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A child opportunity index in Italy: a pilot proposal

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Abstract

Background The Child Opportunity Index (COI) is a new and innovative tool designed to assess the environment in which children grow up, offering a broad evaluation of the opportunities available to them in different neighborhoods. This initiative aims to ensure improvements in children's living conditions and future health outcomes.

Methods The study was performed in the cities of Palermo and Rome. Our Italian COI consists of three main domains: education, health and environment, and economy, each subdivided into specific indicators. We collected information, when available, useful for our indicators from institutional sites and municipal archives. Furthermore, in the city of Rome, we distributed a questionnaire through local pediatricians, collecting data in 2 randomly chosen neighborhoods with questions on children's health and quality of life, proposing an initial approach that, when implemented using data provided by the government and public and private health institutions, aims to evaluate the correlation between socio-economic opportunities and the psycho-physical health of children, as demonstrated in the literature.

Results As a result, many aspects, such as the rate of air pollution or the illegal occupation of houses, were not taken into consideration. We therefore consider our COI proposal only a starting model that will have to be implemented once all the necessary information has been obtained. However, what can be deduced from this first descriptive study is how the opportunities in different neighborhoods are not the same for all children. The number of educational opportunities as well as the number of environmental opportunities differs between the various districts and is not homogeneous between different cities or within the same city.

Conclusions In conclusion, it is not simple to analyze in a scientific manner the child's health impact of living in different areas. The COI could be a useful and simple tool that can give us this information. Pediatricians could collaborate with institutions to implement intervention plans and to reduce existing differences, social and health inequalities. Future studies will have to implement this pilot study to create and validate an Italian model of COI to be used as a useful tool in children's assistance.

Palermo, Italy

Keywords Child opportunity index, Neighborhoods, Children, Health

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Background

The Child Opportunity Index (COI) is a new and innovative tool designed to assess the environment in which children grow up, offering a broad evaluation of the opportunities available to them in different neighborhoods [1]. It is structured into three principal domains: education, health and environment, and economic conditions [1, 2]. Regarding the education domain, the COI explores indicators such as the quality of schools and education, access to educational resources and educational attainment rates [1, 2]. It has been demonstrated that these factors are critical in child's learning outcomes and academic success [3-6]. The health and environment domain of the COI regards the accessibility and quality of healthcare services, the presence of recreational and green spaces, levels of pollution, and neighborhood safety, involving rates of road accidents [7, 8]. These factors have a serious role on physical and mental well-being of children [1]. For example, access to green and sport areas can encourage physical activity, reducing the risk of obesity and metabolic comorbidities, and social interaction [9-12]. The economic domain analyzes employment rates, economic stability, and the availability of economic resources, exploring the material conditions which may support children's development. It is known that high economic stability in a neighborhood often correlates with better infrastructure and resources that facilitate child development [12, 13].

By integrating these indicators, the COI provides a comprehensive view of the conditions that influence children's development, identifying neighborhood with very low, low, moderate, high, or very high opportunities and giving a measure of the quality of environments

 Table 1
 Opportunity indicators in a pilot Italian "Child opportunity Index"

Educational Opportunity	Early childhood and elementary education	Nursery schools and elementary schools Middle School diploma
	Secondary and postsecondary education	 High schools Graduation rate Years of education
	Educational and social resources	 Municipal libraries Bookshops (affiliated for the supply of school textbooks) Cultural and artistic associations Cinemas and theatres
Health and Environmental Opportunity	Healthy environments	 Access to recreational and sports areas Access to green spaces Road accidents
	Health resources	 Health care General practitioners and paediatricians
Economic Opportunity	Economic opportunities	Average income

that children experience every day. In this way, the COI has important predictive value as a multidimensional measure of neighborhood living conditions that could guide patient- and community-level interventions, public health planning, and policy to ensure optimal individual health and equal opportunity for all children, regardless of where they live or their race and ethnicity.

Following the American model, the establishment of a COI with the support of the government, institutions, and pediatricians appears increasingly necessary in Italy. This initiative aims to ensure improvements in children's living conditions and future health outcomes. This purely descriptive pilot study aims to lay the foundation for the creation of an Italian COI in light of the literature and the results from the American experience.

Materials and methods

Based on the standardized COI in the United States, we developed an Italian pilot model of the COI, incorporating indicators comparable to the American index (Table 1). This model was applied in the cities of Palermo and Rome, with both cities divided into neighborhoods. The city of Palermo has been divided into 8 districts according to the administrative subdivision and into 5 Territorial Assistance Units (PTA). On the other hand, only 9 districts of Rome were included in our study.

Our Italian COI consists of three main domains: education, health and environment, and economy, each subdivided into specific indicators. The educational domain includes metrics such as school education across various life stages, diploma and degree attainment rates, average years of study, and educational resources. The health and environment domain encompasses access to recreational and green spaces, availability of sports areas, road accident rates, and the quality of healthcare services. The economic domain evaluates the average household income and indirectly assesses the employment rate.

Collectively, these indicators provide a comprehensive overview of the opportunities available to children within a given socio-economic context.

We collected information, when available, useful for our indicators from institutional sites and municipal archives.

Furthermore, in the city of Rome, we distributed a questionnaire through local pediatricians, collecting data in 2 randomly chosen neighborhoods (district 7 and 13) with questions on children's health and quality of life, proposing an initial approach that, when implemented using data provided by the government and public and private health institutions, aims to evaluate the correlation between socio-economic opportunities and the psycho-physical health of children, as demonstrated in the literature.

Statistical analysis was performed using IBM SPSS Statistics 24.0 software (IBM Corporation, Armonk, NY, USA), through which we conducted a purely descriptive statistical analysis. Percentages and numerical values of the collected data were reported. Additionally, participants' opinions were documented through direct quotes.

Results

District characteristics in Palermo

The geo-demographic characteristics of the eight districts of Palermo (surface area expressed in kilometres² and the resident population, divided into Italian and non-Italian nationalities, updated as of 31/12/2022) are shown in Table 2. The district with the largest extension is the seventh district, while the district with the smallest extension is the first district. The district with the largest population is the eighth district, while the district with the smallest population is the first district. The COI indicators, divided into the 3 domains, which we have analysed if available, are shown in Table 3.

District characteristics in Rome

The geo-demographic characteristics of the nine districts of Rome (surface area expressed in kilometres² and the resident population, updated as of 31/12/2018) are shown in Table 4. In our analysis, the district with the largest extension is the ninth district, while the district with the smallest extension is the first district. The district with the largest population is the sixth district, while the district with the smallest population is the seventh district. The COI indicators, divided into the 3 domains, which we have analysed, if available, are shown in Table 5.

District VII: questionnaire results

The sample in district VII comprised 162 children, of whom 70 (43%) were male with a median age of 10.5 years ± 2.7 years, and 92 (57%) were female with a median age of 10.6 years ± 2.8 years. Of these children, 155 (96%) were of Italian nationality, while 7 (4%) were of other nationalities. Regarding maternal education,

Table 2	Geo-demograph	ic characteris	tics of the	eight districts
of Palerm	10			

District	Resident Popu- lation (Italian nationality)	Resident Population (Other nationality)	Surface area (km ²)
1	25 516	4283	2,497
11	69 259	1 370	21,39
III	71 580	3 622	20,347
IV	98 443	1 568	26,163
V	108 634	5 237	17,53
VI	70 200	839	23,9
VII	74 689	1 235	32,955
VIII	116 602	5668	15,327

10 mothers had a middle school diploma, 65 had a high school diploma, and 87 had a university degree. For paternal education, 19 fathers had a middle school diploma, 77 had a high school diploma, and 66 had a university degree. Unemployment was reported among 16 (10%) mothers, while 161 fathers (99%) were employed. Additionally, 32% of parents did not consider childcare facilities adequate, 20% were dissatisfied with the education provided to their children in schools, and 39% found the socio-cultural environment in which their children were growing up to be inadequate. Regarding benefits, 73% of the children did not receive school meal or study benefits, and 43% did not benefit from school support or recovery programs. Specific learning disorders were reported in 17 children. Moreover, 12 children did not follow a healthy diet, and 10 did not practice sports. Parental reports also indicated that 14 children did not have access to green areas, 35 to play areas, 100 did not use libraries and bookstores, and 19 did not participate in cultural activities. We also investigated childhood development stages, finding abnormalities in 9 children. Chronic pathologies were present in 13 children, specifically asthma, autism, diabetes type 1 and celiac disease. Additionally, 37 children had at least one visit to the emergency room, and 23 were hospitalized in the last year. In terms of healthcare, 65% of parents considered it inadequate. Regarding mental health, 7 children suffered from behavioral disorders, and 26 children suffered from emotional disorders, specifically anxiety and lack of confidence.

District XIII: questionnaire results

The sample in district XIII comprised 94 children, of whom 42 (45%) were male with a median age of 9.7 years ± 2.8 years, and 52 (55%) were female with a median age of 9.8 years ±2.9 years. Of these children, 89 (95%) were of Italian nationality, while 5 (5%) were of other nationalities. Regarding maternal education, 3 mothers had a middle school diploma, 41 had a high school diploma, and 50 had a university degree. For paternal education, 4 fathers had a middle school diploma, 54 had a high school diploma, and 36 had a university degree. Unemployment was reported among 20 (21%) mothers, while all 94 fathers (100%) were employed. Additionally, 33% of parents did not consider childcare facilities adequate, 18% were dissatisfied with the education provided to their children in schools, and 33% found the sociocultural environment in which their children were growing up to be inadequate. Regarding benefits, 64% of the children did not receive school meal or study benefits, and 41% did not benefit from school support or recovery programs. Specific learning disorders were reported in 7 children. Moreover, 10 children did not follow a healthy diet, and 11 did not practice sports. Parental reports

Educati	onal Opportunity- Educa	ational and so	cial resources				.	a 1 11
District	Municipal Libraries(n°)	Cinemas(<i>n</i> °)	Theatres(<i>n</i> °)	Schools(<i>n</i> °)	Middle school diploma	High school diploma	Graduation	Schooling rate (%)
	18	1	8	20	7972	5515	4251	42
	3	1	0	41	25,018	16,785	4742	34,2
111	0	0	1	40	24,338	18,426	6719	38,6
IV	1	1	0	52	31,027	28,687	11,914	44,7
V	3	1	1	67	34,463	30,369	12,800	43,2
VI	2	2	1	34	16,827	23,453	14,307	57,8
VII	2	1	1	43	23,297	21,715	9390	45,4
VIII	7	3	5	39	24,089	35,593	33,281	63,2
Health	and Environmental Opp	ortunity						
District	Recreational areas (n°)		Green space	s (n°)	Sport are	as (n°)	Road accide	ents (n°)
1	13		6		0		215	
11	3		0		2		295	
	1		0		3		233	
IV	2		2		1		366	
V	1		3		2		388	
VI	0		2		3		354	
VII	1		1		3		264	
VIII	2		6		2		921	
Econon	nic Opportunity							
District	Average family income	(€)						
	41,039							
11	60,960							
111	35,965							
IV	96,512							
V	21,666							
VI	22,736							
VII	126,838							
VIII	136,104							
Territor	ial Assistance Unit (PTA)		General Prac	titioners		General Pediatricians		
PTA CEN	ITRO		66			14		
PTA E. A	LBANESE		159			28		
PTA BIO	NDO		147			27		
PTA CAS	SA DEL SOLE		134			20		
PTA GU/	ADAGNA		121			26		

Table 3 The analysed COI indicators, divided into the 3 domains

Table 4 Geo-demographic characteristics of the nine districts in Rome (surface area expressed in kilometres² and the resident population, updated as of 31/12/2018)

District	Resident Population	Surface area (km2)
District 1	170,328	20,09
District 4	175,921	48,94
District 5	245,073	26,92
District 6	257,556	113,88
District 7	130,784	45,84
District 9	183,343	183,31
District 12	141,141	73,07
District 13	133,367	66,93
District 14	192,000	133,55

also indicated that 13 children did not have access to green areas, 20 to play areas, 45 did not use libraries and bookstores, and 14 did not participate in cultural activities. We also investigated childhood development stages, finding abnormalities in 4 children. Chronic pathologies were present in 9 children, specifically asthma and celiac disease. Additionally, 29 children had at least one visit to the emergency room, and 17 were hospitalized in the last year. In terms of healthcare, 63% of parents considered it inadequate. Regarding mental health, 3 children suffered from behavioral disorders, and 11 children suffered from emotional disorders, specifically anxiety.

Educational Opportuni	רא- בטטכמוטוומו מווט צ							
District	W	unicipal Libraries (<i>n</i> °)	Book	shops (n°) (Cultural associations (<i>n</i>	(°) Cine	:mas (<i>n</i> °)	Theatres (<i>n</i> °)
District 1	9		8	(*)	2	31		62
District 4	ſ		5	2	4	9		c
District 5	4		10			11		4
District 6	2		12	1	0	2		<i>(</i>
District 7	4		10	ω	4	7		6
District 9	2		4	0	8	5		2
District 12	ſ		8	0	5	5		7
District 13	2		8	(7	5	2		2
District 14	2		4	01		C		-
Educational Opportuni	ty- Childhood and se	econdary Education						
District Nurser school:	y and elementary s (%)	High schools (%)	Years of education	Middle school	diploma (%)	High school diploma (%)	Graduatio	(%) ר
District 1 50		58	12,5	17,1		32,8	34,1	
District 4 55		21	10,6	26,6		35,3	15	
District 5 61		16	10,3	27		34,6	12,9	
District 6 67		6	9,7	32,2		33,5	8,5	
District 7 75		32	11,2	22,7		37,9	19,4	
District 9 63		20	11,8	20,4		38,5	23,9	
District 12 42		17	11,7	20,6		37	23,9	
District 13 51		13	1	24,3		35,2	19,2	
District 14 48		13	11	24,2		34,6	19,6	
Health and Environme	ntal Opportunity							
District	Recreation	onal areas Gree	en spaces	Sport areas	General Practitio	ners General Pediatricians	Road accidents	
District 1	80	210		75	182	18	1.760	
District 4	20	147		64	138	30	552	
District 5	11	130		74	227	34	956	
District 6	00	91		62	129	35	863	
District 7	15	112		50	262	47	967	
District 9	16	210		36	131	27	698	
District 12	5	67		67	111	19	459	
District 13	7	63		59	109	20	655	
District 14	7	55		52	134	23	510	
Economic Opportunity								
District	Average taxab	le individual income	(Italian) €	Average taxable ind	ividual income (Foreig	n) €	Average family incom	e€
District 1	42.497,28			18.429,93			56.989,59	
District 4	22.619,60			12.558,70			34.322,00	
District 5	20.784,26			10.380,04			29.851,92	
District 6	18.571,99			11.113,46			27.778,02	

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Confronting with a sick child, we pediatricians should consider not only the clinical aspect, but also the several aspects composing child's daily life which condition the well-being of the children. In this study we evaluated characteristics of the children's residential area and the available opportunities. As a tool of our analysis, we proposed a pilot model of COI. This descriptive study was based on information obtainable from institutional sites and online municipal archives. As a result, many aspects, such as the rate of air pollution or the illegal occupation of houses, were not taken into consideration. We therefore consider our COI proposal only a starting model that will have to be implemented once all the necessary information has been obtained. In this perspective the role of political and health institutions is therefore fundamental. However, what can be deduced from this first descriptive study is how the opportunities in different neighborhoods are not the same for all children. The number of educational opportunities (schools, libraries, cinemas, etc.) as well as the number of environmental opportunities (access to green areas and sports centers) differs between the various districts and is not homogeneous between different cities or within the same city. Similarly, the different family income could partly reflect the different educational opportunities. For example, considering the city of Rome, the highest family income is recorded in District 1, which also has the highest percentage of university degrees, while the lowest family income is recorded in District 6, which has the lowest levels of educational attainment and years of study. Moreover presumably, as already demonstrated by other studies, race could represent a factor of inequality. It is no coincidence that the family income of non-Italian households is significantly lower than that of Italian households.

The administration of questionnaires provided by pediatricians could represent an additional element to obtain information regarding the quality of life and health of children, as well as to provide parents' satisfaction ratings towards the services and infrastructures of their neighborhoods. With limited data available, it is not possible to analyze the existence of a potential correlation between neighborhood characteristics and children's health outcomes. However, this descriptive work aims to lay the foundation for broader-spectrum questionnaires that can investigate the anthropometric characteristics of the population (and the consequent obesity rate, for example), the hospitalization rate, the presence of chronic comorbidities, and their potential correlation with neighborhood opportunities.

Targeting interventions to lower-opportunity neighborhoods and advocating for policies that equitably bolster opportunity may improve child health outcomes, reduce health-related socioeconomic inequities, and

District 7	25.951,97	13.029,09	38.360,39
District 9	30.876,94	21.004,36	47.771,96
District 12	29.415,89	15.059,42	43.187,53
District 13	25.482,15	13.007,25	37.214,56
District 14	27.461,98	13.811,06	40.032,77

decrease health care costs [14-21]. Despite our study being the first aimed at validating an Italian COI, it has several limitations. First, not all characteristics of the American model were analyzed due to the lack of available online data. Additionally, it is necessary to establish cut-off values to categorize neighborhoods into low, medium, and high opportunity areas. The assistance of political institutions would be necessary to obtain homogeneous data. Furthermore for stronger and more accurate results, it should be analyzed not only differences in the same city but differences between whole regions. It would be interesting to compare data from northern and southern part of Italy. Additionally, the small sample size of children in our questionnaires does not allow us to evaluate a potential correlation with the various characteristics of their living environment. Larger samples and more extensive data would be necessary to demonstrate what has already been reported in the literature, namely the positive and negative influences that the surrounding environment can have on children's health and future outcomes. Finally, a complete and comprehensive evaluation of all COI indicators, some of which were not evaluated due to lack of data in our study, will need to be evaluated in future studies, establishing also the impact of the excluded indicators.

Conclusion

In conclusion, it is not simple to analyze in a scientific manner the child's health impact of living in different areas. The COI could be a useful and simple tool that can give us this information. Pediatricians could collaborate with institutions to implement intervention plans and to reduce existing differences, social and health inequalities. Future studies will have to implement this pilot study to create and validate an Italian model of COI to be used as a useful tool in children's assistance.

Abbreviations

COI Child Opportunity Index

Supplementary Information

The online version contains supplementary material available at https://doi.or g/10.1186/s13052-024-01825-4.

Supplementary Material 1

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Not applicable.

Author contributions

PF, DC, GC, MZ and IC participated in the study design, data analysis and manuscript drafting. PF, MZ and IC contributed in data analysis and interpretation. PF, MZ and IC performed the patient management and data collection. DC, LML, MT, GG, CM and TM performed the data collection. All authors read and approved the final manuscript.

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Data availability

All data generated or analyzed during this study are included in this published article.

Declarations

Ethics approval and consent to participate

The study was approved by the Mother and Child Department of the University of Palermo (Palermo, Italy) and by the Operative Research Unit of Pediatrics, Fondazione Policlinico Universitario Campus Bio-Medico (Roma, Italy). All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee, and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Consent of publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

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