

The Quinary Method of Socio-Spatial Sampling (QMeth-SSS): a revolutionary tool for analysis and visualisation in the social sciences

Abstract

The Quinary Method of Socio-Spatial Sampling (QMeth-SSS) is a five step protocol for the selection of socio-spatial units (sites) of investigation within a study area. This protocol is anchored on the principle of optimum satisfaction that embraces the triple conditions of representativeness (quantitative, qualitative and geographical) of chosen sampled sites that might have been retained as a function of the total sites population that permits the carving out of space. The experimental application of this tool to a study of impact of crises of the supply of health services in the New Bell Health District in Douala (Cameroon), permits us to conclude that there should exist a better approach to analyse and visualise socio-spatial data in the social sciences. Because, it permits a rational and equitable identification of socio-spatial units of investigation on a quantitative, qualitative and geographical basis and at the same time. These determine the representativeness of geographical data collected and by implication determine the structure and the objectivity of their visualisation.

Key words: Quinary Method of Socio-Spatial Sampling (QMeth-SSS), socio-spatial unit, triple representativeness of socio-spatial sample, visualisation, health service supply, impact.

INTRODUCTION

The Quinary Method of Socio-Spatial Sampling (QMeth-SSS) was developed and presented by Meva'a Abomo at the Commonwealth International Conference that held on from 13 to 14 April 2014 at the University of Douala¹. This tool was conceived to grapple with the subjectivities and paradoxes noted in the choice of the sampling sites in a given study area. Some of these choices have not been based on a well-conceived scientific method. The investigation sites are chosen in a haphazard manner and better still as per the whims and caprices of each researcher. In the first place, the number of sampled sites could appear inadequate as opposed to the whole study area. Secondly, the studied areas may not be appropriate or at least all the sites are not very appropriate considering the study objectives. Thirdly, the sampled sites can constitute an irrational geographical spatial distribution.

These three cases cited are indicative enough of the crises of the triple representativeness that are quantitative/statistical, qualitative and geographical/spatial of the sampled sites. This permits us to realise the often undeclared significance of sites that is generally a physical entity. It is a place where its values and importance change with challenges when the socio-cultural dynamics that are developing there are taken into consideration. Such change in the significance is the root cause of the « socio-spatial unit » caption that reflects the different forms of socio-spatial dynamics on a given site. As part of the in dissociable part of the socio-spatial body the socio-spatial units has the same structure and characteristics. Nevertheless, it is clearly homogenous when the socio-spatial is morphologically heterogeneous and presents a composite socio-spatial outfit. These structuring

¹ Meva'a Abomo D. (2014), *Modèle quinaire d'échantillonnage des unités socio-spatiales (sites) d'investigation et d'analyse pluridisciplinaire*, Communication for the Commonwealth International Conference on Interdisciplinary Collaborative research on Africa, Douala University, 13-14 April, 16p.

realities characterise the binding links between the socio-spatial units and any study and consequently determines the qualitative representative of the site. The site is definitely the usual appellation and the perceptible dimension by human view of the socio-spatial units.

The crisis of representativeness of sites study is a leading element of fundamental research that built up to the Quinary Method of Socio-Spatial Sampling (QMth-SSS); an intelligibility procedure of the selection of sample sites that permitting a triple representability (quantitative/statistical, qualitative and geographical/spatial of a given sample. All that is left are the experimental applications that can give an account of the correctness and the pertinence of the tool in matters of scientific knowledge production.

The current study raises the problem of the input of the Quinary Method of Socio-Spatial Sampling in the analysis and the visualisation of data in the human and social sciences. Visualisation is the process of transformation of raw and abstract data into concrete data that is significant and powerful (Latour, 1993 ; Cairo, 2012 ; Casati, Smith and Varzi 1998); graphical or cartographical representation of empirical data based on visual analysis (Forrest, Valero-Mora and Friendly, 2006) ; a system of analysis in high esteem to politicians considering the efficiency with which it can quickly present and make a synthesis of the visualisation that considers them directly operationalisation (Bihanic, 2015 ; Nathan Yau, 2013 ; 2011). The objective here is to apply the identification of case study sites in experimental studies, analyse and make simulations and to interpret the analytical challenges of the tool in order to better understand its input into the production of scientific knowledge in general and more specifically the visualisation of empirical data.

1- EXPERIMENTAL APPLICATION OF THE QMth-SSS

The experimental application of the Quinary Method of Socio-Spatial Sampling is carried out on the study titled “repercussions of the crises of health supply in the New Bell Health District (Douala-Cameroon) ». New Bell has some 261407 inhabitants of the 1,907,479 of Douala, the economic capital (BUCREP, 2010). The population is cosmopolitan and of great ethnic diversity made up of persons of all social classes: poor, intermediary and rich. The district is made up of a heterogeneous morphology reflecting the varied urban crises that constitutes a true health challenge. (Mounkam Nguede, 2016; Meva’a Abomo, 2015; Meva’a Abomo et al., 2015).

This health issue is the most worrisome considering the urban anarchy of the town. The New Bell Health District in particular is characterised by a health vulnerability because the main markets and commercial surface areas are many there. Mounkam Nguede (2016) had shown that the District is marked by a deep crises in health supply basing on the ratio between health personnel and patients that stood at : 1 doctor to 5603 patients, 1 nurse to 3121 patients, 1 pharmacist to 31,218 patients, 1

medical laboratory technician to 10,406 patients, etc. ; as well as equipment patient ratios such as: 1 hospital bed for 841 inhabitants, 1 hospital room for 1,256 habitants, 1 latrine for 3311 inhabitants, 1 pharmacy for 21,853 inhabitants ; 1 laboratory for 27,316 habitants, etc. These indicators justify the choice of the impact of health supply as the objective of our experimental study axing on three variables: (1) the use of the informal service providers in public health (2) supply of medicines, (3) the practice of self-medication in homes.

Data was collected in different sites of the District. Such sites were identified with the aid of the experimental application of the Quinary Method of Socio-Spatial Sampling that is executed in five steps to obtain socio-spatial units sample that is needed for this work:

- (1) mobilisation of a data referential
- (2) geographical structuration or breakup of the study area into socio-spatial units
- (3) elaboration of a socio-spatial sampling plan
- (4) selection operations
- (5) framing of the opportune matrix of socio-spatial units

- Mobilisation of a data referential

The mobilisation of a data reference is done for the whole socio-spatial sampling process involving (1) the identification of the nature of space; (2) the definition of the logics of the geographical structuration or partition of study space (3) specification of the base of partitioning in the socio-spatial structures or units; (4) qualification or specify the name of the socio-spatial unit that is the base of sampling.

This study on the impact of health service supply in the New Bell District permits us to note that the space of study is a health territory. This precision determines and orientates the choice of the logics of the geographical structuration and breakup of the study that should be in conformity with available data which now becomes the geographical breakup of a health territory. This logic is the official delimitation of the health territory. In the practice, the national health territory is structured in health districts that are also subdivided to health areas. The Health area therefore is a subset of the health district. It therefore becomes a socio-spatial unit or the basic element of a socio-spatial sampling.

The breakup of the study area into socio-spatial units

This step is the applying of the first step or the total breakup of the study space into elementary geographical structures based of the exploitation of a basic referential. The outcome is the definition of the statistical population within which the sample to be examine this identified. Some

complex studies require the definition and superposition of several approaches of geographical breakup of the study area. It requires that for each method of breakup, there should be the identification of varied types of space and several basis of the breakup². It results several types of elementary socio-spatial breakups or many types of statistical units which make up for the plurality of the statistical population that is at the base of the socio-spatial sample.

The total breakup of our health district gives therefore 10 health areas that are conform to the Health map of the Douala town (figure 1) which make up the statistical population: Camp Yabassi, Makéa, Nkololoun, Nkolmintag, Sebenjongo, Nkongmondo, Mbam-Ewondo, New-Bell Bamiléké, Nangué and Youpwé.

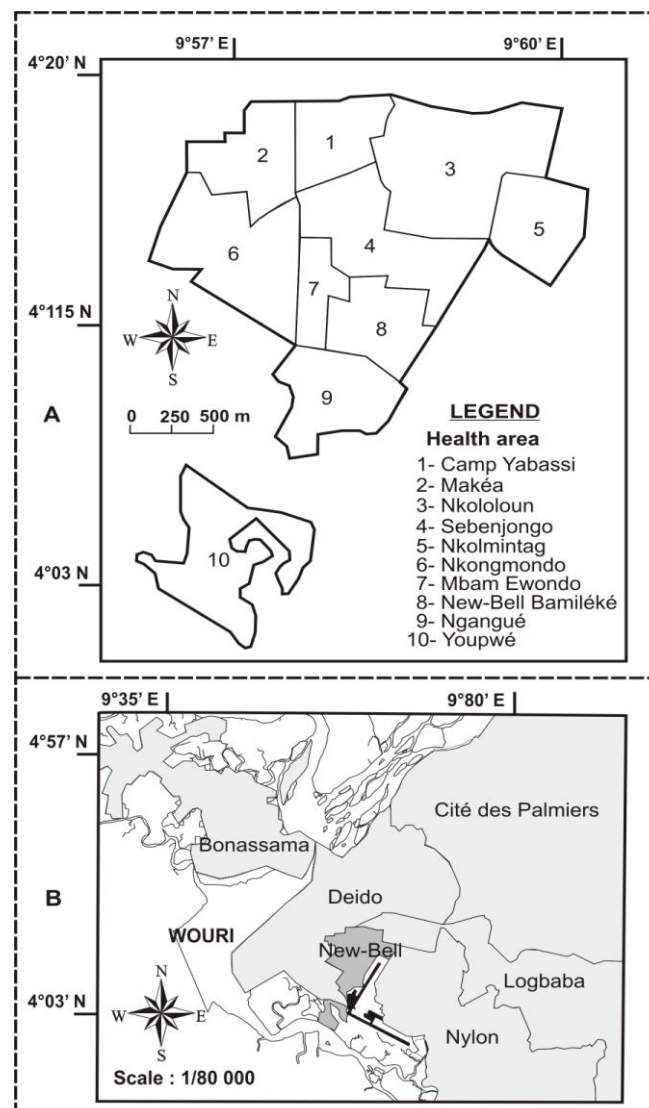


Figure 1 : (A) The breakup of the Health Districts in New Bell
(B) Location of the New Bell Health District in Douala

² Structuring geographical space depends on the breakup of the health territories that can be superimposed on the administrative map of the study area.

Elaboration of a socio-spatial sampling plan

This step is defined as a function of the explanatory terms of the socio-spatial sampling plan: the method, the techniques of socio-spatial sampling to ensure quantitative, qualitative and geographical representativeness of the sample sites retained while giving detailed explanation of the selection process. Our experimental study was focused on the non random socio-spatial sampling method based on four criteria of analysable object being the resort to informal health service offer. These criteria are: health cover, presence of informal system of healthcare, ethno cultural diversity and the geographical location. The nature and the mode of withdrawal was respectively non probabilistic and without replacement. These showed that the four health areas represent fairly well the population of the health areas of our health district studied.

The selection operation

This step is the selection of the socio-spatial units that make for the quantitative, qualitative and spatial representativeness of the study space. It results a bunch or a group of socio-spatial units. If there are many logics of geographical structuration and breakup of study space, it must result the same number of bunches. All these selections are done to applying of socio-spatial plan definite in last step. In the practice, an applying in our experimental study permits to select a bunch of four health areas that are: Nkololoun, Nkongmondo, New-Bell Bamiléké and Youpwé that are equally distributed in the study area (figure 2).

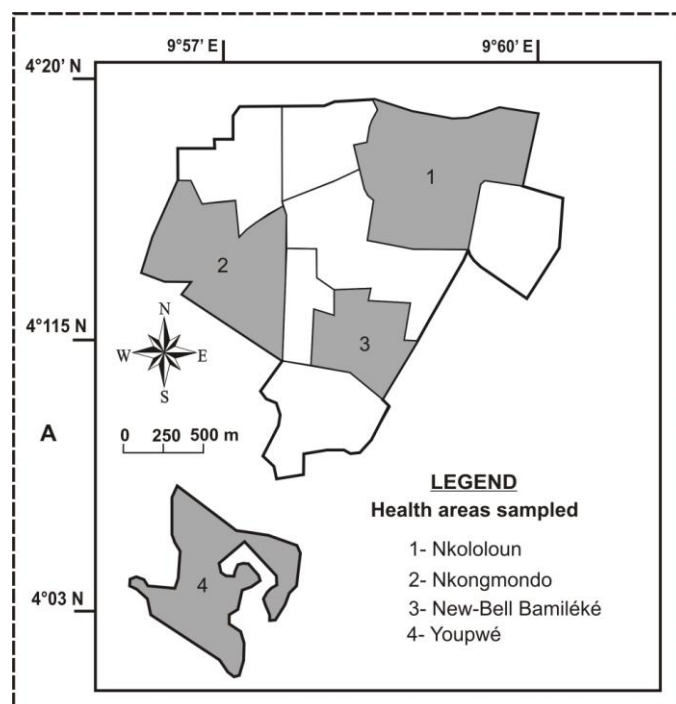


Figure 2 : Location of health districts used in the experimental study in New-Bell

- The opportune matrix of socio-spatial units

This step consists to the determination of the opportune matrix of socio-spatial units from the crossing of all bunches resulting to the logics of geographical structuration and breakup of study space. Hens, it is important in cases where there are many logics of breakup of geographical space. As in this case where there is only one logic, the unique bunch of socio-spatial units resulting to the fourth step becomes the opportune matrix of socio-spatial units; it also becomes the expected socio-spatial sample used in the investigation. The four health areas obtained at the fourth step above also becomes the opportune socio-spatial matrix. It is also the socio-spatial sample related to the stakeholder actions and socio-sanitary prevention in the New Bell Health District for those of Nkololoun, Nkongmondo, New-Bell Bamiléké, and Youpwé (figure 2).

2- ANALYTICAL CHALLENGES OF THE QMth-SSS IN VISUALISATION

The analysis of the challenges of the Quinary Method of Socio-Spatial Sampling requires an empirical experimentation and illustration which gives this study its importance. Empirical data for this study was collected from the four health areas sampled using a quota system in 200 homes equally distributed in the health areas being therefore 50 per area.

- The structure and representativeness of the socio-spatial sample

The structure of the socio-spatial sample is an indicator of its quantitative, qualitative and geographical representativeness. Quantitatively, the sample has four of the ten areas that corresponds to 40 % of the population and confirms the statistical representativeness of the socio-spatial sample (Meva'a Abomo, 2014). Thus, the results can be generalised to all a health district. Qualitatively, the sample has two types of structure. First is related to the health areas that have the same level of public medical coverage. The importance of this structure is linked to the fact that the level and quality of medical coverage influences the degree of population return to informal medical service providers. The sample used has a District hospital and an Integrated Health Centre (New-Bell Bamiléké), two subdivision medical centres (Nkololoun and Nkongmondo), and an area with no public health establishment (Youpwé). The second type of structure is related to the health areas that present the dominant socio-cultural and linguistic variables, because they determine socio-sanitary practices in times of crises of health service supply. The sample is made up of three areas of francophone inhabitants (Nkololoun, Nkongmondo, New-Bell Bamiléké) and one of Anglophone (Youpwé). In all, the sample reflects a quantitative representativeness and so can be generalised especially considering the rationality of the geographical distribution of the health districts (figure 2). This rationality confirms a geographical representativeness of our socio-spatial sample.

- Analytical fundament of the Quinary Method of Socio-Spatial Sampling in the production of scientific knowledge and visualisation

The Quinary Method of Socio-Spatial Sampling also presents analytical importance in the exploitation of collected data. It structures the Space-Object study inking in two complementary modalities. The first modality is structural. It is based on the crossing of operational variables with the geographical breakup of space. This ends up producing a model of distribution of the operational variables in function of the socio-spatial units investigated. The said variables are represented by average values of the socio-spatial units. Thereof is produced a cartographic representation of the geographical elements studied (Figure 3-13). It indicates the geographical representation of three operational variables using qualimetric indicators³. Above all, it also permits questions to be raised about the distribution from visual analysis.

i- The geographical distribution of the use of informal health service providers in the health districts:

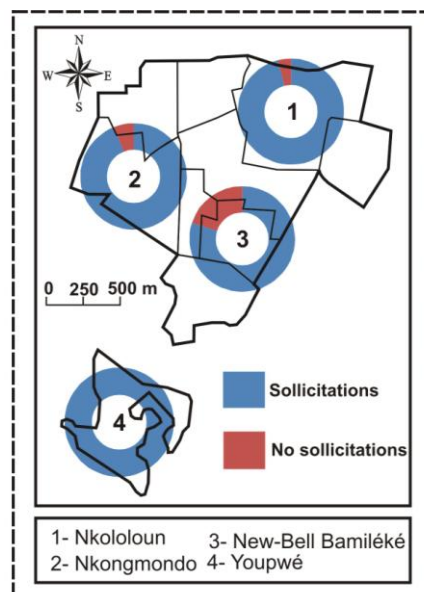


Figure 3: State of request by homes of informal health service providers in the health districts

³ Meva'a Abomo Dominique (2014), Qualimetry refers to a qualitative measurement and so, a qualimetric indicator is a measurable qualitative indicator.

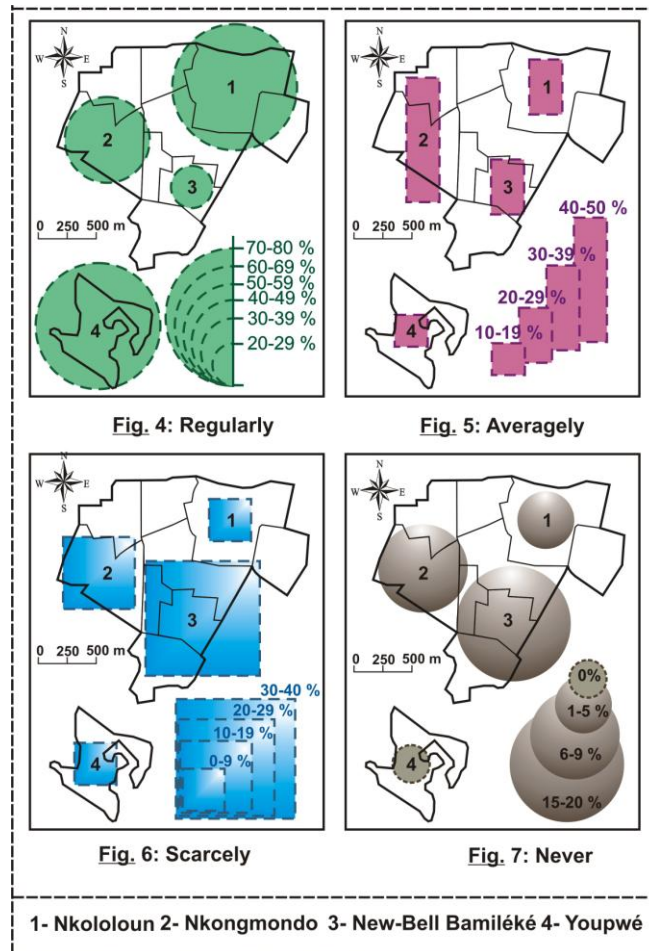


Figure 4-7: Variations of the homes seeking informal health service providers in the health districts

ii- The geographical distribution of the sources of medical supply in the health districts:

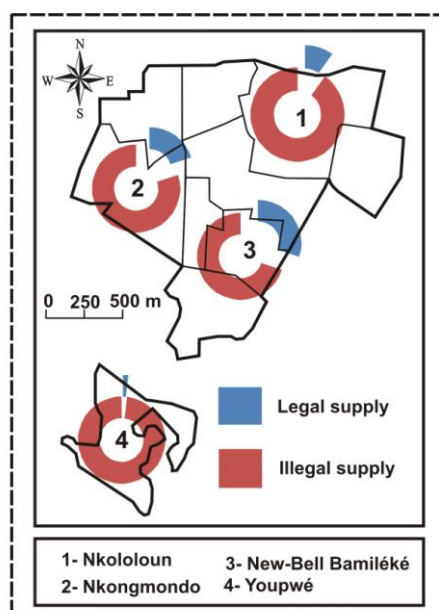


Figure 8: Sources of drug supply in the health districts

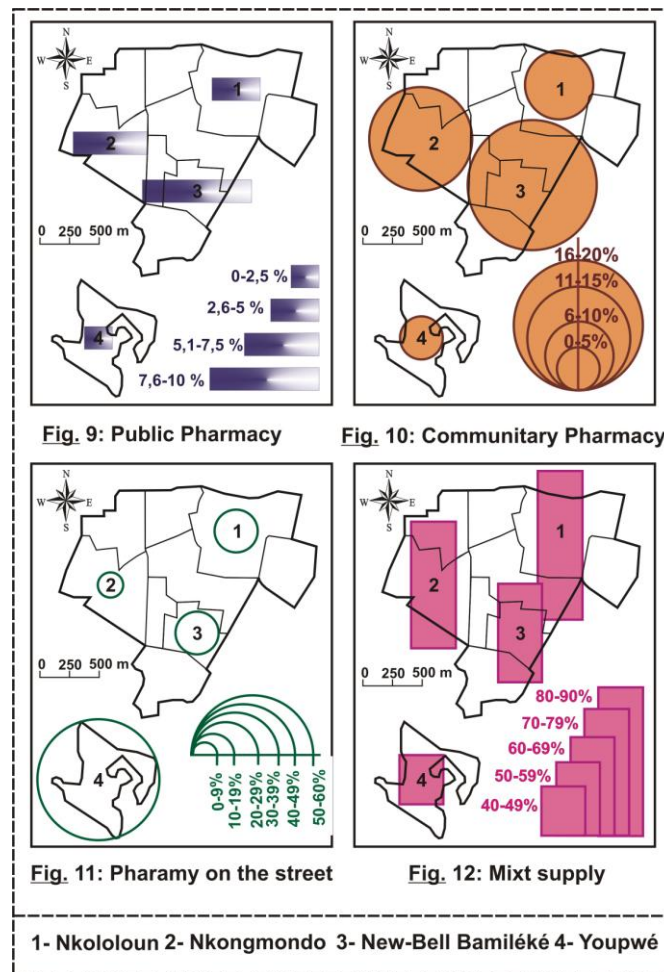


Figure 9-12: The distribution of the sources of supply of drugs in the districts

iii- The geographical distribution of the phenomenon of self-medication in the health districts:

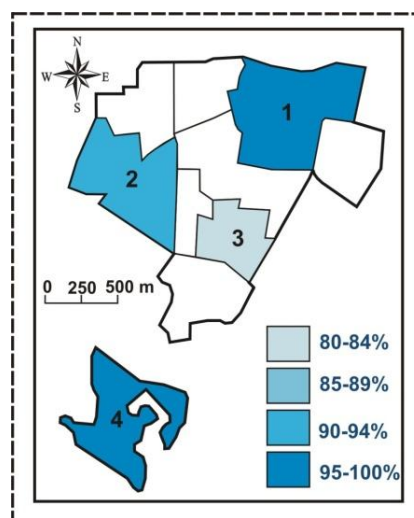


Figure 13: Variation of practices of self-medication in the districts

The second modality that structures the Space-Object study inking is analytical. It is based on the identification of the structural and functional characteristics of the study objective using elements

that can be analysed ; which highlights the apparent and deep interaction between the elements and then between the elements and space. This modality reconstitutes the chain of causalities, functional dynamics of study object, its interconnections, its impacts and the new repercussions from these impacts in a spacio-temporal frame that is dynamic and changing. Analytical modality of the Space-Object inking is funded on two scale levels of analysis. Each scale level of analysis is exploited in two approaches: horizontal and vertical.

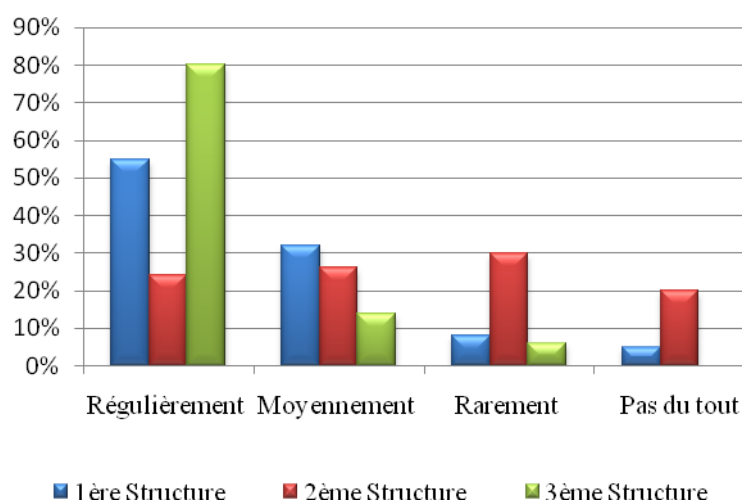
i- The first scale level of analysis of the Space-Object study inking

The first scale level of analysis of the Space-Object study inking minimises the internal variations of the socio-spatial units and maximises the variations between the units. Its *Horizontal approach* is focused on the visual analysis of the cartographic representations that result from the inking Space-Object study. This produces a determination of spatial distribution structures and to an elaboration of geographical configuration of operational variables and therefore the objective of this study. It shows the geographical inequalities of polarised zones, zones of concentration and intermediary zones.

The above figures show in link with the first operational variable a very high demand for informal health service providers in the health (fig. 3). Health districts like Youpwé are totally in the demand for informal health service providers (fig.3). Some variation is noted with homes using this approach showing a polarisation of regular demand in Youpwé (80 %) and Nkololoun (70 %) health areas (fig.4). The New-Bell Bamiléké health area is the zone of greatest concentration, where less than 30 % of homes use informal health service providers (fig. 6) and where 20 % (fig. 7) do not use clandestine service providers. Concerning the operational variable, there is generally a high usage of drugs sold in informal structures (fig. 8). The use of official drugs from standard pharmacies though small is only in the New-Bell Bamiléké area with 10 % and 20 %. These are homes that attest to have not used any informal source of medication. On the contrary, Youpwé is the heaven for those who use informal health service providers from street hawkers of drugs (fig. 11). There is a combination of the sources of supply and levels of income that is often practised. This phenomenon reveals a bipolarisation in the health areas Nkololoun and Nkongmondo with a high concentration of 80 % and 72 % respectively. The analyses of the third variable shows an average occurrence of 93%, self-medication but with the highest concentration in Youpwé (100 %) and Nkololoun (96 %), health areas.

The vertical analytic approach of the first scale level of the socio-spatial analysis is based on the crossing of the operational variables with the type of structures of the samples. For example, the first variable of the experimental study (*the use of the informal service providers in public health*) can be crossed with the first type of structure of the socio-spatial sample (*health areas having the same*

level of public medical coverage). This would permit the characterisation of the informal suppliers of health services in a health district that present the same threshold of health coverage and make comparisons. The figures (figures 14 and 15) produced by this characterisation are due to a visual analysis that shows the inequalities of these characteristics between the structures of the socio-spatial sample.

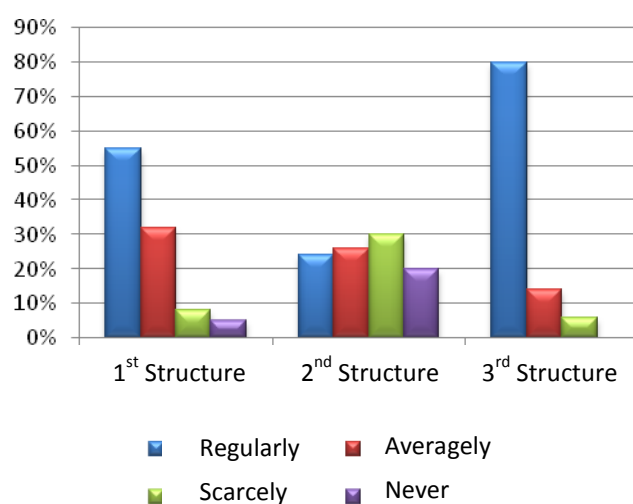


Regularly Averagely Scarcely Never

1st Structure 2nd Structure 3rd Structure

1st Structure: Health Districts having a Sub Divisional Medical Centre (Nkololoun and Nkongmondo)
 2nd Structure: Health Districts having a District Hospital and an Intergrated Health Centre (New-Bell Bamiléké)
 3rd Structure: Health Districts having no public health establishment (Youpwé)

Figure 14: Inter-structure variations of the home demands of services of informal providers for health districts of the same level of coverage



- 1st Structure: Health Districts having a Sub Divisional Medical Centre (Nkololoun and Nkongmondo)
- 2nd Structure: Health Districts having a District Hospital and an Intergrated Health Centre (New-Bell Bamiléké)
- 3rd Structure: Health Districts having no public health establishment (Youpwé)

Figure 15: Intra-structure variations of demand of homes for informal health service providers of the same level of coverage

The same variable for the request of the informal service sector health providers could then be crossed with the second structure of the sample (health districts having a sociocultural and linguistic dominance). This crossing permits us to establish the use of informal health service providers in the health districts where the inhabitants are mostly Francophones and that where they are mostly Anglophones (figure 16 and 17).

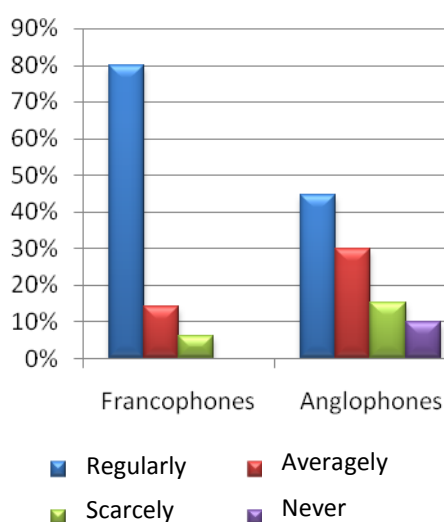


Figure 16: Inter-structure variations of the demand of homes for services of informal providers for health districts of the same socio-cultural and linguistic level

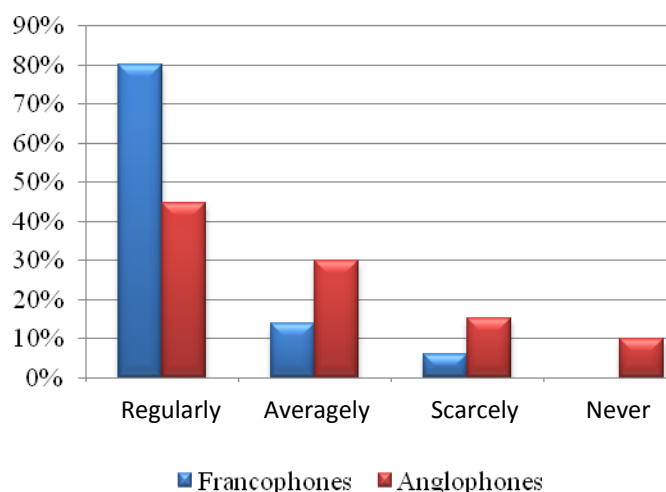


Figure 17: Intra-structure variations of the demand of homes for informal sector health providers of the same level of public health coverage

The second (*acquisition of drugs*) and third (*practice of self-medication in the homes*) variables can also be each crossed to the two types of structures of socio-spatial samples considered for the experimental study. In all the multivariate analysis based on the crossing of the variables between themselves results in variables of synthesis. For example, the crossing of «demand for informal suppliers of health» and «acquisition of drugs» produces two variables of synthesis. The first is the state of demand for informal health service providers as a function of the supply of drugs, and the second is the state of supply of drugs as a function of the demand of the informal health providers. Tables of the characteristics (totals, frequencies, etc) of the variables are determined with the help of a specialised software like the SPSS that is capable of analysing multivariate and monovariate data of statistical enquiry. Each synthesised variable can then be crossed with each type of structure of the socio-spatial structure to produce a new geographical configuration of the space – object combination.

ii- The second scale level of analysis of the Space-Object study inking

The second scale level of analysis of the Space-Object study inking maximises the internal variations of each unit and minimises the variations between the units. It is a deep ecology of each geographical scale of study (spatial unit and the structure of the socio-spatial structure). It is modelled according to its horizontal approach, the inequalities within each socio-spatial unit of investigation. Despite the homogenisation of the characteristics in a health area, it should be noted that there are micro-variations within the socio-spatial units. The horizontal approach has not valorised in this experimental study that decrypted the dominants characteristics, but, it is importance to notice that, there are many geographical micro-variations of the indicators of the object study in each health area. In the all, the horizontal approach permits the identification and the characterisation of the internal geographical micro-configurations of the Space-Object study inking in each health area and each structure of socio-spatial sample (the geographical inequalities of polarised zones, zones of concentration and intermediary zones).

The vertical analysis of the second level scale helps to model inequalities in each socio-spatial sample structure. From the internal micro-variations of the characteristics of the variables studied are more obvious at the scale of socio-spatial sample structures. For example there are equally as many Anglophones living in the health district that is mainly Francophone and vice versa. This vertical approach that was not highlighted in this work permits the general graphical representation on which the visual analysis is based to make structural configurations of discredited characteristics of

operational variables. In the ending, it permits the identification and the characterisation of the internal geographical micro-configurations of the Space-Object study inking in each socio-spatial sample structure (the geographical inequalities of polarised zones, zones of concentration and intermediary zones).

The QMth-SSS has a certain socio-spatial analysis fundament that the present experimental study cannot wholly explain. The researcher is free to implement all these scale levels of analysis of the Space-Object study inking or to choose one or other. Finally, QMth-SSS is an implementation and integration tool of spatial challenges for all fieldwork. It is therefore a precious tool the production of scientific knowledge and visualisation of research results in human and social sciences.

- The social utility of the QMth-SSS in visualisation, political decision making and social transformation

The QMth-SSS contributes to a better geographical configuration of socio-spatial dynamics and their space. Its ability to structure varied dynamics facilitates and enhances its understanding between varied challenges. In principle, the different modalities to manage the space-object of a study are the targets of an increased structuring of visibility. The QMth-SSS that is a method plays the central role in the multiplication of seeing and how to see as well as to perceive. It becomes a precious instrument of (Harley, Laxton and Andrews, 2002) in the human and social sciences. It contributes to the cognitive pro-activity in matters of identification, analysis and interpretation of socio-spatial dynamics and their related impacts. Such is useful and necessary for the mastery of practised space as well as in the challenges of societal dynamics that are developed there.

Mindful of its capacity to structure and configure space, the QMth-SSS significantly increases data visualisation as noted by Farinelli (1989). This is a strong point at the service of politicians, civil society and even local communities. Politicians can use it to plan public action and take targeted geostrategic decisions (Farinelli et al., 2009; Callon et al., 1991). This is because to each socio-spatial unit is a corresponding and specific reality that requires a specific intervention. This is the case with visualisation that is produced by our experimental study aimed at enlightening decision makers in matters of geostrategic planning against the informal sector supply of health services, the fight against street selling of drugs, self-medication, etc. In this way, the efficiency of public policy is improved in the like manner as societal transformations.

The civil society can also use its advantages to better make up its complaints against incompetent policies. The local population can through visualisation realise the geographical inequalities and marginalisation that they have been victims in matters of infrastructure and public

equipment with regards to health, education, etc. As solution, they could protest to politicians and/or take common community initiatives. The same visualisation could be used to appreciate changes that could have occurred later as from a comparison with the start off situation. Finally, the Mth-QESS reveals a societal utility that must be perceptible and taken into consideration.

Conclusion

The present experimental study is focused on the impact of the crises of health supply in the District of New Bell was an empirical framework for the application of the Quinary Method of Socio-Spatial Sampling. Findings show that the QMth-SSS can help in structuring socio-spatial analysis and the visualisation of field data in the human and social sciences. Just as any other methodological tool, it has its strengths and weaknesses, two of weak are worthy to note.

First is that the tool in itself cannot guarantee that the results are pertinent because this is strongly a function of the manner in which the data was collected on the field. The non-usage or poor mastery of these field techniques can easily lead to defects in the results. The QMth-SSS therefore only contributes to the production of knowledge. The second defect is that its exploitation requires the use of base maps of the study area in general and also maps of the delimitation of the socio-spatial units in particular. Unfortunately the maps of the quarter boundaries, health districts, swampy zones, etc, are hard to find in urban and rural areas and even when they exist the dynamics of such boundaries are fostered by man even though the researcher can determine these boundaries on a base map. The lack of this delimitation on a map creates a distortion in the socio-spatial analyses and would reduce it to mere approximations. In sum, it is important to state that these boundaries are to put to question the pertinence of these tools. These are loopholes that can be handled.

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