Nursing & Primary Care

Avoidable Hospitalizations in Ages 0-17. What do Current Information Flows tell us?

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ABSTRACT

Introduction: *Potentially avoidable hospitalizations can be used as indicators of access and quality of primary care. Several criteria are reported in the literature to identify these cases. We have used the criteria proposed by the US Agency for Healthcare Research and Quality integrated by three further conditions monitored in Italy by S. Anna Institute of Pisa and the National Outcome Plan. The study reports on the characteristics of potentially avoidable hospitalizations, in the age group 0-17 years in the province of Trento – Italy, in the year 2018. The study also explores the possible role of some maternal and perinatal factors.*

Materials and Methods: *The cases of interest were extracted from the computerized archive of hospital discharges relating to subjects residing in the province of Trento, for the age group 0-17 years, considering both discharges from provincial institutions and that from institutions outside the province of Trento. We followed the selection and exclusion criteria indicated by the reference institutions. Many socio-demographic and care variables were considered among those present in the hospital discharge form. The hospitalization rate was calculated for all the cases identified and for the individual conditions. The hospitalization rate by age group was also calculated. We compared the hospitalization rate in Italians vs. foreigners and in relation to the area of residence. By linking the hospital discharge archive with that of the Childbirth, we explored the role of some maternal-perinatal factors.*

Results: *In 2018, 413 potentially avoidable hospital admissions were identified in the 0-17 age group representing 6.8% of the total hospitalizations. Admissions for tonsillectomy represent almost 60% of cases. Males predominate over females. The 0-4 age group comprises 43.5% of hospitalizations, 86.2% of cases are Italian citizens, 19.8% reside in an urban area and 80.2% in a rural area. 57.0% of the total cases have been hospitalized in day hospital/day surgery; urgent hospitalizations represent 68.7% of cases and only 11.4% of hospitalizations take place over the weekend. All cases are discharged to their home for an overall average hospital stay of 3.6 days. Hospitalization takes on a decreasing trend with increasing age. A higher hospitalization rate emerges in foreigners and also in residents in rural areas. There is an excess of subjects with low qualifications among the mothers of cases with avoidable hospitalization.*

Discussion: *The use of hospital data to describe the quality of primary care is widespread although it has various limitations. One limitation is represented by the quality of hospital data and the other by the fact that hospital data does not inform us about non-medical aspects that may have a relevant importance on improper hospitalization. To explore these hidden aspects, it would be advisable to integrate hospital data with an audit involving all stakeholders. With all the limitations of the case, the results of our study give a satisfactory picture with respect to avoidable hospitalizations in the age of 0-17 in the province of Trento. An analysis of the criteria for using tonsillectomy would allow a control of most cases. More generally, a homogenization of the organization of primary care and of the hospital-territory relationship could be useful.*

Keywords

Introduction

Avoidable or rather potentially avoidable hospitalizations are conditions for which appropriate, timely and continuous primary care can reduce the risk of hospitalization by preventing the condition, controlling acute episodes or correctly managing chronic disease [1]. These conditions can be used as indicators of access and quality of primary care, within the framework of an optimal hospital / territory integration and in a historical context where a transition of health care is now necessary: from the hospital sector to the community sector [2]. Several criteria are reported in the literature to identify potentially avoidable hospitalizations. The most commonly accepted one, at least in Western countries, is the one that refers to the category of primarily manageable hospitalizations, at least potentially, in the area of primary care, the so-called ambulatory care sensitive conditions (ACSC). The US Agency for Healthcare Research and Quality (AHRQ) proposed a series of avoidable hospital admissions, respectively for children/adolescents (0-17 years) and for adults [3]. Most of these typologies have also been acquired by two Italian performance evaluation systems, namely the system of the Sant'Anna Institute of Pisa University which includes a series of Italian regions [4] and the National Outcome Plan (PNE) which considers all Italian regions [5]. During the year 2018, the Provincial Agency for Health Services of Trento (APSS), identified, as a topic of interest to be explored, through a comparison with the Directors of the Hospital Service, the Territorial Service and the Prevention Department, that of so-called avoidable hospitalizations. A specific working group agreed in the first months of 2019 on the list of hospitalizations to be investigated and entrusted the statistical epidemiological evaluation to the Clinical and Evaluation Epidemiology Service of the APSS. This study reports the quantification and characteristics of potentially avoidable hospitalizations, which occurred for the age group 0-17 years in the province of Trento (north east Italy, 540,000 inhabitants as of 31.12.2018) in the year 2018. The study also explores the possible role of some maternal and perinatal factors.

Materials and Methods

For the definition of the ACSC categories to be assessed for the age group 1-17, reference was primarily made to the conditions already considered by the US Agency for Healthcare Research and Quality (AHRQ) integrated by 3 conditions already monitored, at the Italian level, by the S.Anna Institute of Pisa and the PNE (tonsillectomy, otitis and vaccine-preventable infectious disease). The full list of conditions assessed is shown in table 1 together with the extraction and exclusion criteria.

The cases of interest were extracted from the computerized archive of hospital discharges relating to subjects residing in the province of Trento, for the age group 0-17 years, using both the database of discharges from provincial institutions and that of discharges from institutions outside the province of Trento, the so-called passive hospital mobility. For each type of potentially avoidable hospitalization, the following variables were assessed: age, gender, residence (rural/ urban area), citizenship (Italian/ foreign), day of the week of hospital admission, hospitalization regime (day hospital/day surgery vs. ordinary hospitalization), type of admission (urgent, scheduled), length of hospitalization, method of discharge. Only for subjects born in institutions of the province of Trento, the following data relating to the mother were recovered: age at birth and educational qualification as well as gestational age, distinguishing between full-term and preterm births (weeks of gestation <37). This was possible by matching the hospital discharge data with the birth data recorded in the Birth Assistance Certificate archive (BAC). The link keys were: date of birth, gender, surname of the father. For cases with hospitalization associated with a vaccine-preventable disease, the specific vaccination status was checked by accessing the computerized provincial vaccination register. For each type of clinical condition, a distribution of frequency has been prepared by gender, age class, residence, citizenship, day of the week of admission (focusing on hospitalizations that took place over the weekend), by hospitalization regime, by type of hospitalization and by length of hospital stay. The relationship with maternal-perinatal factors was analyzed for the complex of avoidable hospitalizations, calculating the ODDS Ratio with the related 95% confidence intervals. For each type of hospitalization, the specific percentage weight on the total hospitalizations (in the province and outside the province) of the age group 1-17 was calculated. The hospitalization rate was calculated for all the avoidable conditions encountered and for the individual types. A hospitalization rate for the provincial level was calculated on the basis of the resident population as of 31.12.2018, then distinguishing between Italians and foreigners. A hospitalization rate between urban area (corresponding to the municipality of Trento) and rural area (corresponding to rest of the municipalities of the province of Trento) and according to age classes was also calculated. Hospitalization rates are accompanied by 95% confidence intervals. The significance of the differences between the categories under comparison was tested with the chi-squared test, with a significance level of 0.05%.

Results

In 2018, 413 potentially avoidable hospital admissions were identified in the 0-17 age group and 89% of these took place at hospitals of the province of Trento. Overall, avoidable hospitalizations represent 6.8% of the total hospitalizations (in the province and outside the province) registered in the 0-17 age group. Admissions for tonsillectomy represent almost 60% of cases (Table 2). Males predominate over females (59.8%), both overall and in individual clinical types. The lowest average age is recorded in vaccine-preventable diseases (1 case of pertussis at 9 months of age, 1 case of mumps at 3 years and 6 months, both in unvaccinated subjects). The highest average age is recorded in the short-term complications of diabetes mellitus which includes all cases with ketoacidosis. The 0-4 age group comprises 43.5% of hospitalizations. 86.2% of cases are Italian citizens, 19.8% reside

Table 1: ICD 9 CM Codes and criteria for extracting acsc cases from hospital discharge archive.

Clinical Conditions	ICD 9 CM Codes	Exclusion criteria
Gastroenteritis	Principal ICD-9-CM diagnosis: 008.6*, 008.8, 009*, 558.9 or in secondary diagnosis for gastroenteritis and in principal diagnosis for dehydration: 276.5*	Age < 3 monthsi; principal or secondary diagnosis of gastrointestinal anomalies; principal or secondary diagnosis of bacterial gastroenteritis
Short-term complications of diabetes	Principal ICD-9-CM diagnosis 250.10, 250.22, 250.11, 250.23, 250,12, 250,30, 250.13, 250.31, 250.20, 250.32 250.21 250.33	Age < 6 years
Asthma	Principal ICD-9-CM diagnosis 493.*	Age < 2 year; secondary diagnosis of cystic fibrosis and respiratory system abnormalities
Acute appendicitis with complications	Any-listed ICD-9-CM diagnosis 540.0 ,540.1	Age< 1 year
Tonsillectomy with or without adenoidectomy	A principal ICD-9-CM diagnosis code 381*-382.9.	
Otitis	Main or secondary intervention: 28.2 e 28.3.	
Urinary tract infections	Principal ICD-9-CM diagnosis 590.10, 590.81, 590.11, 590.2, 595.0, 590.3, 595.9, 590.80, 599.0	Age < 3 months; immunocompromised subjects
Vaccine-preventable infectious disease	Principal ICD-9-CM diagnosis: 032*, 033*, 037, 045*, 052*, 055*, 056*, 070.2-070.3, 072*, 320.0, 320.1.	Age < 3 months Age<13 months for 052*, 055*, 056*, 072*;

Table 2: Province of Trento. Potentially avoidable hospitalizations age 0-17 years. Percentage weight of each condition on the total avoidable cases and on total hospitalizations aged 0-17. Year 2018.

Clinical conditions	Avoidable cases	% on total avoidable cases	% on total hospitalizations in age 0-17 years
Gastroenteritis	32	7.7	0.5
Asthma	11	2.7	0.2
Tonsillectomy	244	59.1	4.0
Otitis	32	7.7	0.5
Vaccine-preventable infectious disease	2	0.5	0.0
Short-term complications of diabetes	10	2.4	0.2
Acute appendicitis with complications	44	10.7	0.7
Urinary tract infections	38	9.2	0.6
Total cases 0-17 years	**413**	**100.0**	**6.8**

Table 3: Province of Trento. Socio-demographic characteristics of cases with avoidable hospitalization aged 0-17 Year 2018.

Clinical conditions	Gender		Average age	% age 0-4 years	Citizenship		Residence area	
	Males	Females			Italians	Foreigners	Urban	Rural
Gastroenteritis	19	13	7.3	46.8	28	4	7	25
Asthma	7	4	6.2	36.3	9	2	5	6
Tonsillectomy	147	97	6	43.4	209	35	43	201
Otitis	19	13	6.5	43.7	31	1	7	25
Vaccine-preventable infectious disease	1	1	1.5	100.0	2	0	0	2
Short-term complications of diabetes	5	5	15.1	20.0	9	1	0	10
Acute appendicitis with complications	27	17	11.3	9.0	42	2	9	35
Urinary tract infections	22	16	2	86.8	26	12	11	27
Total cases 0-17 years	**247**	**166**	**6.3**	**43.5**	**356**	**57**	**82**	**331**

Table 4: Province of Trento. Care characteristics in avoidable cases 0-17 years. By clinical condition. Year 2018.

Clinical conditions	Hospitalization regime		% urgent admission	% week end admission	% Dicharge at home	Average hospital stay
	Ordinary	Day H/surgery				
Gastroenteritis	31	1	90.6	34.3	100%	5.8
Asthma	9	2	72.7	18.2	100%	2.6
Tonsillectomy	24	220	49.6	0.8	100%	1.3
Otitis	23	9	90.6	9.3	100%	2.9
Vaccine-preventable infectious disease	2	0	100.0%	0,00%	100%	3.0
Short-term complications of diabetes	9	1	60.0%	30.0	100%	3.5
Acute appendicitis with complications	44	0	100.0	27.3	100%	6.2
Urinary tract infections	34	4	86.8	39.4	100%	3.7
Total cases 0-17 years	**176**	**237**	**68.7**	**11.4**	**100%**	**3.6**

Table 5: Province of Trento. Hospitalization rates/1000 residents for each type of avoidable hospitalization 0-17 years and 95% CI. Year 2018.

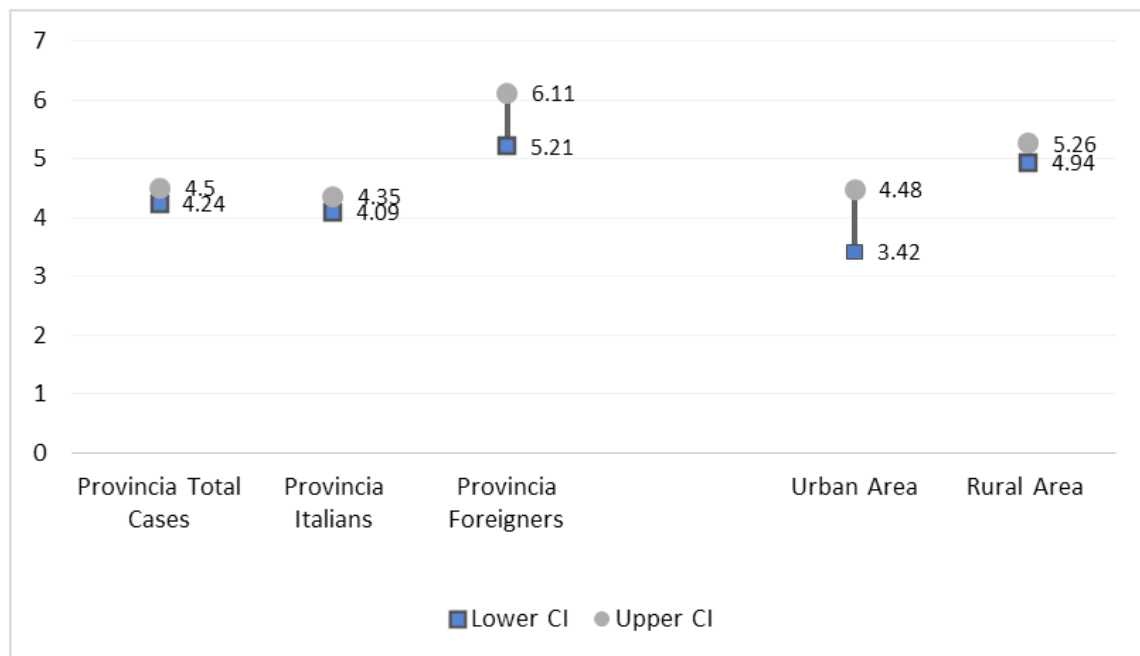| Clinical condition	Hospitalization rate/1000	CI 95%
Gastroenteritis	0,34	0.31-0.37
Asthma	0,12	0.08-0.16
Tonsillectomy	2,59	2.49-2.69
Otitis	0,34	0.31-0.37
Vaccine-preventable infectious disease	0,02	0.0-0.04
Short-term complications of diabetes	0,11	0.08-0.15
Acute appendicitis with complications	0.47	0.43-0.51
Urinary tract infections	0.40	0-37-0.43

Figure 1: Province of Trento. Hospitalization rate/1.000 for all avoidable cases 0-17. Provincial level, italians and foreigners. Urban and rural area. 95% CI. Year 2018.
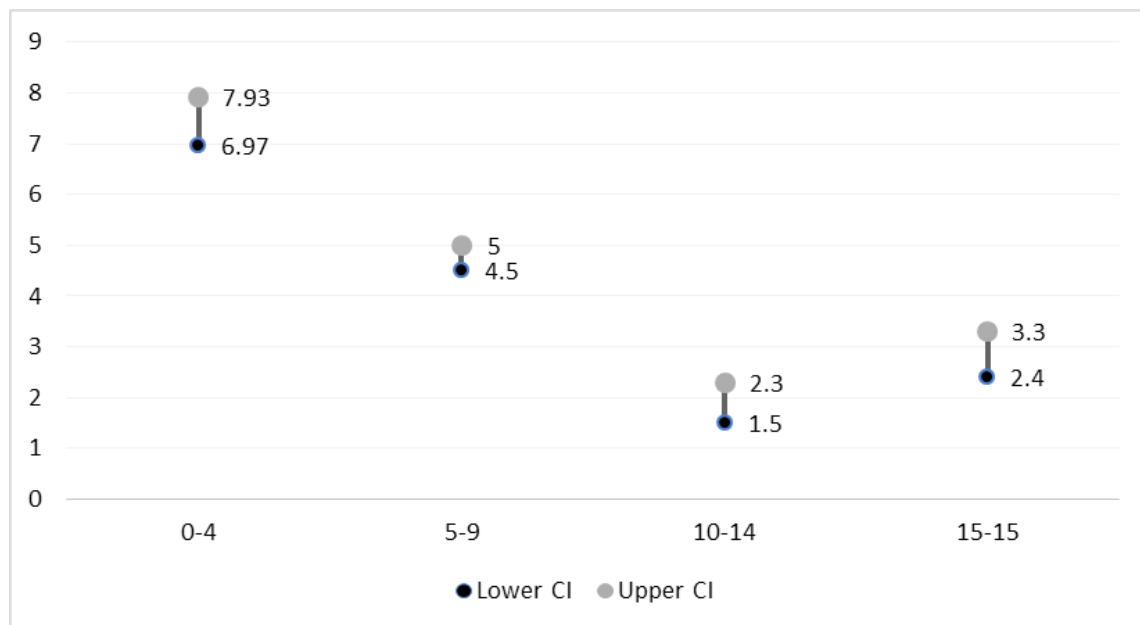

Figure 2: Province of Trento. Hospitalization rate/1.000 for all avoidable cases. By age classes. Year 2018.

Table 6: Province of Trento. Maternal and perinatal characteristics between cases with avoidable hospitalizations and control without avoidable hospitalizations 0-17 anni. Year 2018.

Maternal/Perinatal factors	Cases	Controls	ODDS Ratio and 95% CI
Average age of the mother	32 (range 19-51)	32 (range 16-53)	-
% mother <19 years	0.10%	0.40%	2.53 (0.74-8.64)
% foreign mother	19.30%	21.70%	0,89 (0,68-1.16)
% preterm babies	6.9%	6.2%	1.13 (0.72-1.77)
% mother with a low educational qualification	25.70%	20.50%	1,33 (1.03-1.73)

in an urban area and 80.2% in a rural area (Table 3). As regards the care characteristics, 57.0% of the total cases have been hospitalized in day hospital/day surgery with a wide variability between the types and a higher value (90.0%) in the case of tonsillectomy. Urgent hospitalizations represent 68.7% of cases overall, with a higher proportion in the case of complicated acute appendicitis, otitis and gastroenteritis. Only 11.4% of hospitalizations take place over the weekend with a higher proportion in the case of urinary tract infections. All cases are discharged to their home for an overall average hospital stay of 3.6 days. Hospitalizations for tonsillectomy and acute appendicitis with complications represent 28.4% and 26.3% of hospital days, respectively (Table 4). The hospitalization rate for individual pathologies confirms the highest value for tonsillectomy (Table 5), a value that remains higher than the national average value reported by the S. Anna Institute of Pisa [4]. Considering the set of avoidable conditions, a higher hospitalization rate emerges at the provincial level in foreigners than in Italians with a statistically significant difference. The overall rate is also higher among residents in rural areas than among residents in urban areas also in this case with a statistically significant difference (Figure 1). Hospitalization takes on a decreasing trend with increasing age, a fact that can be found in a similar way both in urban and rural areas (Figure 2). As regards the evaluation of maternal and perinatal factors, it must be noted that the linkage between the hospital admissions database and the BAC database was possible for 85% of cases for 12% of the cases the BAC data was not available as they were born outside the province and for 3% of the cases, the relevant information was missing. Between cases and controls no difference emerges in terms of the age or citizenship of the mother or in terms of the proportion of premature births (Table 6); instead there is an excess of subjects with low qualifications among the mothers of cases with avoidable hospitalization. This excess is statistically significant (p <0.05).

Discussion

The use of hospital data to analyze the quality of primary care has long been known, assuming that the conditions chosen as an indicator of this quality can express the ability of community services to manage them in an appropriate and timely manner [6]. This evaluation approach also has limitations in the face of the difficulty of evaluating the activity of community health services (Continuity Care Service, General Practitioners, Family Pediatricians and Territorial outpatient activities) according to direct methods. It should also be taken into account that there are factors, determining a hospitalization, which are beyond the possibility of control by primary medicine itself [7,8]. This is a series of social and cultural factors that may have a significant importance in the management of health problems, in the request for a health intervention or in access to services, such as the level of health literacy, the level of income or education, family and in particular parenting resources present. Another factor to keep in mind may be the existence of language barriers that can act as an obstacle to access to services by more vulnerable categories such as foreigners [9,10]. The informative potential of hospital data is influenced on the other hand by the type of variables that are of routine collection and by the quality of the recording. In this study we tried to make the best use of the variables collected in the hospital discharge form which presents a format governed by a national standard [11]. Taking these limitations into account, our study nevertheless provides interesting starting data against which a multi-professional working group can compare itself. This comparison may represent an important moment for an acquaintance between operators of different health services who do not always have the opportunity to interface on a shared topic [12,13]. The work described goes beyond what is made available by the national monitoring systems that make a comparison between regions on the exclusive basis of the hospitalization rate [4,5]. The cases provided are affected by the inclusion criteria used and only partially allow a comparison with previous Italian data, which are however limited. There is an excess of hospitalization due to ACSC conditions in males and in the 0-4 age group, aspects already reported by previous studies [14-19].

The weight of potentially avoidable hospitalizations reported in our study is equal to 6.8% of all hospitalizations in the age of 0-17, a value that appears lower than that reported by previous Italian studies, as well as that of the overall hospitalization rate [18-20]. Hospitalization appears greater, in addition to males, in those who reside in rural areas, that is, in the suburbs of the capital city of Trento and in foreigners. Several aspects may be at play at the basis of this evidence. With regard to factors relating to health services: the distribution of primary care services in the territory, the quality of territorial care after childbirth in a mother at risk, the level of integration between hospital services and territorial services, the quality of communication between different levels of the health services, the level of access and sharing of guidelines and / or operational protocols, the professional skills of health workers in the hospital-territory supply chain. Other factors at play could be the level of trust of the population in local operators and the custom of access to services. The frequent reorganizations of the territorial services, more for the necessity of the health structure than of the population, however, do not help to maintain a continuity of relations between the population and health services [21,22]. Moreover, the 0-4 age group includes over 40% of all

hospitalizations for ACSC, an aspect that leads to reiterate the importance of what is implemented by the community as a whole and by health services in the first 1000 days of development of the child in terms of early taking charge of cases at risk, breastfeeding, adherence to the controls provided for by health check by Family Pediatricians, adherence to good prevention and/or nutrition practices by the family [23-27]. Considering the individual clinical conditions, it emerges that 6 out of 10 hospitalizations are due to tonsillectomy operations, with a provincial rate that exceeds the national average [4,5]. Tonsillectomy with or without adenoidectomy continues to be one of the most frequent pediatric surgeries. In Italy, although there is a significant decrease in time, the use of tonsillectomy remains approximately 20-30% greater than that recorded in Northern European countries and significant regional differences remain. Variations in the use of intervention, between countries and within individual countries, are usually attributed to heterogeneity in medical practice and the training of specialists rather than to differences in morbidity [28-30]. However, it is not possible on the basis of hospital discharge data alone to define a priori how many of these interventions may have been unnecessary. It would be very useful to verify this aspect through a specific audit to be conducted through a standardized form, with the involvement of all the parties involved. It may be plausible to think that by optimizing the use of tonsillectomy, it may be possible to control the entire picture of avoidable hospitalizations at the age of 0-17 in the province of Trento. Hospitalizations on weekends, when general practitioners and family pediatricians are not active and doctors of the continuity of care service are activated, represent only 11% of cases. So in 9 out of 10 cases, hospitalization occurs on a weekday when there is the possibility of contact with a General Practitioner and / or a Family Pediatrician. Also in this case, the current data do not indicate whether or not the family contacted their doctor before admission. The overall care profile can be considered satisfactory, while taking into account, for non-surgical conditions, an excess of recourse to ordinary hospitalizations. All hospitalized subjects are discharged to their home after an average hospital stay, for the whole of the series of 3.6 days. The evaluation of maternal / perinatal factors was limited by the fact that the record linkage between hospital data and birth data was only possible in 85% of cases. Even with these limits, the role of the level of maternal education is confirmed, which in itself can be considered a proxy indicator of the socio-economic status. Various studies have reported an association between this indicator and hospitalizations for ACSC in the age of 0-17 [3,15,18,27]. In conclusion, studying and analyzing potentially avoidable hospitalizations is important for several reasons: 1. to reduce the burden of inappropriate hospital admissions, 2. to reduce hospital costs, 3. to reduce iatrogenic hospital risks, 4. to enable expansion of primary care services, 5. to ensure the long-term sustainability of the Health Service, 6. to improve in the long term, the integration between hospital level and territorial level, 7. to allow, at every level of the National Health Service, and especially at company level, a monitoring of their performances. The hospital information flows can provide a good level of knowledge but should be complemented by a depth assessment such as through an audit. The framework outlined by the study can represent the basis for implementing any improvements even if it is better than in other Italian regional areas. The homogenization of services in the provincial territory, the dissemination and practice of updated guidelines, support for breastfeeding and parenthood in a broad sense and the promotion of vaccinations, can contribute to the control of avoidable hospitalizations in the age of 0-17 years in a context of continuous transformation of the relationship between hospital and community. Monitoring of the phenomenon over time seems to be recommended to check for any deviations in relation to the changing characteristics of the population and the organization of health services.

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