Quality of child healthcare in European countries: common measures across international databases and national agencies

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Background: The evaluation of child healthcare is not yet widely explored, especially from a cross-country comparison perspective. The routine adoption of measures by national assessment agencies is under-investigated. Though the guiding principles developed at international level call for a child-centric multi-dimensional evaluation of child care, its feasibility is hampered by the availability of robust and harmonized data. **Methods:** To explore the data availability, international databases (IDBs) were scrutinized and measures dealing with child health-related issues were collated. In parallel, an *ad hoc* questionnaire was administrated to 30 Country Agents (CAs) to gather measures routinely adopted at local level. To facilitate the comparison of measures, a three-level conceptual map was developed. **Results:** The IDBs yielded at 207 measures that pertained mainly to non-health determinants of health, whereas the 352 measures obtained from CAs focused on process and outcome. A set of 33 common measures that related to immunization, morbidity and mortality were identified. **Conclusions:** A limited set of measures used both in IDBs and at national level identify common areas of concerns that certainly capture crucial issues with child prevention and health outcomes. However, they are far from satisfying a child-centric multi-dimensional approach to the evaluation of child well-being and well-becoming. There is room for improvement at both international and national levels. IDBs should include and harmonize measures that concern the provision of child-centric services and encompass physical, social and mental development. At the national level, efforts towards the inclusion of measures that concern non-health determinants of health should be pursued.

Introduction

Since the World Health Organization's (WHO) publication of the European child and adolescent strategy in 2005,[1] guiding principles for improving the quality of child healthcare have been developed at international level,[2–5] setting priorities to support policies and target specific areas of intervention. The multi-dimensional approach, which underpins these initiatives, reinforces the concept of well-being in its diverse components: physical, social and mental. It recognizes the importance of health-enhancing factors, such as lifestyle, as well as contextual aspects, among which are environment, economics and socio-cultural background. From this perspective, to monitor progresses achieved in the quality of child care, it is necessary to identify evidence-based measures grounded in robust and harmonized data gathered from different sources and possibly validated by health assessment agencies. Moreover, the adoption of a child-centred perspective requires the development of an *ad hoc* framework for quality care and standards that 'take into account children's right to health and recognizes that their health and physical, psychosocial, developmental and communication needs are different from those of adults'.[6] In fact, criteria used to evaluate the quality of care for adults cannot be directly translated to children as they differ in terms of health determinants, disease patterns and provision of preventive and therapeutic health services.[7] Efforts in this direction were achieved by the CHILD project,[8] which critically

revised and improved child health indicators.[9] It proposed a wide spectrum of indicators, including non-health determinants of health and risk and protective factors, which are key components in child healthcare assessment. The adoption of this comprehensive vision makes the evaluation of child healthcare quality a challenging task, especially in cross-countries analyses.

The monitoring of progress achieved by countries that have signed international conventions and/or adopted international strategies to improve child healthcare is rarely carried out.[10,11] Generally cross-country comparisons tend to be based on disease incidence,[12] on a limited number of countries,[13] on specific aspects, such as poverty,[2,3] or policy.[14] Comparative studies[15] on primary care services in Europe do not include the evaluation of child healthcare. The invisibility of children, which has been repeatedly observed,[14,16,17] strongly limits the evaluation of child care and influences the breadth of aspects to be considered when monitoring child well-being and well-becoming. Moreover, little is known about the routeing adoption of measures by national health assessment agencies[18] or on the operational issues and policies arising from the implementation of health systems' evaluation.[19]

This article aims to fill this gap through the identification of a set of core shared measures to verify whether a cross-country comparison of child healthcare is feasible. Moreover, it intends to explore whether the available measures fulfil the requirements of a comprehensive, multi-dimensional evaluation of child care from a cross-

country perspective. It analyzes, on the one hand, international databases (IDBs) that collect data on the evaluation of child health status and, on the other hand, the measures routinely used in EU/EEA countries to evaluate the quality of child healthcare.

This study is part of the Models of Child Health Appraised (MOCHA) project that aims to investigate the complexity of health systems in Europe through the appraisal of existing national models of primary healthcare for children.

Methods

Sources of information

To explore the available measures that capture the multi-dimensional aspects of quality of healthcare for children, two types of sources were examined: IDBs and results of a survey submitted to national experts of the healthcare system in the 30 EU/EEA MOCHA countries.

Open-access IDBs dealing with child health-related issues released by main international organizations, agencies, research networks and observatories were scrutinized and their cross-country data availability verified. To be collected, a measure should be child-specific and/or child-related, focused on any health or care-related domain and reported by at least one MOCHA country.

For each identified measure, its description, last available year, child age reference, gender coverage, data availability for each country and the originating source(s) were recorded. Databases were inspected from February to May 2017.

To gather information on measures currently used for evaluating the quality of child healthcare at national level, an ad hoc questionnaire was administered to national experts [Country Agents (CAs)]. They were appointed by the MOCHA project and selected on the bases of their knowledge of paediatric care in their country. They were supported by a network of collaborators to cover the different aspects considered in the project.[20]

The aim of the questionnaire was to explore whether and to what extent child healthcare is recognized as a specific target of quality through the analysis of the metrics routinely used at national level. CAs were asked to list the measures currently used in their own country for evaluating the quality of child healthcare, and to report pertinent references to official documents (e.g. policy documents and/or assessment reports), web links and scientific works produced at national or regional level. These materials were thoroughly examined to identify further unreported measures. A table that summarized all the measures was sent back to the CAs for further checks and clarifications. The queries were sent to the CAs by the end of 2016; the majority of the replies was received between January and May 2017 whilst additional answers were received in May 2018.

Among the 27 MOCHA countries that responded to the questionnaire, four do not have agencies for the evaluation of the quality (Greece, Malta, Poland and Romania). A total of 23 countries reported the presence of agencies, half of them devoting a specific part to child healthcare, while the other countries integrate some child-specific items within their health system evaluation.

Framework identification and measures classification

To facilitate the comparison of measures collected in both IDBs and CAs' questionnaires, an iterative analysis combining a top-down and a bottom-up approach was adopted to provide a comprehensive map of the different areas of concerns used to evaluate child healthcare. A reference point for the identification of the taxonomies was the conceptual framework developed by Arah et al.,[21] which has been variously adopted[15,22,23] to perform country comparison of health systems. This framework has the advantage of expanding the Donabedian's model based on structure, process and outcomes,[24] balancing domains specifically related with health performance measures with those closely connected with factors that influence a child's well-being. This is also in line with measures proposed by previous research projects[8,9,25,26] and literature[27,28] on quality indicators that underline the importance of including societal and public health determinants for a more comprehensive evaluation of child healthcare quality.

To build the framework, two research teams independently analyzed and classified the collected measures, and a consensus was reached by subsequently consulting external experts, especially in cases of possible double attributions. The criteria for defining common measures were based on their description and the extent to which both of them would provide equal or equivalent information. When measures were based on different denominators (i.e. at 3 months vs. at 6 months), they were considered separately, while when they were expressed through different rates (e.g. per 100 000 inhabitants vs. per 1 000 000 inhabitants) a harmonization was pursued.

The result of this iterative process is a three-level map that accommodated the different perspectives of the selected sources of information (figure 1). At the highest level of the map are the domains [social, political, economic and environmental context (SPEEC), health-related behaviour (H-RB), structure, process and outcome], while the other two levels were named categories and sub-categories. Colours on the map helped the identification of specificities of each type of source (dark gray for IDBs and light gray for CAs) as well as their communalities (white background).

The entire set of results, as well as the classification of measures within the conceptual map, is available in the Zenodo repository.[29]

Results

Analysis of IDBs

Table 1 shows the analysis of measures available in IDBs. Almost two-thirds of the 207 measures were retrieved from OECD databases (66.2%). Eurostat and the WHO provided 14% and 5.8% of the measures, respectively, while the other identified sources contributed <3% each. A total of 15 measures were found from multiple sources mainly pertaining to immunization and mortality.

The oldest measures collected are from 2002 to 2010 (14.5%), whereas the most recent ones are from 2015 to 2016 (34.3%).

More than half of the measures (57%) have an available estimate for 26–30 countries, 26% for 21–25 countries, while for 7.2% the data are available only for 1–5 countries. For six countries, estimates are available for <70% of the measures (Lithuania 68%, Romania 67%, Bulgaria and Malta 63%, Croatia 62% and Cyprus 49%), highlighting important gaps for cross-countries comparison.

Considering the gender perspective, only 29% of the measures report the estimate for male and female separately, while for 38% of the measures, gender disaggregation is not available.

A total of 157 measures (76%) are age-related, and among them, 87 (42%) describe a specific age group. Two age groups are most frequently covered: the one related to children that are <1 year old ($n=41$) with measures related to vaccine administration, neonatal/infant mortality and breastfeeding. The other considers the 10–17 years age group ($n=42$), focussing on school performance and lifestyle behaviours. Measures that fall in multiple age ranges ($n=70$) are generally related to diseases, hospitalization, health and school health service expenditures, using the traditional 5-year range, which do not consider important phases of children's psychophysical development.

The most represented domain is SPEEC (49.3%), followed by outcome (19.3%), while the other domains are almost evenly depicted.

Analysis of CAs' questionnaires

Considering the 23 compiled questionnaires, 352 measures were identified. Looking at the domains in which these measures are
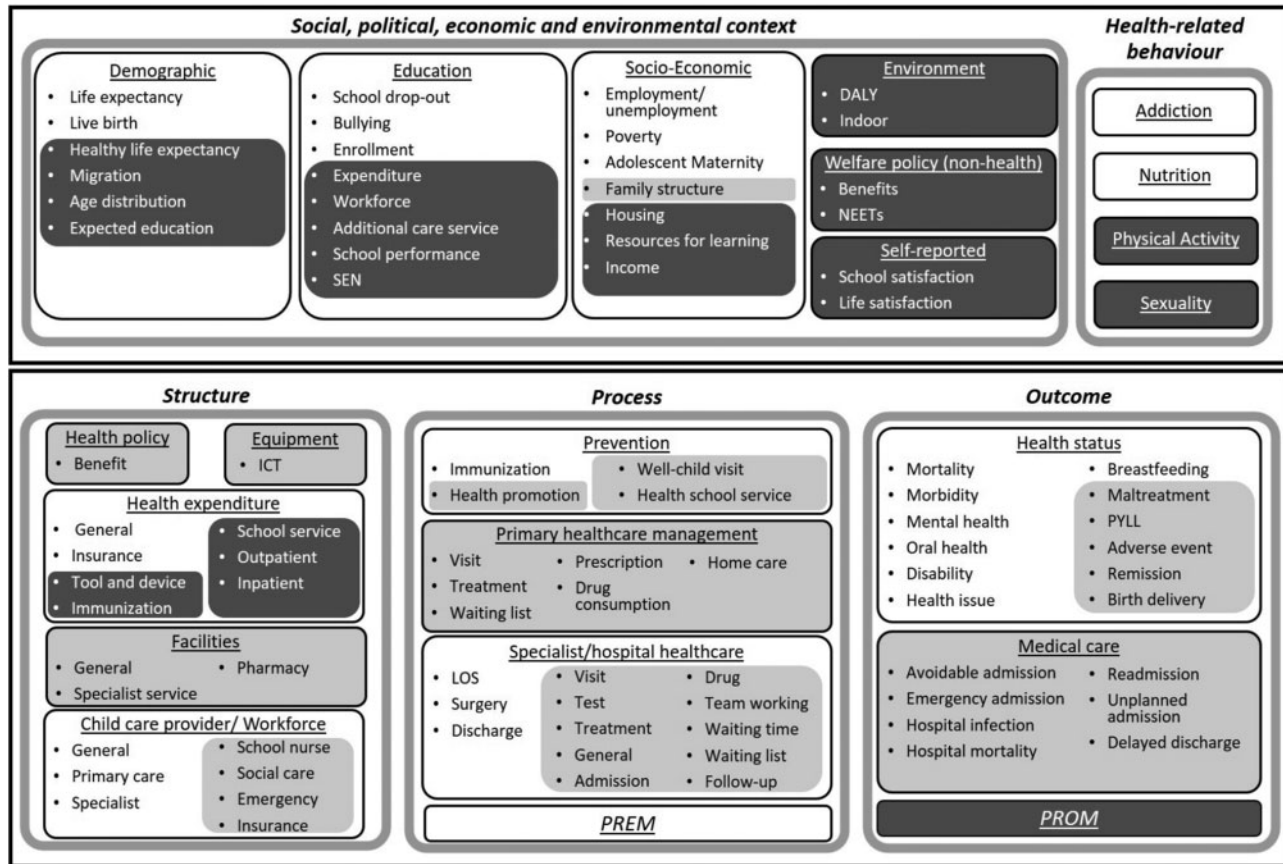
Figure 1 Map of the domains, categories and sub-categories

Notes: In white, core sub-categories covered by both sources; in dark gray, sub-categories only covered by international databases; in light gray, sub-categories only covered by MOCHA countries. DALY, disability-adjusted life years; ICT, information and communications technology; LOS, length of stay; NEETs, not in education, employment or training; PREM, patient reported experience measure; PROM, patient reported outcome measure; PYLL: potential years of life lost; SEN, special education needs.

distributed, the overall tendency is towards measures classified in the process (50.7%), outcome (33.0%) and structure (10.3%) domains. Country evaluation of non-medical determinants of health is rarely accomplished (3.1% for SPEEC and 2.9% for H-RB).

From a country perspective, they are not equally distributed, ranging from a minimum of six measures (Iceland) to a maximum of 130 (UK) (cf. data in 29). Only six countries reported at least 20% of all the retrieved measures: UK (37%), Finland (29%), Ireland (25%), Austria (22%), Estonia (22%) and Denmark (20%). This high variability is evident considering majority (87.1%) of the measures are reported by at most four countries and that close to half of them (44.6%) are reported by only one country. An in-depth analysis of variability[30] highlighted differences in the adoption of measures that privilege a wide spectrum of different aspects of child well-being (breadth vision) vs. a more focused selection of measures that evaluate specific area of concerns from different perspectives (depth vision).

Considering the classification of measures within age ranges, 122 measures (35%) are age-related, and among them, only 34 measures (28%) have a single age range that focus on the neonatal period ($n=29$), especially on birth and delivery ($n=9$) and mortality ($n=8$). Within the measures that cover more than one age interval, 51 measures (42%) comprise the 0–17-year period of life and 7 measures (6%) cover the whole spectrum of age ranges. Among them, 64% consider childhood and adolescence as a whole period, without making any age group distinction. These measures are generally related to hospitalization rates distributed by pathologies or track the prevalence of certain diseases.

Table 2 contains the 29 measures adopted by at least six countries (25% of the CAs). The most common one is immunization

rate, adopted by 13 countries. Additional measures regarding immunization highlight its central role, not only in the child health prevention, but also in the child care process in general. These measures are child-specific and focus on explicit age ranges, the majority of them related to the first years of life. Among the 11 measures that consider a single age range, 7 are related to the neonatal period, while only 1 measure is focused on age 1–4 years. The remaining three measures cover four out of the five age classes considered. Moreover, there is an evident concentration of the measures on two key focal points: natality and mortality. Considering natality, the countries reported the generic birth rate, the number of stillborn and the number of live births, while mortality is considered both in general terms (total mortality per age group) and for specific life periods (birth, neonatal, infant and adolescence).

This analysis not only highlights the worrying lack of common measures of children's healthcare quality in Europe,[30] but also shows the evident gap in the selection of child-specific measures that do not consider other important aspects of child life-course development.

Common measures

The analysis of both sources of information highlights the different perspectives used to evaluate child healthcare, as depicted in the coloured areas of figure 1. Domains directly linked to child healthcare (structure, process and outcome) show the predominance of sub-categories used at country level, while domains covering non-healthcare determinants (SPEEC) and lifestyle attitude (H-RB) present a higher proportion of measures collected by IDBs.

Table 1 Characteristics of the 207 measures collected from IDBs

Measures	n	(%)
Source		
Centralized Information for Infectious Diseases (CISID)	2	(1.0)
Eurostat	29	(14.0)
Organization for Economic Co-operation and Development (OECD)	137	(66.2)
The World Bank Data	6	(2.9)
United Nations Children's Fund (UNICEF)	6	(2.9)
World Health Organization (WHO)	12	(5.8)
Multiple sources[a]	15	(7.2)
Last available year		
2002–10	30	(14.5)
2011–12	28	(13.5)
2013–14	78	(37.7)
2015–16	71	(34.3)
Countries' coverage		
1–5 countries	15	(7.2)
6–10 countries	6	(2.9)
11–15 countries	5	(2.4)
16–20 countries	9	(4.3)
21–25 countries	54	(26.1)
26–30 countries	118	(57.0)
Gender disaggregation available		
Yes	60	(29.0)
No	79	(38.2)
Not applicable	68	(32.8)
Age		
Specific age range:		
<1	41	(19.8)
1– 4	3	(1.4)
5–9	1	(0.5)
10–17	42	(20.3)
18–24	0	–
Overlapping rages (i.e. 0–4, 0–17, 0–24, 1–9, 1–24, 5–17, 10–24)	70	(33.8)
Not applicable	50	(24.2)
Domains		
Structure	20	(9.7)
Process	23	(11.1)
Outcome	40	(19.3)
Health-related behaviour	22	(10.6)
Social, political, economic and environmental context	102	(49.3)
Total	207	(100.0)

a: Beyond the reported ones, additional sources were: Eurobarometer; European Observatory on Health System and Policies; European Quality of Life Survey; Health Behaviour in School-ages Children (HBSC); Institute for Health Metric and Evaluation (IHME).

Table 3 shows the 33 common measures identified in both the IDBs and the CAs' questionnaire.

This analysis looked at the metrics used to evaluate child care through a different lens, considering the common measures detected in the analysis of CAs' questionnaires. Its aim is to confirm a potential use of shared, available measures on which a consensus on its importance has been achieved, especially when they are widely diffused in the current practice of national assessment agencies. In this way, they can represent a candidate set of core measures for cross-country analysis, and/or be suggested as metrics to be introduced at country level.

The results in table 3 are presented starting from the domain containing the majority of the common measures, i.e. the outcome domain (39.4%). Among the 13 measures classified in this domain, 7 concern mortality rates with different levels of granularity, sometimes with a certain degree of overlap. The main focus is on infant mortality, referred to as specific child age (neonatal and perinatal), along with causes of deaths. These measures were provided by IDBs for the majority of countries considered in this analysis,

even if they are not always included in the evaluation of child care at national level.

In nine countries, breastfeeding is considered an important aspect for the evaluation of the quality of healthcare. Moreover, two measures on the proportion of children who were exclusively breastfed at 3 and 6 months were also available in the IDBs for an additional 10 countries.

Within the process domain, the prevention category includes measures mostly related to immunization, providing different clusters of vaccines and vaccination periods, while the specialist/hospital care category comprises measures concerning in-patient length of stay and discharges. Both aspects offer important information on the delivery of primary and secondary care.

Three measures common to the two sources belong to the structure domain and concern general health expenditure and workforce, confirming that this domain is more widely assessed at country level and considers a larger set of diverse aspects.

Although the SPEEC domain is mainly covered by IDBs, in six subcategories, there are measures shared by the two sources. These concern population demographic characteristics, education and socio-economic contexts. It is worth noticing that bullying, which is an emergent concern analyzed by an international survey, is adopted at country level more frequently than other surveys reported in IDBs, such as those related to lifestyle behaviour.

Considering the domain H-RB, two measures concern addiction (tobacco and alcohol) and four measures refer to nutrition (consumption of fruits and vegetables and two related to obesity). These are potential candidates for evaluating the quality of healthcare in several countries as the country coverage by IDBs is almost complete. More importantly, they are among the few indicators that consider adolescents as a target group for the evaluation of quality of health.

Discussion

This article presents the results of an analysis carried out in parallel on two sources of information. On the one hand, IDBs were inspected to collect measures that monitor child health and investigated data availability at EU/EEA country level. On the other hand, measures adopted at country level for the routine evaluation of child care were analyzed on the basis of information and documents provided by MOCHA-appointed CAs.

The three-level map of child relevant domains allowed for the classification of a considerable number of measures collected (IDBs=207 and CAs=352) and facilitated the detection of possible specialities of the two groups of sources and/or communalities. Moreover, the resulting map outlines the breadth of domains and sub-categories that, even if further improvable, may represent a starting point for an adequate multi-dimensional evaluation of child healthcare.

What emerged from the comparison of the two sources of information is the tendency to privilege different aspects of care for children. This is evident already at the domain level: the IDBs collect data mainly focused on socio-economic aspects, while the evaluation at country level tends to adopt measures related to process and outcome. Differences in scope of data collection may explain this tendency. IDBs aim to monitor and compare the population health status by providing a benchmark useful for the identification of areas of intervention that do not exclusively pertain to health systems. For this reason, they adopt a broader concept of child well-being, which considers the different socio-economic characteristics of each country. On the contrary, agencies performing quality assessment tend to focus on the performance of the health services based on the resources available in the structure, the process applied, and finally considering its effects in terms of outcomes. This is probably related to the traditional flow of routinely collected administrative information that in many countries is related with the increasing necessity of monitoring health expenditure and containing costs.

If these differences in perspectives at the domain level can enrich the evaluation of child healthcare, when it comes to an in-depth

Table 2 List of the 29 measures reported by at least 25% (*N*=6) of the countries: measure description, number of countries using it and its characteristics

Measure	Domain	Sub-category	# of countries	Measure characteristic		
				Child-specific	Disease-specific	Age-specific [age range] years
Immunization rates/ coverage	Process	Immunization	13	√		
Infant mortality per 1000 live births	Outcome	Mortality	11	√		[0–11m.]
Number of live births	SPEEC	Live birth	10	√		[0–11m.]
Immunization coverage MMR (measles/mumps/ rubella)	Process	Immunization	9	√	Measles Mumps Rubella	
% of low birth weight newborns	Outcome	Health issue	9	√		[0–11m.]
Number of stillborn children per population	Outcome	Mortality	9	√		[0–11m.]
Number of health workers/human resources	Structure	General	8			
Percentage of children aged 24 months who have received 3 doses diphtheria (D3), pertussis (P3), tetanus (T3) vaccine, haemophilus influenzae type b (Hib3), polio (Polio3), hepatitis B (HepB3) (6 in 1)	Process	Immunization	8	√	Diphtheria Tetanus Pertussis Poliomyelitis Haemophilus B Hepatitis B	[1–4]
Immunization coverage DTP3 (diphtheria, tetanus, pertussis vaccine, 3 doses)	Process	Immunization	8	√	Diphtheria Tetanus Pertussis	
Hospitalization rate (among children and adolescents) per 1000 [100 000]	Process	Admission	8	√		[0–11m.] [1–4] [5–9][10–17]
In-patient hospital days (length of stay) for common diagnoses	Process	Length of stay	8			
Teenage pregnancies per 1000 females	SPEEC	Adolescent maternity	8	√		
Number of dental care providers	SPEEC	Specialist	7			
Health expenditure per capita	Structure	General	7			
% children aged who have received 3 doses meningococcal C (MenC3) vaccine	Process	Immunization	7	√	Meningitis	
Caesarean section rate	Outcome	Birth delivery	7	√	Caesarean delivery	[0–11m.]
% of babies exclusively breastfed (up to 6 months age)	Outcome	Breastfeeding	7	√		[0–11m.]
Total mortality per age groups	Outcome	Mortality	7			[0–11m.] [1–4] [5–9][10–17]
Birth rate	SPEEC	Live birth	7	√		
% 12 years girls who have received first dose of HPV1 (human papillomavirus) vaccine	Process	Immunization	6	√	Papilloma virus	[10–17]
Use of antibiotics (DDD/ defined daily dose per bed-days/patients)	Process	Drug consumption	6			
Health visitors home care visits	Process	Home care	6			
Outpatient attendances at paediatric hospitals	Process	Admission	6	√		
Hospitalization due to asthma bronchial (among children and adolescents)	Process	Admission	6	√	Asthma	[0–11m.] [1–4] [5–9][10–17]
Number of hospital discharges	Process	Discharge	6			

(continued)

Table 2 Continued

Measure	Domain	Sub-category	# of countries	Measure characteristic		
				Child-specific	Disease-specific	Age-specific [age range] years
Cancer incidence (among children and adolescents) per 100 000	Outcome	Morbidity	6	√	Cancer	
Number of children who die 0–14/0–27 days (neonatal death) after birth per 1000 live births	Outcome	Mortality	6	√		[0–11m.]
Suicide rate among adolescents per 100 000	Outcome	Mortality	6	√		
Spontaneous abortions	Outcome	Mortality	6	√	Abortion	

Table 3 Common measures between IDBs and national experts, categorized within the map domains

Sub-category	IDBs measure	CAs measure	IDBs countries	CAs country
Outcome domain **Category: health status**				
Breastfeeding	% of children who were exclusively breastfed at 3 months	% of babies breastfed at first visit (or 3 month)	BEL, CYP, CZE, DNK, ESP, FIN, GBR, HUN, ISL, ITA, NLD, NOR, PRT, SVK	DEU, GBR, IRL, LVA
Breastfeeding	% of children who were exclusively breastfed at 6 months	% of babies exclusively breastfed at 6 months	All MOCHA countries excluding EST, FRA, LTU, SVN	EST, FIN, GBR, HUN, IRL, LTU, NLD
Health issue	Number of live births weighing <2500 g as a proportion of total live births	% of low birth weight newborns	All MOCHA countries excluding CYP	AUT, BEL, DEU, EST, FIN, GBR, IRL, ITA, PRT
Disability	% of children aged 0–15 with a disability, by severity, age and sex	Newly recognized disabilities of children	ESP	BGR, LVA
Morbidity	% of children age 13–14 self-report that they have ever had asthma % of children age 6–7 whose parents that the child has ever had asthma	% of children suffering from asthma by age group	AUT, BEL, DEU, ESP, EST, FIN, GBR, IRL, ITA, LTU, LVA, MLT, POL, PRT, ROU, SWE	AUT, DEU, EST, FIN
Morbidity	Estimated number of children (0–14) with type 1 diabetes	Incidence rate of diabetes type 1/type 2 among 0–14 years children	All MOCHA countries excluding BGR, HRV, MLT, ROU,	AUT, EST, FIN, LTU, LVA
Mortality	Crude death rate for all childhood cancers	Cancer mortality among children and adolescents	All MOCHA countries	AUT, FIN, GBR
Mortality	% of suicides by people aged 15–19	Suicide rate among adolescents	All MOCHA countries	AUT, FIN, GBR, IRL, LTU
Mortality	Infant mortality, total and by age, cause of death, country of occurrence and residence, NUTS 2 region of residence and occurrence	Infant mortality	All MOCHA countries	AUT, BGR, CYP, DEU, EST, FIN, GBR, HUN, LVA, LTU, IRL
Mortality	Under 20s deaths, total, by age, cause of death, NUTS 2 region of residence, country of residence and occurrence	Mortality rate related to the 10 most important causes of death (ICD-10) by age	All MOCHA countries	AUT, FIN, GBR, IRL, LTU
Mortality	Perinatal mortality, total and by country and NUTS 2 region of occurrence	Perinatal mortality	All MOCHA countries excluding ISL	BRG, LVA
Mortality	Perinatal death 1000+ grams	Mortality rate by birth weight (1000 grams and over)	All MOCHA countries excluding BGR, ESP, FRA, GBR, GRC	LVA
Mortality	Neonatal mortality, total, by type, country and NUTS 2 region of occurrence	Number of children who die 0–14/0–27 days after birth (neonatal death)	All MOCHA countries	BGR, EST, FIN, GBR, IRL, NOR
Process domain **Category: prevention**				
Immunization	% of infants vaccinated against diphtheria,	% of children aged 24 months who have	All MOCHA countries	AUT, DEU, EST, FIN, GBR, IRL, ITA, LVA

Table 3 Continued

Sub-category	IDBs measure	CAs measure	IDBs countries	CAs country
	tetanus, pertussis vaccine, three doses (DTP3)/haemophilus influenzae type b (Hib3), polio (Polio3), hepatitis B (HepB3) in the first year of live	received 3 doses DTP3 vaccine, Hib3, Polio3, HepB3 (6 in 1)		
Immunization	% of infants vaccinated against measles-containing vaccine (MCV1//MCV2)/mumps/rubella containing vaccine (RCV1)	Immunization coverage measles/mumps/rubella (MMR)	All MOCHA countries	AUT, DEU, EST, FIN, GBR, ITA, LTU, LVA, IRL, SWE
Immunization	% of infants vaccinated against DTP3	Immunization coverage DTP3	All MOCHA countries	AUT, DEU, EST, FIN, GBR, LTV, LVA, POL, IRL
Immunization	% of surviving infants who received the third dose of pneumococcal conjugate vaccine (PCV3)	Immunization coverage pneumococcal/PCV booster (pneumonia, septicaemia, meningitis)	BEL, BGR, CYP, DEU, DNK, FRA, GBR, GRC, HUN, IRL, ISL, ITA, LUX, NLD, NOR, SVK, SVN, SWE	DEU, FIN, GBR, IRL, ITA
Category: specialist/hospital care				
Length of stay	Hospital days of in-patient (bed-days), total and by ICD10 and NUTS 2 region	In-patient hospital days (length of stay) for common diagnoses	BEL, CYP, CZE, DEU, DNK, FIN, FRA, GBR, HRV, HUN, ISL, ITA, LTU, MLT, NLD, NOR, POL, PRT, ROU, SVK, SWE	CYP, DNK, EST, FIN, GBR, IRL, LTU, LVA
Discharges	Hospital discharges, in-patient, total and by diagnosis and NUTS 2 region	Number of hospital discharges	BEL, BGR, CYP, CZE, DEU, DNK, FIN, FRA, GBR, HRV, HUN, ISL, ITA, LTU, MLT, NLD, NOR, POL, PRT, ROU, SVK, SWE	AUT, EST, FIN, GBR, IRL, LTU
Structure domain				
Category: health expenditure				
General	% current expenditure on health for pregnancy, childbirth and the puerperium	Payment for assistance in childbirth	CZE, DEU, HUN, NLD, SVN	LVA
General	% current expenditure on health, by disease (ICD)	Health expenditure per capita	CZE, DEU, HUN, NLD, SVN	AUT, CZE, DNK, EST, FIN, GBR, IRL
Category: child care provider/workforce				
Primary care	Physicians by medical speciality: general paediatricians	Number of medical doctors by specialty	All MOCHA countries excluding SVK	BGR, DEU, LVA
Social, political, ecomomic and environmental context (SPEEC) domain				
Category: demographic				
Life expectancy	Life expectancy, at birth and per year of age, total and by gender	Life expectancy	All MOCHA countries	BRG, DNK
Live birth	Live births	Number of live births	All MOCHA countries	AUT, BEL, BRG, CYP, EST, FIN, GBR, LTU, IRL, LVA
Category: education				
School drop-out	% of primary-school-age children who are not enrolled in primary or secondary school.	Early school-leavers	All MOCHA countries excluding AUT, CZE, SVK	AUT
Bullying	% of 11- to 15-year-olds who report having been bulled at least 2 or 3 times at school in the previous couple of months, by gender	% of children aged 10–17 who report having been bullied at school	All MOCHA countries excluding CYP	AUT, FIN, GBR, IRL, NLD
Category: socio-economic				
Adolescent maternity	Teenage births adolescent fertility rate (births per 1000 women ages 15–19)	Teenage deliveries (age 15–17 years)	AUT, BEL, CZE, DEU, DNK, ESP, FIN, FRA, GBR, GRC, HUN, IRL, ISL, ITA, LUX, NLD, NOR, POL, PRT, ROU, SVK, SWE	GBR, ICE, LTU
Poverty	At risk of poverty rate (cut-off point: 60% of mean equivalized income), age 0–17	Poverty of children and adolescents; lasting risk of poverty	All MOCHA countries	AUT, GBR
Health-related behaviour (H-RB) domain				
Category: addiction				
				AUT, DEU, FIN, GBR, NLD

(continued)

Table 3 Continued

Sub-category	IDBs measure	CAs measure	IDBs countries	CAs country
	% of 11- to 15-year-olds who smoke at least once a week by gender	Smoking prevalence at 12–19 years	All MOCHA countries excluding CYP, EST, LVA	
	% of 11, 13 and 15 year-olds who have been drunk at least twice, by gender or age	Incidence of alcohol addiction by gender and age groups	All MOCHA countries excluding CYP	FIN, LTU, LVA
Category: nutrition	Daily fruit eating among 15-year-olds	Frequency of fruit consumption by children and adolescents by age group	All MOCHA countries excluding CYP	AUT, DEU
	Daily vegetable eating among 15-year-olds	Frequency of vegetable consumption by children and adolescents by age group	All MOCHA countries excluding CYP	AUT, DEU
	Body mass index by sex, educational attainment level and income quintile [15–19 years] % of underweight, normal, overweight, pre-obese; obese	Overweight per age groups Obesity per age group	All MOCHA countries excluding IRL, ISL	AUT, DEU, NLD

IDBs, international databases; CAs, country agents; AUT, Austria; BEL, Belgium; BGR, Bulgaria; HRV, Croatia; CYP, Cyprus; CZE, Czech Republic; DNK, Denmark; EST, Estonia; FIN, Finland; FRA, France; DEU, Germany; GRC, Greece; HUN, Hungary; ISL, Iceland; IRL, Ireland; ITA, Italy; LVA, Latvia; LTU, Lithuania; LUX, Luxembourg; MLT, Malta; NLD, the Netherlands; NOR, Norway; POL, Poland; PRT, Portugal; ROU, Romania; SVK, Slovak Republic; SVN, Slovenia; ESP, Spain; SWE, Sweden; GBR, UK.

analysis of measures considering both categories and sub-categories, the feasibility of integrating available data is hindered by the variety and specificity of the metrics. This is true especially when comparing measures used at country level. MOCHA countries provide a different emphasis on the evaluation of child healthcare as indicated by the number of measures adopted (from 6 to 130 measures) and by the limited number of measures in common among the selected specific aspects (29 out of 352). Moreover, even among common measures, the number of countries that share the same metrics is not so high, when considering that only one measure is common in at most 13 out of 23 countries. Similarly, the identification of common measures in both IDBs and CAs' questionnaires shows not only a limited set of core measures, but also a restricted range of aspects that partially capture the evaluation of child healthcare. They generally coincide with those resulting from cross-country comparisons. Both sources of information are mainly focused on immunization, morbidity and mortality, which certainly capture crucial issues of child prevention and important healthcare outcome. However, they are far from satisfying a child-centric multi-dimensional approach to the evaluation of child well-being and well-becoming. Note that, the majority of other common measures, such as breastfeeding, smoking, alcohol, vegetable and fruit consumption, adolescent maternity and risk of poverty, belong to recommended indicators reported in the European strategies for children and adolescents.[1,5,6,31] They are generally gathered through *ad hoc* international surveys and thus good candidates for cross-country comparison. Therefore, a wider adoption at country level can be encouraged to evaluate health-enhancing factors that identify health issues to be addressed with appropriate educational campaigns and policies. Conversely, looking at the variety of measures used at national level, there is room for cross-border learning from countries that use a large number of measures to enhance the evaluation of service provision for children and adolescents. This pertains in particular to the domain related to the provision of child services spanning from prevention (well-child visits and health promotion activities) to primary and secondary care (waiting time and waiting lists). This would allow a more precise evaluation of service delivery vis-à-vis children health needs. Moreover, a more detailed analysis of medical care in terms of treatment and prescriptions would provide evidence on children's burden of disease and health outcomes.

This analysis brings to the fore the limitations of both sources of information, which hinder a multi-dimensional approach of child healthcare evaluation. They are mostly related to the non-adoption of a life-course approach, which represents one of the fundamental statements of health strategies and international recommendations. Children and adolescents' psychophysical development needs are rarely analyzed during the measurement of quality of care, especially if we consider mental health. Age distribution following paediatric life-stages should be improved in both IDBs and national evaluation practices. While the major focus on the maternal, perinatal health, and on the first years of the child fulfil the need to assess a crucial period of child development,[32] more effort should be devoted, especially in national evaluation practices, to the collection of data related to later stages of child development, especially in adolescents.

Disclaimer

The sole responsibility for the content of this article lies with the authors. It does not necessarily reflect the opinion of the European Union, or of the full project. The European Commission is not responsible for any use that may be made of the information contained therein.

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Key points

- There is a need for a common set of harmonized measures to evaluate the quality of child care encompassing all components that influence child well-being and well-becoming.
- The comparison of the results from international databases and national experts highlighted a limited set of common measures that relate to the quality of child healthcare, which are far from satisfying a child-centric multi-dimensional approach.
- There is room for improvement, both at international and national level, considering age distribution that should cover all paediatric live stages.
- Efforts on collection of data on adolescents and mental health should be encouraged.

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