hospital Münsterlingen		18			
Hospital of Oberengadin Samedan		5			
Eastern Switzerland Children's Hospital St Gallen		89			
Paediatric Institute of Italian-speaking Switzerland	Ticino	40	48,504	40	8
Cantonal Hospital Lucerne	Central Switzerland	110	134,739	110	8
Hospital of Bülach	Zurich	10	255,334	390	15
Cantonal Hospital Winterthur		66			
Hospital of Zollikerberg		11			
City Hospital Zurich Triemli		24			
University Children's Hospital Zurich		263			

Figure 3: Absolute numbers of structural and operated neonatology beds across Switzerland. University Children's Hospital of Basel: Four of the neonatal beds are rooming-in beds; University Children's Hospital of Bern: 10 beds are neonatal intensive care unit (ICU) beds, 22 intermediate care (IMC); Children's Hospital Wildermeth Biel: 2 IMC beds; Hospital of Jura Délémont: one fully equipped kangaroo-room; Hospital of Zollikoberg: 6 of the beds are IMC beds; Eastern Switzerland Children's Hospital St Gallen: additional 20 neonatology beds were reported. Only level 3 beds are shown in this figure.



wards a shortage of nearly 40,000 nursing staff and around 5500 doctors by the year 2040 [11]. This shortage is exacerbated by inadequate funding for paediatrics, which leads to difficulties in staffing as well as attracting and retaining paediatric specialists. Additionally, staff working in specialised care settings, such as PICU and neonatal units, require specific training and expertise, further compounding staffing challenges. While the number of paediatric patients requiring inpatient care experiences significant seasonal fluctuations, a certain level of standby capacity must be maintained, as most hospital admissions in paediatrics are unplanned (e.g. through the emergency department or deliveries). Addressing this shortage and the inadequate funding in paediatrics will be essential to ensure the high quality and standards of paediatric care in Switzerland in the future. Another important factor why paediatric structural beds were not operated could be the growing trend in paediatric care towards shorter inpatient stays, outpatient treatment, home-based care for certain conditions and the flexible adaptation of the operated beds to meet specific needs. As a result, the number of paediatric beds may decrease, without necessarily compromising the quality of care.

Regional differences

The survey shows a concentration of paediatric beds in larger hospitals, located in Zurich, Geneva, Lausanne, Bern, Basel and Lucerne. In addition to this centralising effect, our study found regional differences in bed availability; the Lake Geneva region has the highest bed-to-child ratio, compared to substantially lower ratios in other regions such as Central Switzerland, Eastern Switzerland and Ticino. These calculations may however not fully reflect real-life availability, as children and families often seek care beyond their cantonal and regional hospitals. Factors such as specialised expertise, the availability of PICUs and other reasons may lead families to seek treatment in other cantons, regions or even internationally. In addition, tourism can influence the paediatric bed situation in some regions, as the influx of visitors may increase demand for healthcare services. Other reasons could contribute to these regional differences, including hospitalisations and treatment of children in adult hospitals. As a result, patient distribution may differ from simple geographic allocations. However, these discrepancies suggest that access to paediatric care can vary significantly depending on geographic location, which could impact the quality and timeliness of care for children in different areas in Switzerland. It is therefore crucial to recognise that demand for paediatric beds is shaped by multiple factors beyond population size alone. Policy decisions regarding paediatric bed capacities should avoid a one-size-fits-all approach and instead consider the full context of regional healthcare demands and disparities in access to care.

Comparison with other countries (Germany and the United States)

Data for international comparisons are limited. When comparing the Swiss data with Germany, both countries show similarities in paediatric bed availability, although Germany has a higher proportion of non-operated beds. A longitudinal analysis in Germany shows a steady decline

in paediatric beds, which decreased by one-third between 1991 and 2022, despite an annual increase of over 100,000 paediatric cases [5]. In the United States (US), where hospital infrastructure is extensively studied, a similar trend of declining paediatric inpatient capacity has been observed. Between 2008 and 2018, there was a 19% annual decrease in paediatric units and a 12% annual decrease in paediatric beds, with rural areas being most affected. Despite these reductions, the number of PICU beds is increasing, particularly in large paediatric hospitals [4]. Moreover, the proportion of hospitalised patients requiring intensive care and those with complex chronic conditions is rising in the US [4, 12]. Concurrently, there has been a decline in overall admissions, an increase in short-stay admissions for observation and a reduction in the average length of stay in children's hospitals [13, 14]. It is important to consider that many countries, including the US, have dedicated children's transport systems, which allow for more flexible reallocation of beds and resources, especially in times of need [15]. This system can mitigate the impact of bed shortages in one location by enabling patient transfers to other facilities.

Strengths and limitations

A key strength of this study is that it is the first of its kind to provide an estimate and analysis differentiating between structural and operated beds of all paediatric hospitals and departments in Switzerland. The distinction between structural and operated beds is critical, as structural bed numbers alone do not offer an accurate representation of a hospital's true capacity to provide care. Operated beds – those actively staffed and available for use – are a more precise indicator of the resources that are accessible to patients.

However, our study is also subject to limitations. First, our analysis focused on the metric of paediatric hospital beds. Bed availability alone does not provide a complete picture of the system's capacity to care for paediatric patients. The definition of a "bed" can vary depending on the context (paediatric, IMC, daycare, etc) and bed use may be adapted to specific needs, such as IMC beds repurposed for neonates. Second, bed category definitions differ between hospitals and there is no universal definition of types of beds in paediatric hospitals and departments in Switzerland. For instance, some hospitals make no distinction between PICU and neonatal intensive care unit (NICU) wards, paediatric and surgical beds and include psychiatric beds. Third, our study employed a cross-sectional design, which limits its ability to account for the significant seasonal variations in bed capacity that hospitals may plan to accommodate seasonal fluctuations in admissions. These fluctuations are driven by factors such as respiratory illnesses and viral outbreaks.

Conclusion

While a significant portion of paediatrics beds in Switzerland are operated, the existence of many non-operated beds has been noted. Ensuring equitable access to paediatric care across different regions is essential and our findings indicate disparities. The study underscores the critical need for comprehensive data collection on paediatric hospital capacity. This includes national definitions of bed types and the documentation of the number of children treated in

adult facilities. For the future planning of paediatric care in Switzerland, a cantonal approach is likely no longer adequate. Instead, regional structures should be developed and implemented to create an optimal healthcare system for children. Furthermore, given the fluctuating and evolving nature of paediatric healthcare needs, it is essential to track paediatric hospital capacity over time enabling better resource allocation and planning.

Data sharing statement

The underlying data are not publicly available, as no data-sharing agreement was in place at the time of collection. The data were provided by participating hospitals under confidentiality terms that do not allow for public redistribution. However, all aggregated data used in the analysis are included in the manuscript to ensure transparency. The analytical code was written in R and is publicly accessible at <https://doi.org/10.5281/zenodo.15346080>.

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Author contributions: NR initiated and designed the study and oversaw the distribution of the survey. JW analysed the data and drafted the initial manuscript, which was subsequently revised by NR. CB, VB, SF, MG, PG, MVK, JL, VM, KPB, GFL, RPL, BR, RKS, GDS, FS, MT, RVV, AZ, PZ, UZ and HK provided data, critically reviewed the manuscript and contributed to its final version. All authors approved the final manuscript.

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Potential competing interests

All authors have completed and submitted the International Committee of Medical Journal Editors form for disclosure of potential conflicts of interest. No potential conflict of interest related to the content of this manuscript was disclosed.

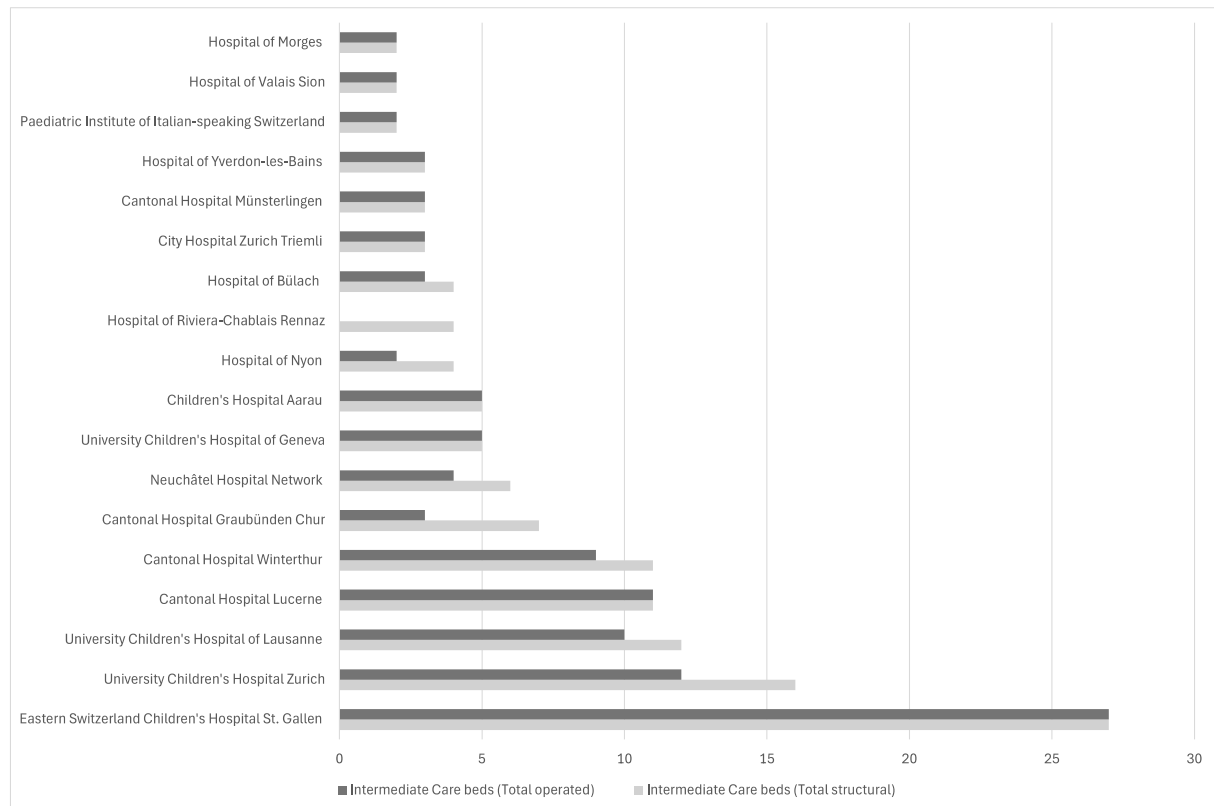
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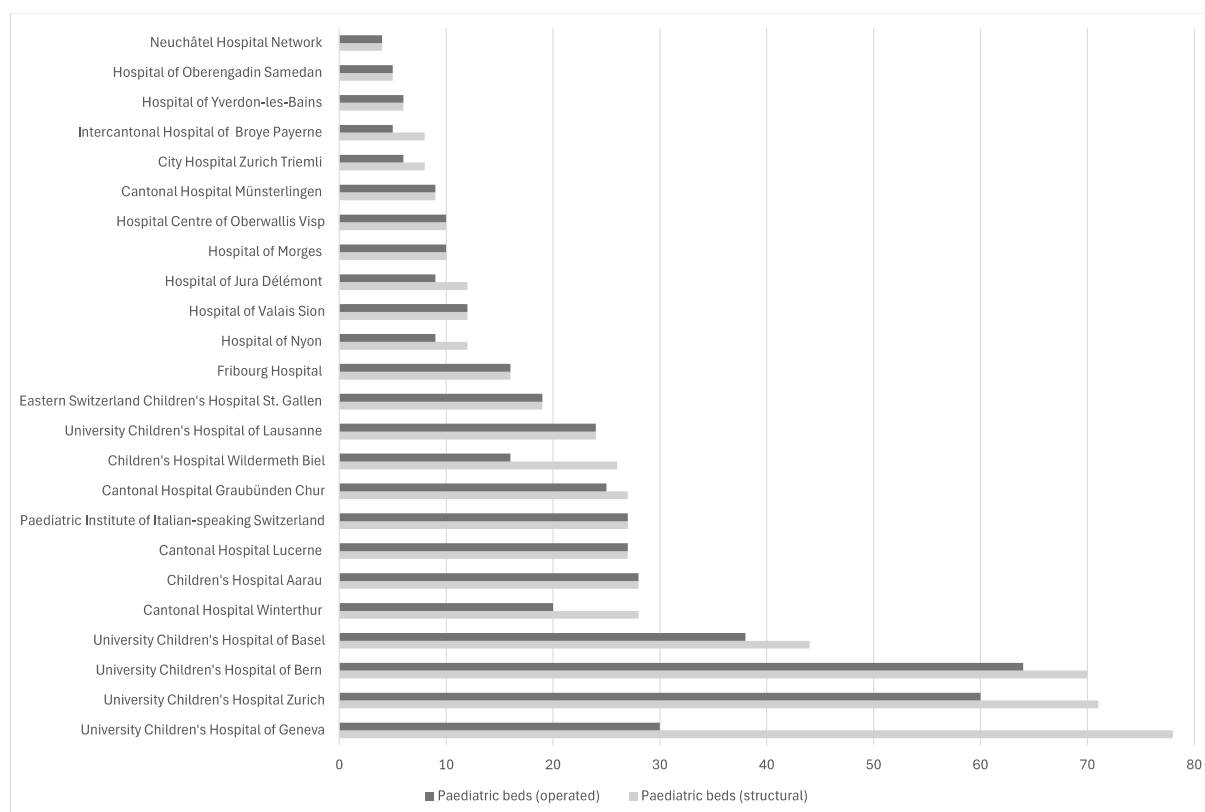
Appendix

Figure S1 Absolute numbers of structural and operated intermediate care beds across Switzerland.



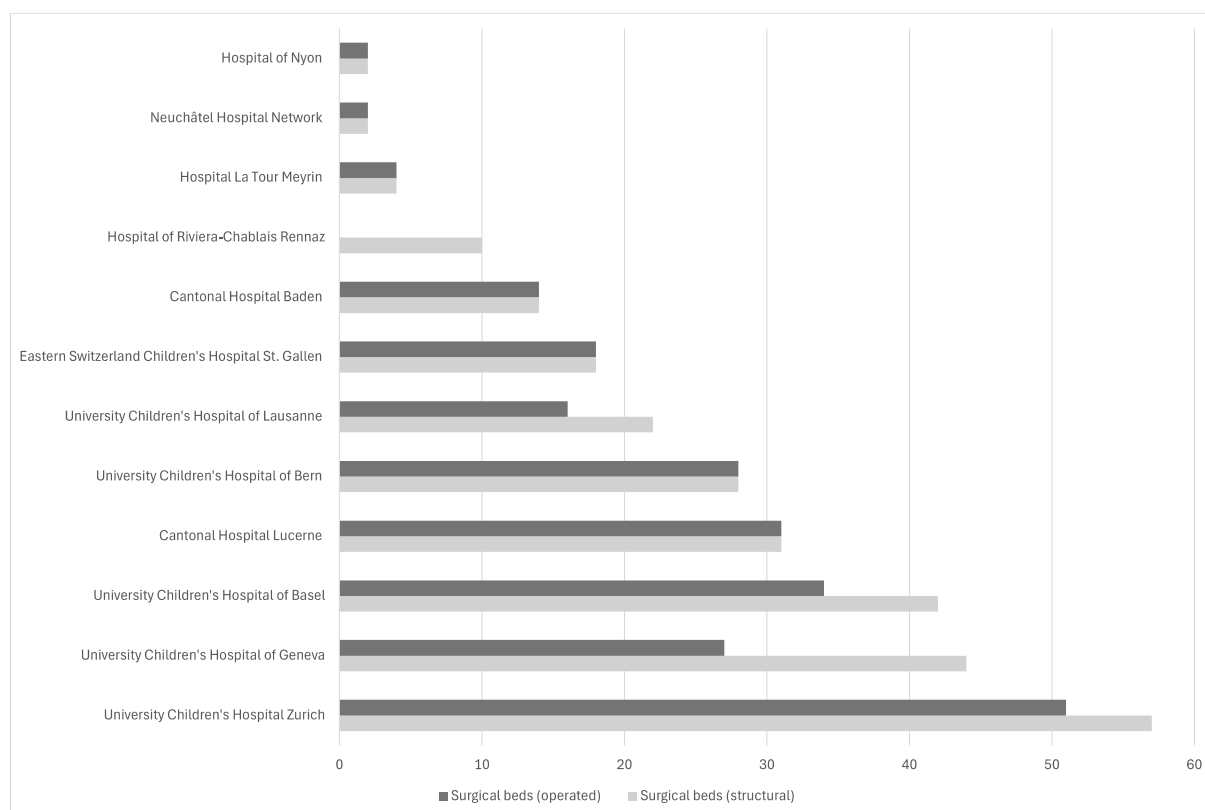
Aarau, Bern: NIMC beds are included in neonatal beds; Basel: IMC beds are included in ICU neonatal beds; Chur, St. Gallen, Winterthur: Neonatal only; Rennaz: 2 additional beds during winter

Figure S2 Absolute numbers of structural and operated paediatric beds across Switzerland.



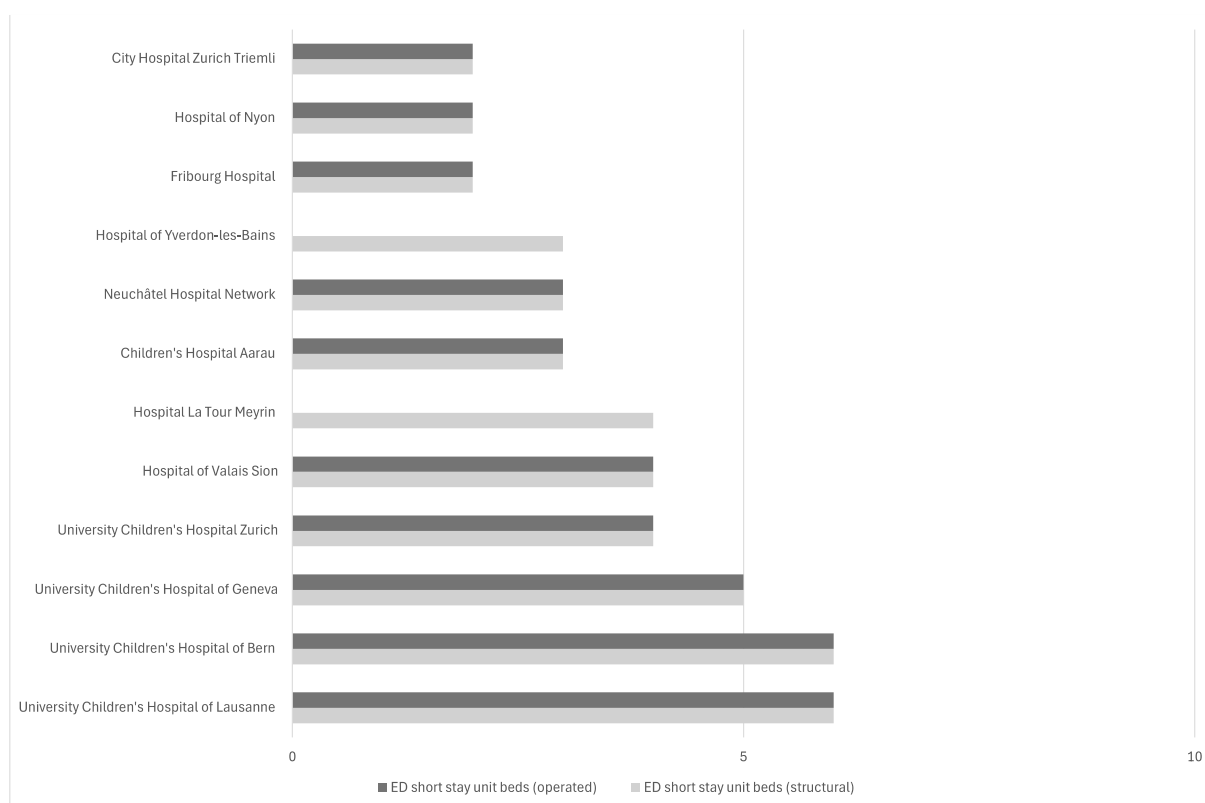
Chur, Delemont, Freiburg, Sion, Winterthur: Mixed use surgical/medical; Payerne: Mixed use surgical/medical/short stay/day care; Zürich (Stadtspital Triemli): reduced due to staff shortage during the Covid-pandemic.

Figure S3 Absolute numbers of structural and operated surgical beds across Switzerland.



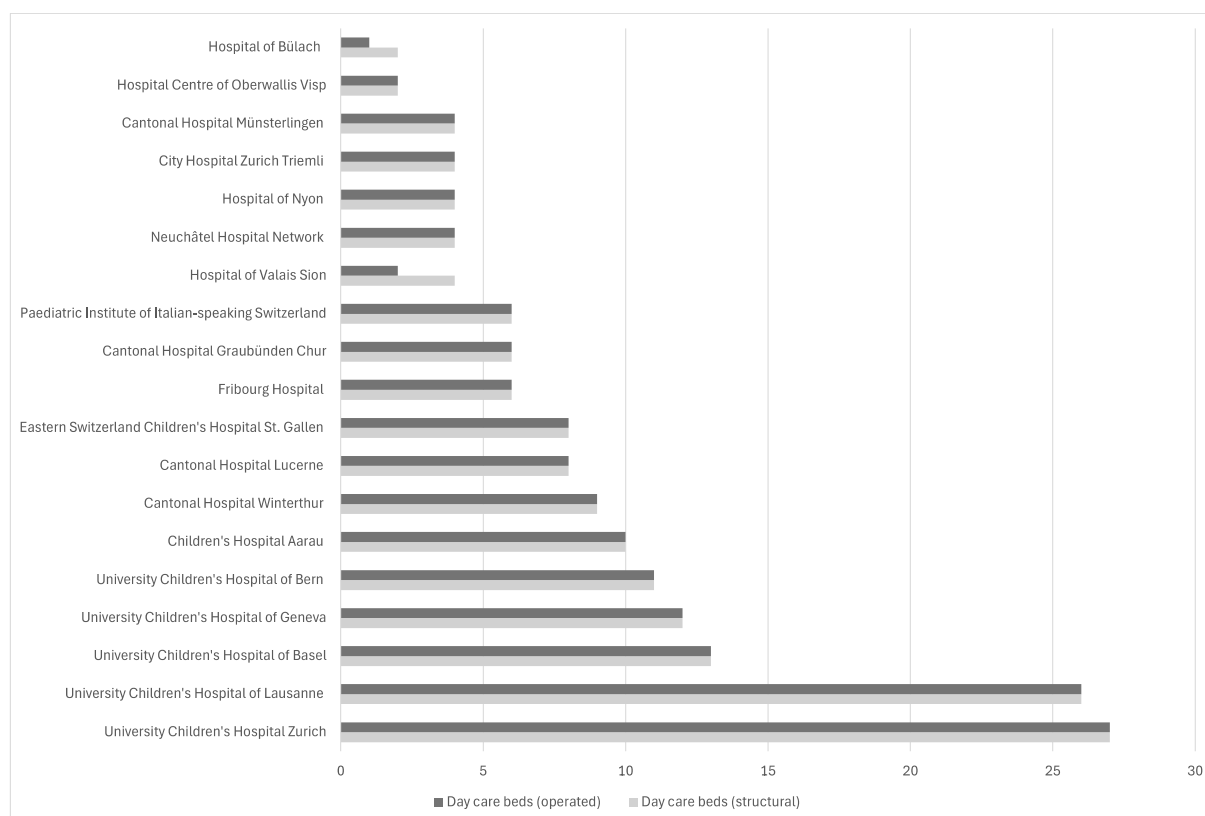
Aarau, Sion, Visp, Freiburg: surgical beds included in paediatric beds; Baden: surgical and paediatric beds are on the same ward ; Luzern: 2-10 beds are often used as paediatric beds; Tessin: together with paed. Beds in Bellinzona (flexible distribution); Zürich, Universitätsspital: if needed (e.g. in winter) surgical beds are given to paediatric patients

Figure S4 Absolute numbers of structural and operated ED/short stay beds across Switzerland.



Aarau: only in use if bed shortage on regular ward; Luzern: planned in the new Children's Hospital; Winterthur: school-age kids/adolescents on adult short stay unit upon availability; Yverdon: beds for programmed intervention, but no staff/nurse for spontaneous observation

Figure S5 Absolute numbers of structural and operated daycare beds across Switzerland.



Biel: includes surgical day care patients; Bülach: only neonates

Figure S6 Absolute numbers of structural and operated other beds across Switzerland.

