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Integrated "SaMU" method for assessing health performance in cities for an urban public health project in Algiers

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ABSTRACT

Abstract: *The aim of this present study was to evaluate the health performance of a city. The performance evaluation tool, which we propose to call "SaMU" (French abreviation for Health in Urbain Environment), is based on a system of criteria, indicators and indices for the evaluation of health performance in urban areas, which is scientifically valid and adaptable to the local context, in order to integrate it into the design, management and decision-making process relating to the improvement of the existing state, through the urban project approach. This method meets the World Health Organisation's objectives as well as the Sustainable Development Goals (SDGs) 2015. The application of the method on the municipality of Gué de Constantine in Algiers relies on criteria and indicators representative of the quality of life which makes it possible to discover the level of health performance of a city, but also to identify the different factors that can lead to the success or the failure of the urban public health project.*

I. Introduction

Since the urban sustainable development approach has highlighted the issue of quality of life and well-being of populations, it has become clear that the choices of urban planning influence the health of urban dwellers. The problems of health performance in cities are therefore one of the fundamental public health issues and are closely linked to the quality of the urban environment. If we follow certain reference texts including the Agenda 21 [1], it has become a substantial theme of the issue of local sustainable development, just as the governance principle with participation of different actors in the development process.

The recent emergence of the term urban performance in the field of integrated urban development management is strongly linked to the notion of quality of life and living spaces, introduced as the fundamental objective of urban development by Agenda 21 and confirmed by the various charters for the sustainable city, especially in Europe, with the Leipzig Charter of 2007 [2] updated at the international conference "Urban Energies" in Berlin in October 2012.

In recent years, in Algeria, and Algiers in particular, there has been a gradual deterioration in the quality of life in the city, reflecting the lack of the authorities' interest in urban comfort, urban safety and well-being of the inhabitants, even though they call for a local development and the attractiveness of the territory. This attitude is particularly seen at the level of urban planning tools that do not sufficiently take account of local parameters in relation to health stakes. This is why, in this research, we are interested in ways to improve the well-being and health of urban populations by offsetting the negative impacts of urbanization, which can be achieved through, among other things, the guarantee of access to nature and efficient access to urban services and equipment - two aspects that should be continuously monitored and evaluated.

The progressive implementation of the metropolitanization of Algiers objective expressed in the Algiers PDAU 2035 adopted in 2016 [3], but also the transformations that the Algerian health

sector is undergoing today (Law no. 18-11) and the health challenges of sustainable development lead us to note the urgent need to provide actors with a tool for assessing health performance in the local context in order to facilitate decision-making.

The subject of this study meets the targets of research and development in Algeria and at the same time integrates the global objectives of the WHO (City-Health Program [4]) and the UN (Sustainable Development Goals SDG 2015 [5]). It has a great importance in the local context as the state of health in urban areas is deplorable, which may be aggravated by the threat of climate change. This aspect is however not supported by urban planning instruments (PDAU and POS), in the absence of adequate evaluation and monitoring tools. We have therefore focused our problematic on the notion of health performance evaluation in the city, through the design of a decision support tool capable to guide the implementation of a strategy for their improvement, which could serve as a basis for launching an urban public health project in Algiers.

II. Materials and methods

The quality of life is an intrinsic notion that can be felt and defined differently according to the given socio-cultural and socio-economic context. It is needed as a scientific concept, but it has many definitions and its methods of approach are as numerous as the disciplines that propose to assess it. It also depends on the intrinsic characteristics of the elements determined and their spatial distribution. The identification of the conditions necessary for the quality of life is thus a first step which can be completed by the objective evaluation of these qualities. This is why our approach is conceived according to two schemas: the first "empirical" through the crossing of the different urban planning programs, and the second "conceptual" focuses on the concept of quality of life and is integrated into the approach of the urban project. The design of the "SaMU" method follows six steps:

II.1. Constructing a grid of criteria (comparative approach)

Crossing and comparative analysis of the different national and international programs (PNAEDD programs: National Action Plan for the Environment and Sustainable Development, SNAT: National Spatial Planning Scheme [6], INSP: National Institute of Public Health), WHO: World Health Organization, allowed us to identify the common criteria for assessing health performance [7]. In this phase, the WHO Evaluation Dashboard [4], set up as part of the Healthy City program, served us as a guiding dashboard. We crossed it with the objectives of the other programs [7] (international, national and local), in order to identify common objectives and criteria (table 1).

Table 1. *Criteria crossing matrix.* ***Source:*** *Daoudi M. according to the WHO assessment dashboard, implemented as part of the Healthy City program*

Type indicators	Preoccupation Field	Category/Criteria	International projects	National projects	Local programs	∑
Physical and emotional health indicators	Physical health	Mortality	1	1	1	**3**
		Morbidity	1	1	1	**3**
		Preventive health	1	1	1	**3**
		Health care benefits	1	1	1	**3**
	Emotional health	Safety/ Security	1	0	1	2
		Cultural vitality	0	1	1	2
		Psychological health	0	0	1	1
		Social support	1	0	1	2
		Political health	0	1	0	1
Environmental indicators	Problems /questions related to the environment	Air pollution	1	1	1	**3**
		Noise pollution	1	1	1	**3**
		Water pollution	1	1	1	**3**
	Infrastructures/ services in the human environment	Transport	1	1	1	**3**
		Energy use	1	0	1	2
		Water supplies	1	1	1	**3**
		Hygiene	1	1	1	**3**
		Waste disposal	1	1	1	**3**
		Housing	1	1	1	**3**
		Free spaces	1	1	1	**3**

	Government proficiency	Quality of air	1	0	1	2
		Noise	1	0	1	2
		Energy	1	0	1	2
		Water supplies	1	1	1	**3**
		Waste disposal and sanitation	1	1	1	**3**
		Housing	1	1	1	**3**
Socio-economical indicators	Means of existence	Employment	1	1	1	**3**
		Work conditions	1	0	1	2
		Employee exploitation	1	0	1	2
		Education	1	1	1	**3**
	Prosperity	Ability to satisfy one's basic needs	0	0	1	1
		Income distribution	1	0	1	2
		Housing	0	0	1	1
		∑	27	20	31	78

The categories of criteria that verify the set of 3 groups of sustainable development tools oriented towards the "health" target can be considered as relevant because of their compatibility with both global and local scales [7].

We thus obtain a reduction in the number of criteria from 78 to 54. Among these criteria, not all of them relate directly to the decision-making field related to urban planning and development, but they're all witnesses of the influence that the urban environment exercises on the health of the inhabitants.

The contextualized dashboard is composed of 18 categories and 63 indicators. Their relevance is based on their availability in local statistical databases, their reproducibility and their measurability.

II.2. Construction of health performance assessment indicators (causal approach)

There are many tools for describing and quantifying the environment, and they are constantly being revised and adapted to the needs of different users.

We have chosen the PSR model (Pressure State Response) which is described in several documents such as that of the OECD: *core set of indicators for environmental performance reviews « le modèle PSR de l'OCDE ne tente pas de spécifier la nature ou la forme des interactions entre l'activité humaine et l'état de l'environnement»*. The PSR model assumes that human activities exert pressures (such as polluting emissions or changes in land use) on the environment, which can induce changes in the state of the environment (change in levels environmental pollution, diversity of habitats, waterways, etc.).

In our case, we first sorted out all health-related indicators and then separated them into two grids: (i) Grid number 1 of indicators is related to the health status of the population (ii) Grid number 2 of indicators is related to the urban causes of this state. For example, for indicator n°5 of the state grid n°1, relating to the percentage of the population having received all the vaccines, the corresponding cause indicators of grid n ° 2 are the availability of the health structures and their accessibility(table 2).

Table 2. *Indicators dashboard of the cause to effect approach.* ***Source:*** *Daoudi M. according to the WHO assessment dashboard, implemented as part of the Healthy City program*

Field of preoccupation	Category	Indicators of state (grid n°1)	Indicators of cause (grid n°2)
Indicators of physical and emotional health			
Physical health	Mortality	1-Gross mortality rate 2-Infantile mortality 3-life expectancy at one year	Availability of sanitary equipment. Equipment level Accessibility of sanitary facilities. Management Information
	Morbidity	4-Prevalence rate of diseases in the city in question (respiratory diseases, diarrhea, measles, etc.)	
	Preventive	5-Percentage of the population having received	

	health	all the vaccines 6-Percentage of the population that benefits from health education 7-Number of hours passed each week doing cardiovascular exercises	
	Health care benefits	8-Number of people benefitting from health care 9-Number of doctors per 1000 inhabitants	
Indicators related to the environment			
Problems /questions related to the environment	**Air pollution**	10- Sulfur dioxide: total emissions (t) and concentration (g/m^3) 11- Suspended particles: total emissions (t) and concentration (g/m^3) 12- Lead residue suspended in the air : total emissions (t) and concentration (g/m^3)	Human and urban vulnerability: Sources of pollution and nuisance emissions. Major risks
	Noise pollution	13- Percentage of the population exposed to traffic and airport noise 14- Numbre of public noise complaints 15- Noise level in living areas (dB)	
	Water pollution	16- Curve of dissolved oxygen in surface water (mg / l) 17- Biological oxygen demand in surface water (mg / l) 18-pH 19- Coliforms in water sources (number/100ml)	
Infrastructures/ services in the human environment	**Transport**	20-Number of registered automotive vehicles (by type) 21- Road length (in Km) ; type 22- Total automotive vehicle fuel consummation 23-Usage by mode of transportation (Number of people / day) 24-Estimated quantity of polluting emissions by vehicles (in tons) 25-Number of accidents leading to trauma 26-Mortalité rate attributed to road accidents	Management Information Hygiene and cleanliness
	Water procurement	27-% of the population having access to healthy drinking water 28-% of the population using other sources of water supply (wells, tank, rivers, streams) 29-% of households supplied with drinking water 30-Quality of drinking and bathing water	Management Hygiene and cleanliness Access to water and energy
	Hygiene	31-% of the population having access to adequate sanitary services 32-% of the population served by centralized sewerage systems	Hygiene and cleanliness
	Waste disposal	33- Municipal and industrial waste produced (tons / day) 34- Municipal and industrial waste evacuated (tons/ day) 35-Municipal expenses relating to solid waste management 36-Water residue produced (litres/day) 37-Number municipal used water purification plants 38-Treatment of industrial effluents (litres/day)	Management Hygiene and cleanliness
	Housing	39-Average habitable surface per person (m^2 per person) 40-Average occupation per room (number of people per room) 41-Number of non integrated habitation units 42-Number of habitation units added annually	Management Participation
	Free spaces	43-Surface area of this free space per 1000 inhabitants (m^2)	Access to nature Biodiversity and climate
Government proficiency	**Water procurement**	44-Are there healthy drinking water supply programs? 45- Are there appropriate regulations for water	Access to water and energy Management

		supply services? (Yes/No) 46- Is there a system to control the quality and effectiveness of the water supply? (Yes/No)	Hygiene
	Waste disposal and sanitation	47-Are there any programs to extend and improve the sewage systems? (Yes/ No) 48-Are there regulations on discharges of industrial effluents? (Yes/ No) 49-Are there regulations on controlled landfills? (Yes/ No) 50-Are there regulations promoting recycling and waste reduction? (Yes/ No)	Management Hygiene
	Housing	51-Are there social housing construction programs? (Yes/ No) 42-Are there slum remediation programs? (Yes /No) 53-Is land use regulated? (Yes/ No)	Management Hygiene
Socio-economic indicators			
Means of existence	**Employment**	54-% of the active occupied population (employment rate) 55-% of the active currently unemployed (unemployment rate) 56-% of the active currently underemployed population (under employment rate) 57- Dependency ratio (ratio of the young population to the working population and the ratio of the elderly to the working population) 58-% of the workforce in the informal sector	Management Information Availability of services.
	Education	59-% of the share of the city's gross domestic product devoted to education by community 60-Number of programs aimed at improving the skill level of employees 61-Literacy rate (by sex) 62-Enrollment rate in primary and secondary schools 63-Gross / net enrollment rate	Availability of educational amenities and accessibility. Management.

This table allows us to translate the language of effects into the language of causes, some of which relate to social, economic or environmental policy actions, while others emerge from actions relating to programming and urban planning. It is then these indicators that interest us.

II.3. Sorting indicators related to urban (MCA).

The purpose of the multi-criteria analysis (MCA) is to help make a decision or evaluate several options in situations where no possibility is perfect. This method also makes it possible to reconcile economic, social, environmental, design, technological or other aspects in a single, systemic approach. In the context of the multi-criteria decision, the purpose of the decision is formed by a set of actions or alternatives. For B. ROY [8], real problems can be formulated using multicriteria analysis methods. These methods, according to VINCKE [9], however, do not provide objectively better solutions (these solutions do not exist), unlike conventional techniques of operational research, they allow instead to prioritize them in order to identify their more in line with the objectives. Table 3 is the result of the application of the MCA on Grid 2 of the Cause Indicators in Table 2.

Table 3. *Dashboard of health performance indicators related to urban (after MCA).*

Area of concern	Selected urban indicators
Services, amenities and accessibility	Availability of sanitary amenities
	Level of amenities
	Accessibility of sanitary equipment
Human and urban vulnerability	Protection against major risks
	Hygiene and cleanliness

	Fight against nuisances and pollution
Biodiversity and urban ecosystem	Access to nature
	Biodiversity and climate
	Access to water and energy
Quality of governance	Participation
	Management
	Information

By applying the causal method to our initial dashboard (63 indicators), we were able to identify 12 indicators that relate directly to the urban. This reduction / transposition is necessary in order to not only signify the evaluation for the use of the general public (managers, decision-makers, urban projects managers, etc.), but also to guide the tool on the useful elements, allowing us to initiate concrete actions of urban improvement. However, the evaluation of a concrete situation cannot do without the stage of prioritization of criteria and / or indicators, which depends on the local context. For the need of construction of our method, we will use a sample-witness of a municipality of the wilaya of Algiers.

II.4. Structural analysis for the prioritization of indicators (Mic Mac method)

For the theoretical construction need of the "SaMU" method, the analysis approach of the health performance criteria in the city was followed by a structural analysis applied to a selected area of the wilaya of Algiers, which aims to highlight local urban indicators essential for maintaining good health status in the city. The analysis was carried out with the help of MicMac software [10]. It allowed us to identify the direct and indirect influence relationships that the selected indicators have on health performance. The process involves the following phases: *(i)* the identification of variables, *(ii)* the description of the relationships between variables and *(iii)* the identification of key variables. The structural analysis applied to our dashboard of urban-related indicators has shown us that, in order to assess the health performance of a city, it is necessary to take into account, the three following synthetic criteria: availability and accessibility of sanitation amenities, proximity to sources of emissions harmful to health, and finally, access to nature (Figure 1). From the crossover results of the direct and indirect influences / dependencies between the variables, we notice the very important influence of these three criteria which stand out as the most influential on the central variable (health performance).

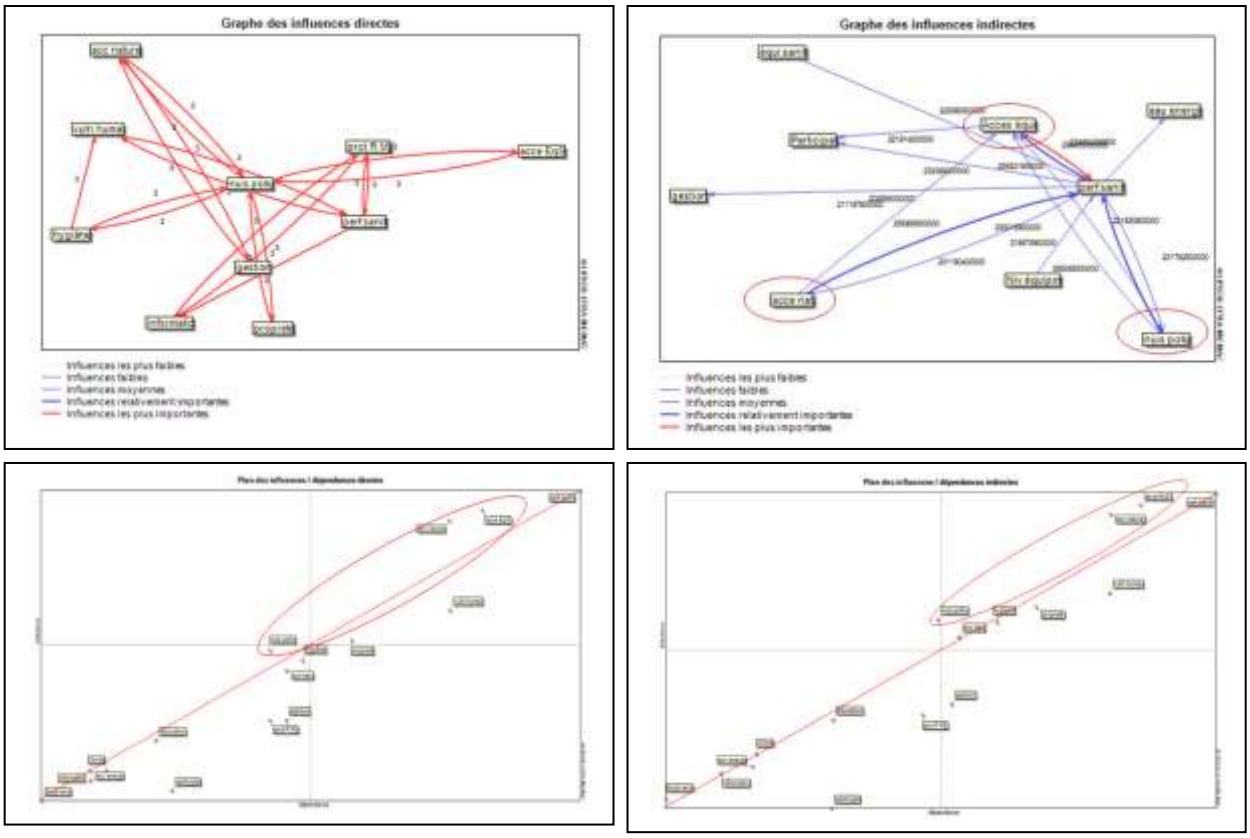


Figure 1.*Result of structural analysis with the three priority criteria for the assessment of health performance in the city.*

These criteria must then be translated into measurable indicators and indices that will visualize health performance in the city. The next step in the approach followed in this research work is therefore to establish a grid of indicators and indices for assessing health performance in the city.

II.5. Weighting and aggregation of criteria and indicators

The grid above suggests the need to identify the method of weighting and aggregation of its constituents, according to a given concrete context. There are several methods of weighting, among which we count the so-called "objective" methods, such as the entropy method [11], the direct evaluation methods by simple ranking, as *the fixed point scoring method* or *the method of successive comparisons* [12], or the indirect methods such as *the pair comparison* [13], as well as *the fuzzy sets theory* [14]; [15].

In our evaluation method, the weighting of the synthetic criteria is carried out through the contribution of stakeholders (health and urban professionals, inhabitants, managers and decision-makers) through closed questionnaire surveys conducted on site (Involved a sample of 100 people (women and men aged 16 to 65 and over) in four municipalities of the wilaya of Algiers (Gué de Constantine: 25 people, Bouzaréah: 25 people, Sidi M'hammed: 25 people and Ouled Fayet : 25 people), interviewed on site during one week (from Sunday 11 to Thursday 15 November 2012) by a questionnaire on the assessment of health performance in the city.

This survey is structured around questions on the theme of transport and movement, on health status, health management, social organization and finally issues related to the level of health-related facilities. The data was analyzed using Excel software. This survey will be used to weight the relevant indicators to determine the synthetic indices of local health performance based on the *fixed point scoring* method by distributing a sum of points across all the indicators, using a weighting tree « *la répartition d'une somme des points sur l'ensemble des indicateurs, utilisant ainsi un arbre de pondération* » [16]. The choice of this method is based on its ability to consider in a balanced and consistent way an uneven number of indicators by level of evaluation. « *L'attribution d'un score plus important à un critère synthétique ou à un indicateur réduit l'importance relative d'un autre critère ou indicateur. L'inconvénient par contre, résulte dans la difficulté d'appréhender la complexité globale de la réalité, si le nombre de critères est important* » [17].

To carry out the assessments, each indicator has a qualitative and quantitative unit of measurement, in order to be able to record health performance according to a common rating scale, chosen according to the context of action or evaluation. The use of a simple scale makes it possible to assign a cardinal (qualitative) value to all indicators based on judgments of values for each of them, regardless of the initial nature of the indicators selected (quantitative or qualitative).

This approach facilitates the use of the method by evaluators. The scoring exercise is, of course, a subjective exercise, but one that is necessarily based on observation, study of documents and investigation. Once established, the "rated" value of the statistical indicators must be compared to a reference value (ratios, norms, standards).

Overall, the criteria are evaluated through the SMART indicators (deemed Significant, Measurable, Accessible, Realistic or Reproducible and Temporarily located). For our case, the grid takes all these conditions into account. The indicator value is translated on a standardized scale from 0 to 3divized in three steps at equal intervals. At the maximum value of the indicator corresponds a note in the maximum range of the scale. For negative impact categories, the rating scale is reversed.

Aggregation introduces the synthetic vision of health performance, which promotes decision-making. For this purpose, an aggregative approach is preferred; by linking the synthetic criteria to the synthetic indicators, we will have the same number (three) of synthetic criteria and synthetic indicators. However, our method applies a two-level weighting. These two levels of aggregation are done by applying a mathematical formula, with the aim of arriving at the end of the aggregation process at a reduced value to facilitate the use of our tool by decision-makers. Indeed, for the first level of aggregation, we used the *Weight Sum Method* (WSM) « *qui est le modèle des sommes pondérées* » [15], for the aggregation of the value of the synthetic indicators relating to each synthetic criterion. It will be represented by the sum of the weighted values of the various indicators corresponding to the three synthetic criteria. In the second level of aggregation, we combined three synthetic indicators using the *Weight Product Method* (WPM), in order to obtain an index for the three synthetic indicators « *la valeur indicielle est définie comme la moyenne des valeurs des indicateurs synthétiques* » [15] as explained in the following table (Table 2).

Table 3. *Representative table of indicators and indexes of health performance assessment in the city with the two levels of aggregation.*

Synthetic criteria	Synthetics indicators	Synthetics Indexes	Index
SC1 Access to health facilities	Ratios of facilities Distance in Km Distance in time	SI1 Accessibility to health equipment Index	**Health Performance Index (HPI)**
SC2 Proximity to sources of emissions harmful to health.	Distance of noise sources (airport, motorway, train) Distance to toxic emission sources (industrial units, nuclear units, incinerators) Distance to sanitary danger sources: provokes pandemics (discharges, establishments that receive infectious illnesses.	SI2 Access to nature Index	
SC3 Access to nature	Ratios of green spaces Distance in Km Distance in time	SI3 Proximity to harmful to health facilities index	
	Weighting	**1st level of Agrégation WSM (Somme)**	**2nd level of Aggregation WPM (Product)**

Our "SaMU" tool is composed of 3 criteria and 09 indicators [7]. The maximum score assigned to the synthetic criteria is 9.8; the minimum score assigned to the synthetic criteria is 0.10 (Σ Scores = 10), knowing that, depending on the number of indicators, the SaMU method imposes the formula: $0.10 \leq Sc < 10$ (the scores of the synthetic criteria and indicators are greater than or equal to 0.10 and less than 1).

Calculatoin method for the maximum value of the Health Performance Index (HPI):

$$HPI = (VSI1 + VSI2 + VSI3) / 3$$

$Score_{max}$ indicator = 9.8; $Score_{min}$ indicator = 0.1 (Σ Score indicators = 10)

$Score_{max}$cumulate = 9.8x 9.8 = 96.04; $Score_{min}$cumulative = 0.1x 0.1 = 0.01.

Maximum score = 3; Minimum score = 1 (Qualitative scale, score given according to comparison with the reference value)

Weighted maximum value of the indicator V_{imax} = 9.8 x 3 = 29.4
Weighted minimum value of the indicator V_{imin} indicator = 0.1 x 1 = 0.1.

Maximum value of the synthetic indicator:
$VIS_{1max} = V_{1.1max} + V_{1.2\ max} + V_{1.3max}$ = (9.8x3 + 0.1x3 + 0.1x3) = (29.4 + 0.3+ 0.3) = 30
$VIS_{2max} = V_{2.1max} + V_{2.2\ max} + V_{2.3max}$ = (9.8x3 + 0.1x3 + 0.1x3) = (29.4 + 0.3 + 0.3) = 30
$VIS_{3max} = V_{3.1max} + V_{3.2max} + V_{3.3max}$ = (9.8x3 + 0.1x3 + 0.1x3) = (29.4 + 0.3+ 0.3) = 30
Maximum value of the index VI_{max} = (VIS_{1max} + VIS_{2max} + VIS_{3max}) / 3 = (30 + 30 + 30) / 3 = 90/3 = **30**

$$HPI_{max} = 30$$

II.6. Presentation of the results: by the "radar" graph / by mapping

The results obtained by this method will be represented in graphical form, of the "radar" type. It is a tool that has proven its usefulness in many areas. It presents a graphic comparison of the advantages and limitations of the studied project [15]. Thus an alternative or proposal is evaluated on the basis of a set of objectives, themselves defined by different indicators meeting specific criteria. For the sake of clarity, the representation of the evaluation allowing the visualization of all the indicators is based on a radar diagram. The analysis of the evaluation radar will lead us to the assessement of health performance in urban areas according to criteria or synthetic indicators. All the

assessment work carried out will thus lead to guidelines for action in order to improve health performance in urban areas for an urban public health project in the Algerian context.
The results obtained by this method will also be represented in the form of a map. This type of spatial representation will allow us to better understand the level of health performance of the different municipalities of Algiers.

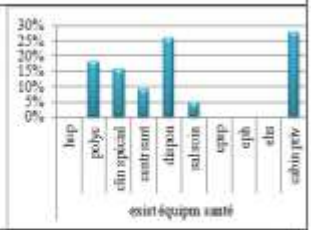
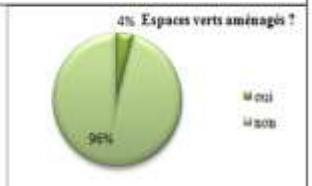
The operational application of the method will be in a witness territory chosen from among the 57 municipalities of Algiers. This test will allow us to verify the feasibility of assessment for the first level of validation of the tool. Several other test evaluations would be necessary to conclude on a definitive validation.

III. Results and discussion

III.1. Analysis results of the municipality of Gué de constantine

Gué de Constantine is a peripheral town at the southern entrance to the agglomeration of Algiers. From 35,000 inhabitants in 1987, it now reaches nearly 140,000 inhabitants to become the 2nd largest municipality in the wilaya of Algiers. It is crossed by the Oued El Harrach, which is the subject of a recreation and leisure park development project for the population of this municipality. The town is also crossed by the railway line; it has two train stations and will also be served by the Algiers Metro. On the other hand, the lack of public equipment and services, the lack of green spaces and insalubrity contribute to the degradation of the quality of life and constitute a threat to the health of the population of this municipality.
It is becoming more and more vulnerable to health risks, especially as it hosts Algeria's largest slums. In recent years, the municipality of Gué de Constantine has undergone several changes in order to improve the quality of life of its inhabitants. In 2016, several slums were absorbed, among them Ain el Malha and Remli. Table 4 presents a summary of the characteristics and the servey results of the municipality of Gué de Constantine for each aspect / criteria for assessing health performance retained in the application of the SaMU method.

Table 4. *Technical sheet of the three synthetic aspects (Municipality of Gué de Constantine)*

The Three Aspects	Situation	Characteristics	Survey results
Aspect availability and accessibility to health facilities. **Municipality:** Gué de Constantine **Population:** 133.247 hab. **Population density:** 91,64hab. / ha.		★ The health infrastructures: EPSP, EPH, EHS, Polyclinics, treatment rooms, Maternity clinics... **Number:** 01 Polyclinic, 03 Health center, 02 Care unit, 01Maternity.	
Aspect proximity to emission sources that are harmful to health **Number of discharges** : 06		★The waste, incinerators, antennas ... we will concentrate on the waste because it's very recurrent in this municipality. The presence of these sources of health nuisance emissions affects the social well-being and negatively morphs the image of the municipality. There are already 06 dark points: (El Wiaam, ZHUN Ain Naadja B2, Ain Malha, Marché Ain Naadja, Biotic El Remli and Sonelgaz)	
Aspect access to common nature **Total Green Spaces Surface:**197510 m² ≈1,5 m²/ inhabitant		★Density of green spaces in relation to the resident population: gardens, urban parks... able to contribute effectively to the local well-being in terms of social improvement, improving the local microclimate or protection against the sanitary risks.	

III.2. Results of assessment of the health performance by the "radar" graph

The application of our "SaMU" tool, in the Municipality of Gué de Constantine, will be carried out in order to check whether it meets the criteria for health performance as we have recommended them. Given that this municipality responded in December 2010 to the WHO call for membership in the global network of "Healthy Cities" projects, this assessment will help us to lay the foundations for an urban public health project in Algiers.

We begin our assessment by weighting the criteria [7], which is done on the basis of the survey, but also on the degree to which the three synthetic criteria are taken care of by the various urban planning instruments. The results of the calculation of the scores obtained by the municipality in each of the dimensions are presented in the form of the radars in figure 2.

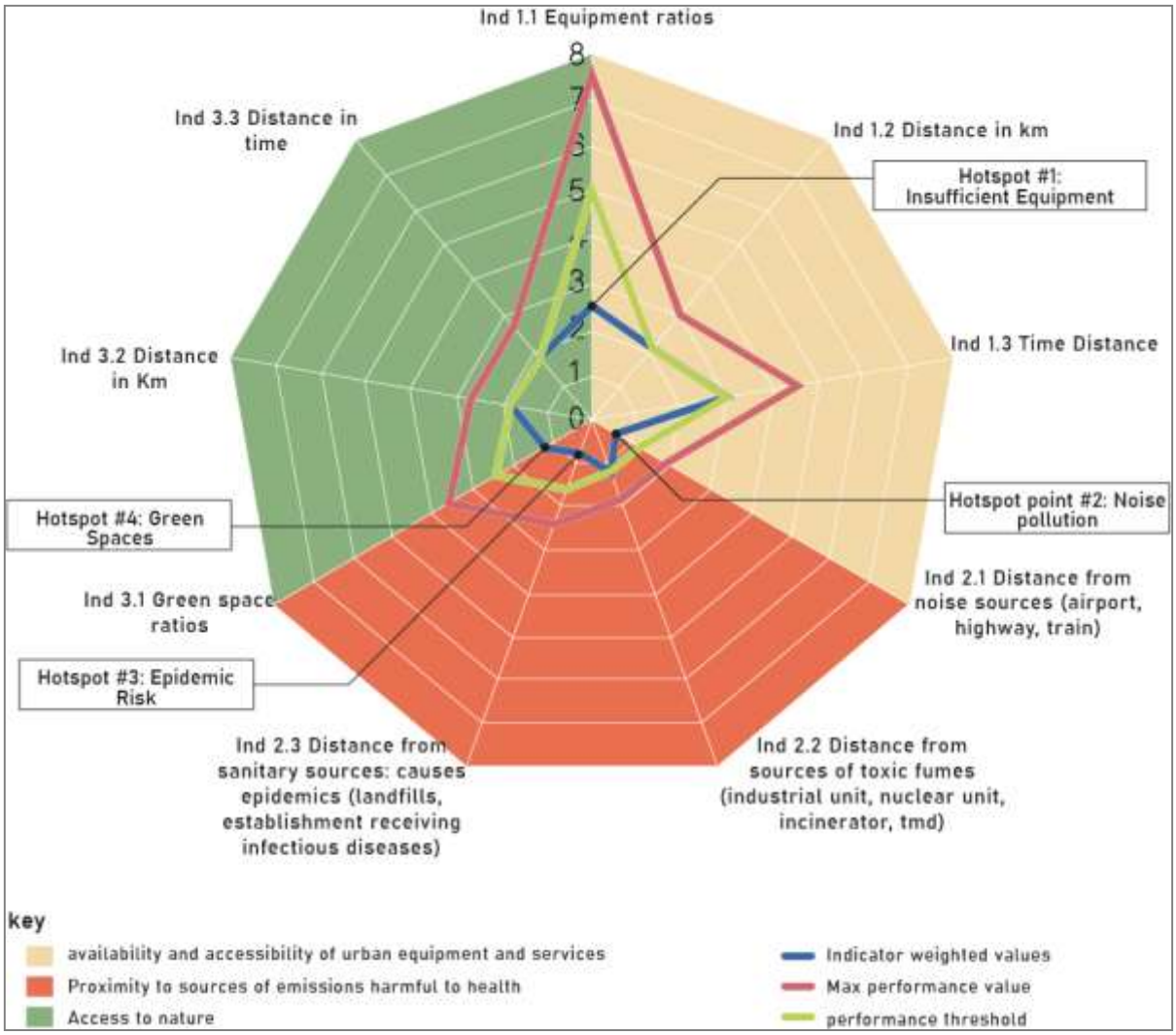


Figure 2. *The "radar" graph of assessment of the health performance of Gué de Constantine.*

We compare the value of the VI indicator of each criterion with the maximum possible value of each Vmax index (see Equation HPI $_{max}$) and "a performance threshold" defined as 2/3 of this maximum value. It is considered that to be recognized as efficient, the health performance index should reach 2/3 of the maximum value. A city satisfying more than 2/3 of the maximum score will therefore be considered very efficient.

According to figure 2, the criterion of **access to health equipment** is an important criterion, to be reviewed for the municipality of Gué de Constantine, since it does not achieve health performance either in terms of the ratio of health equipment, or in terms of time spent access. The quality of life is impacted in a lasting way, and the possible occurrence of an epidemic constitutes a major risk, the management of which must be mentioned in the specifications of urban projects, both in the phase of prospective strategic programming. As in the design phase of urban infrastructure development (roads and parking lots,

various networks, land and even air transport networks by drone, helicopter, or other means) and the creation of fully equipped specialized medical emergency units.

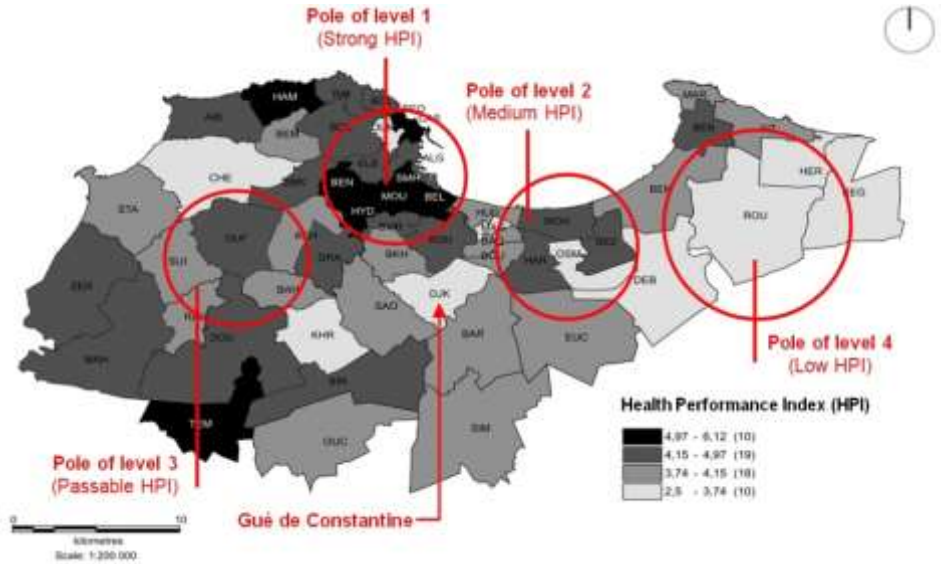
According to figure 2, the **proximity criteria of emissions harmful to health** is a second important criteria to be reviewed for the municipality of Gué de Constantine since it does not achieve health performance. In terms of distance from noise sources, Gué de Constantine is crossed by the railway line, it has two stations located near homes, and it is also very close to the international airport, as it is limited from the north by the South ring road. There is no protection against these nuisances in the town, the easements and buffer zones are not properly materialized [18]. There is therefore a need to improve the quality of life and ensure sound comfort. We must also not overlook the health risk posed by sources of toxic emissions and sources causing epidemics, with the provision of buffer zones and protective barriers.

Finally, according to figure 2, the criterion of **access to nature** should also be reviewed for the municipality of Gué de Constantine. In terms of ratio, the area of accessible green spaces in this municipality is insufficient because it does not obey the standards of the World Health Organization (WHO) and the rules of urban planning. The spatial proximity of green spaces is a necessity to encourage biodiversity and improve the well-being of the inhabitants of any urban municipality. In addition, the openness and visual continuity on green spaces is not considered in the reparation of these spaces for the municipality of Gué de Constantine. We must also not forget the access time to the latter, which is a factor to be taken care of for Algiers in general and in the commune of Gué de Constantine in particular.

The application of our assessment method to the municipality of Gué de Constantine shows on the one hand the feasibility of the assessment and on the other hand, the average level of health performance in the municipality in question. For reasons of feasibility over time, particularly with regard to the constitution of a database, we have opted for the evaluation of a single municipality. Thus, the method will have been applied to test its operationality on the concrete case.

III.3. Results by mapping of assessment of the health performance

The application of the "SaMU" method on the 57 municipalities of the wilaya of Algiers thereafter, will allow us to establish a representative mapping of the Health Performance Index (HPI) of each of these municipalities. The following map (figure 3) shows the result. It will allow us to better understand the level of health performance of the various municipalities in the wilaya of Algiers.



TOP 10 Health Performance Index (HPI).

	Commune	IPS
1	Hydra	6,12
2	Hammamet	5,96
3	Ben Aknoun	5,83
4	El Mouradia	5,43
5	Sidi M'hamed	5,31
6	Belouizdad	5,23
7	Casbah	5,16
8	Bab El Oued	5,06
9	El Madania	5,01
10	Tessala El Merdja	4,97
48	El Magharia	3,73
49	Khraicia	3,72
50	Gué de Constantine	3,67
51	Oued Koreiche	3,43
52	Dar El Beida	3,40
53	Oued Smar	3,39
54	Cheraga	3,22
55	Reghaia	3,19
56	Rouiba	2,81
57	Heraoua	2,50

Figure 3.*Health Performance Index (HPI). Source: Daoudi M. based on the Algiers Local Performance Barometer 2015.*

To develop this map (figure 3), we have used the results of the Barometer of the local urban performance of the municipalities of Algiers [19].

After reading the indicators used by the Barometer, we found that it was based solely on equipment and infrastructure indicators to determine the level of

sanitary comfort in the municipalities. We have also noted that our three synthetic criteria for evaluating health performance correspond to the following five criteria of the Barometer: green and open spaces, pollution, waste and sanitation, education, health and sport and finally the urban environment. We therefore carried out a simulation to calculate a health performance index according to these five selected criteria, for the 57 municipalities (the evaluation method is that of the Barometer [20], which consists of an internal *benchmarking* reported on a scale ranging from 0 to 10.

According to figure 3, the health performance index distinguishes four health quality poles on the territory of the wilaya, distributed between the strong core in the center and the municipalities of the hyper center, as well as two secondary centers: a coastal municipality (Hammamet) and Tessala El Merdjaau fringe of Mitidja, by their qualities of cleanliness and availability of green and open space. On the other hand, the five industrialized municipalities in the East visibly suffer from an unfavorable level of health performance, as well as the municipalities of: Oued Koreiche, El Magharia, Cheraga, Khraicia and Djasr Kasantina (Gué de Constantine), which confirms the results of our assessment by the SaMU tool.

The results obtained on the health performance index, draw for the wilaya of Algiers a TOP 10 ranking of the most efficient municipalities, but also show those which need the urgent implementation of a strategy prospective improvement of health performance by setting up an urban public health project [7].

The SaMU tool intervenes directly in the 04 phases of the Urban Project approach: for the evaluation of health performance in the first phase of the strategic diagnosis, for the selection of the optimal scenario among the different scenarios of the 2nd phase, as a model for listing the projects of the 3rd phase action plan and finally for monitoring during the last phase of monitoring the impacts of these projects during implementation.

At this stage of our reflection, we believe that we have given the ingredients for an urban public health project after having highlighted the need to thematize the urban project by this notion of health, which means that any company in the field of urban planning should target not only urban characteristics, but also urban performance (quality of life, well-being and health of inhabitants).

However, this method has limitations, given the elimination of certain indicators that could be important to complete the tool (several indicators had to be judged irrelevant due to the absence of data or the impossibility of designing a local repository). The use of the Barometer without the contextualized weighting and the application of the "SaMU" tool on a single municipality are also limiting factors. However, the approach that we propose could overcome these limitations, if the time and the means of updating the data would have allowed it.

This contribution addresses a topical, innovative and operational subject. There are therefore many research perspectives. One of these perspectives is the application of our "SaMU" tool on the three other municipalities predefined for the survey (Bouzaréah, Sidi M'hammed and Ouled Fayet), in order to obtain convincing results to confirm the total validity of the method. We can also extend the application to the 57 municipalities of the wilaya of Algiers to build a real Barometer of the health performance of the capital, which will be used to prepare a guide for the planner and designer of the urban health project.

In addition, it is important to decompartmentalize the approaches to the urban project and open it up to other disciplines. Another line of research concerns the aspect of the local climate plan (LCP) in order to verify the possibility of a health LCP. The last avenue would be to transform the "SaMU" tool into software, which could facilitate its use and broaden the scope. All these perspectives offer avenues for research that converge towards the same objective, which is the improvement of the quality of life, well-being and human health in cities.

IV. Conclusion

The urban health performance assessement method, which we have called "SaMU", proposes a systemic evaluation approach appropriate to the local context and the objectives of our research. It is intended to help you make a decision without prejudice to the decision-maker's prerogatives, by assessing performance in urban areas to establish an urban public health project in Algiers. This new evaluation method is part of a systemic approach and meets two requirements: *(i)* being easy to use by decision-makers without the necessity of computer software *(ii)* take into accounted the qualitative and quantitative criteria that influence all decision.

The study of health performance in cities should therefore combine, faced with the urbanization of territories, three health issues that are declined in terms of *(i)* access to urban services and equipment, *(ii)* proximity to sources of emissions harmful to health and finally *(iii)* access to nature. These three issues fall under the prerogatives of the urban public health project in its programming, planning and development component. Among them, the first two are supported by the planning instruments in force in Algeria: PDAU (French abreviation for Master Plan for Development and Urbanism) and POS (French abreviation for Land Use Plan). On the other hand, the third is only taken into account under the aspect of leisure and recreation, unrelated

to well-being, health and resilience to climate change.

In this article, we have explained the design process for our "SaMU" tool for evaluating health performance in urban areas. The operationality of this method has been tested in a specific context of the municipality of Gué de Constantine, which is at an average level of health performance.

Following the assessment of health performance, this research also allowed us to identify the weaknesses of the municipality of Gué de Constantine in terms of health performance, which opens the way for a decision to improve them through a supplement or a correction, which the client could take into account by formulating precise specifications, based on references and taking charge of all the health performance criteria for the development of an urban public health project that integrates the health issue, by applying the approach of the urban project.

V.References

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