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A computerized solution for controlled distancing in a municipality in the state of Rio Grande do Sul/Brazil

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***Abstract*—** *The World Health Organization pronounced prevention, control, and management measures necessary from the state of a pandemic by coronavirus (SARS-Cov-2). Planning in situations of uncertainty is a task that aims to discover, evaluate, and face this circumstance. Objective: to describe a computerized solution for the distance control in establishments authorized to operate in the municipality of Gravataí (State of Rio Grande do Sul, Brazil), from May 1 to August 19, 2020. Results: The legal responsible for the establishment had to declare the customer service total area, administrative/production sector, and the total number of workers. The rule applied was the distance of at least 2 m² among people. A matrix determined by the system of colored flags was used to place a set of deliberations aimed to prevent and confront the COVID-19 epidemic, following mandatory protocols and specific criteria related to economic activities. Conclusion: The automated computerized solution to control distancing was useful for management in terms of inspection and quick decision-making, as it provided the necessary information regarding compliance with municipal and state decrees regarding the prevention of the new coronavirus.*

I. INTRODUCTION

In December 2019, a new betacoronavirus subtype was reported in Wuhan province. Known as SARS-Cov-2, this virus is associated with respiratory conditions hitherto of unknown origin, relating both to mild and severe forms of the disease[1]. Due to its high transmissibility, the virus has spread with such swiftly and in an overwhelming manner. Consequently, on March 11th, 2020, The World Health Organization (WHO) has declared a pandemic status for the new coronavirus[2].

Thus, planning in situations of uncertainty is a fundamental task that aims to discover, evaluate and face this circumstance. In this context of uncertainties, robust risks and actors with different interests, a non-deterministic planning looks to order human conduct. In view of this, it tries differently from the rationality of

traditional planning, which is based on setting up objects relating them to resources and deadlines[3].

The COVID-19 pandemic sets a scenario that keeps many goals inarticulate and unknown means to achieve them. The pandemic illustrates the uncertainties about the means and ends, that is, a true chaos. In this arrangement, government action is expected to aim to institute order.

In the midst of a context of crisis and the need to guarantee governance, as alternative to traditional planning models there is the Strategic Planning Situational (SPS) by Carlos Matus, which aims to integrate ways of thinking and actions of technicians and politicians in the search for answers to the problems that afflict social groups and society as a whole. This model is based on knowledge formed not only by the heterogeneities of the human and social sciences, but also by political and administrative sciences, enabling an analysis entwined with the problems of society, with the prediction of interventions within a scale of urgency and priorities [5].

Based on the guidelines of the Epidemiological Surveillance Guide of the Public Health Emergency of National Importance due to Coronavirus Disease 2019, the Federated Units defined their surveillance and control strategies for disease. The state of Rio Grande do Sul, through Decree No. 55,240, of May 10, 2020, instituted the "Controlled Distance System for prevention and dealing with the pandemic caused by the new coronavirus" (COVID-19) [6].

The System allows monitoring the evolution of the coronavirus epidemic, and health, social and economic effects. Based on scientific evidence and the strategic analysis of information, this model establish a set of measures aimed at preventing and dealing with the pandemic, observing the regional segmentations of the health system and sectoral divisions of economic activities according to the National Classification of Economic Activities (NCEA)[6].

In the Controlled Distancing System, the territory of the state of Rio Grande do Sul was divided into seven macro-regions. Each of them are composed of the corresponding municipalities of the 21 Regions, that aggregate 30 Health Regions[7]. The pandemic situation in the Regions is checked through the evaluation of 11 indicators determined to measure the spread of the virus and the possibility of response by the health care system[8].

Considering the 21 Regions and according to the pre-established scores of the indicators, a system of flags was created. The colors yellow, orange, red and black are used, respectively, for the gradual and proportional application of a set of measures aimed at prevention and coping with the COVID-19 epidemic. The banners were structured according to mandatory protocols and specific criteria to be followed by the different sectors of the economy. They used as a basis a weighted average of the indicators, classifying each Region in a colored flag weekly[8].

In this perspective, there are operating criteria that vary according to the color of the flag. The operating ceiling for each activity is highlighted, which decides the maximum number of workers present, simultaneously, in the work environment. Also, the operating ceiling must meet the occupancy ceiling of an environment, which means that the activity cannot run with a number of workers or public greater than the maximum number of individuals authorized for the free physical space, respecting the minimum mandatory distance. The mode of operation, on the other hand, indicates the way in which an activity is carried out when it is in operation. The activities can be carried out in person, however with restrictions applied through protocols and/or alternative ways to keep it in operation (e.g.: teleworking, delivery, pick up and take away, drive-thru, individualized service, among others).

The county of Gravataí is part of Region 10 of the Controlled Distancing System in the state of Rio Grande do Sul. The region is named after the capital of the state of Rio Grande do Sul, which is part of it: Porto Alegre. As this is the most populous municipality, Porto Alegre developed a web platform capable of applying the various Municipal Decrees and regulations from the State Controlled Distance System.

To develop and implement computerization, it was necessary professionals who develop/operate information systems and technical professionals of the health sector. All civil servants that taken part in the development process of the system were statutory and assigned to the Municipal Health Department (MHD) of Gravataí. Hardware resources, physical devices, and equipment used for information processing (machines and media) were fundamental in this process. These resources were working tools of the civil servants of the Hall city, whose acquisition took place before the COVID-19 pandemic. Also, a software was used to control the hardware and to process the information.

The present study aims to describe an automated computerization solution for the controlled distancing from establishments authorized to work in the municipality de Gravataí, from May 1st to August 19th of 2020.

II. METHODS

On May 1st, 2020, the Term of Health Responsibility[9], generated through an electronic address (http://saude.gravatai.rs.gov.br/termo) was instituted. Based on information about the administrative/production and customer service areas, self-declared by the entrepreneurs, the system calculated the maximum number of people in the service area to the customer (occupancy ceiling) and in the administrative/production area (operation ceiling).

That computerization was implemented prior to the controlled distancing from the state of Rio Grande do Sul. At first, the person responsible for the establishment self-declares the total number of areas intended for customer service and administration/production, and the total number of workers. The rule to be applied was the distance of at least 2 meters between people. The following formulas were used for this calculation:

Administrative/production area (AA) = sum of free areas for circulation and length of stay (m^2) of workers (At) per m^2.

[Customer area (AC) = sum of free areas for circulation and stay (m^2) for customers (Al) for m^2]

The m^2 in the denominator refers to the area of the circle that each individual occupied considering the interpersonal distance of 2m, being the radius equal to 1 (one). Subsequently, the Term of Sanitary Responsibility was based on the matrix determined by the colored flag system[8].

Following the protocols of the Controlled Distancing System, in the Term of Sanitary Responsibility, the occupancy ceiling indicated the number of persons present, simultaneously in the establishment, obeying the Norms of Fire Prevention and Protection[10] and observing the mandatory distancing of 2 meters between individuals. In this way, to measure the occupancy ceiling of establishments released for operation, the following general formula was used:

[Occupancy Ceiling (TOc) = sum of free areas for circulation and permanence (m^2) of the client (Al) by the rule of the controlled distancing system (0.25) by the Municipal Reduction Coefficient (CRm) and Coefficient Public normative (CNp)], i.e., [TOc = Ax 0.25 x (1- CRm) x CNp].

To establish the occupancy ceilings, the calculation involved the parameter of one person wearing a mask for every 2m² of free area or one person without a mask for every 5.5m² of free area. Therefore, the rule of the municipal controlled distancing system defined the occupation as one person for every 4m² of area, regardless of the use of a mask.

The Municipal Reduction Coefficient (CRm) was applied in the self-declared area, both for the calculation of the occupancy ceiling and for the operating ceiling, considering that the establishments would refer to the total area and not to the free area in line with the municipal decree. Therefore, in the orange flag, period from May 2 to June 22, 2020, when the area was up to 100m², it was reduced by 20%; 101 to 200m², 30%; from 201 to 400m², 40%; and if greater than 400m² the reduction was 50%. In the red flag, in force between June 23 and August 19, 2020, the reducers applied in the areas self-declared were: 40% in those smaller than or equal to 100m², 45% in areas between 101 and 200 m², 50% when between 201 and 400m², and 60% for those above 401m².

The public normative coefficient refers to the percentage of capacity allowed by economic activity as expressed in municipal decrees based on the Controlled Distance System of the State of Rio Grande do Sul. As for the operating ceiling, whose concept was mentioned above, it was established according to the flag color and the economic activity, and its value could not exceed that of the occupancy ceiling. Also, when the administrative/production area is less than 4m², the operating ceiling is equal to one (=1).

To calculate the operating ceiling, the following two formulas were applied, prevailing the most restrictive value when compared.

[Operation Ceiling (TOp): Worker Normative Coefficient (CNt) x No. workers per shift (T), i.e., TOp = CNt x T]

Or

[Operation Ceiling (TOp): sum of free areas for circulation and permanence (m 2) of the worker (At) by the rule of the municipal Controlled Distance System (0.25) by the municipal Reduction Coefficient (CRm), i.e., TOp = A x 0.25 x (1- CRm).]

The worker normative coefficient refers to the percentage of workers allowed by economic activity considering municipal decrees.

III. RESULTS

The legal responsible for the establishment accessed the computerization tool through the link http://http://saude.gravatai.rs.gov.br/termo/, and fill in the branch of activity. The system only allow proceeding if the activity was authorized to operate.

On the next screen, a window appear with the current municipal decree regarding the controlled distancing regime, and a field for the applicant to fill in with the number of the National Registry of Legal Entities or Individuals of the Federal Revenue.

Subsequently, a form was presented with indispensable variables for identification of the establishment, in particular, the self-declared areas for calculating the occupancy and operating ceiling, and number of workers (Figure II, quadrant bottom).

When clicking on "generate term", the following screen displayed the verification of the data of the legal person responsible for the establishment. After confirmation, the Term of Responsibility is generated and saved in the database of the controlled distancing management tool, for use by the municipal agents.

This computerization tool had a control panel for the establishments, presenting the area and population variables from the Terms of Sanitary Responsibility (Table 1) generated by establishments authorized to work.

It was possible to observe three scenarios, the first being prior to the Controlled Distance System in the state of Rio Grande do Sul, and the other two referring to the colors of the deliberated flags for Region 10, where Gravataí is inserted (Table1).

The first scenario took place from May 1st to 12th 2020[9]; the second, due to the orange flag, it was from May 13th to June 22nd, 2020, [11,12]; and the third, under the red flag took place between June 23rd and August 19th, 2020 [12,13]. At table 1, it can be seen that, even with the progression of the severity of the scenarios, there was an increase in registered entrepreneurs and, consequently, an increase in the number of workers and clients released in specific economic areas.

To exemplify the difference in the occupancy ceilings values (the number of persons present, simultaneously, in the establishment) and of operation (the maximum number of workers present at the same time in the work environment) according to the scenarios (Table 2), it used the activity of restaurant – dish done. For this, the following fields were filled in: total number of workers = 10; administrative/production area = 20; free area for customer movement = 100.

The worker normative coefficient of scenario 2 is from the Decree 17.934, of May 13, 2020, and scenario 3 was present in the Decree 18.014, of June 23, 2020. In other words, the computer tool was always in line with its legal counterpart.

IV. CONCLUSION

The pandemic caused by the new coronavirus (SARS-Cov-2) corroborated the need for measures to prevent, control and manage the disease in a marked way. Planning in this context of uncertainty configures a fundamental task to discover, evaluate and face it. Thus, the state of Rio Grande do Sul/RS instituted the Controlled Distancing System, holding general and specific rules according to economic activity. Thus, in the government exercise, the Municipality of Gravataí/RS, aiming to prove the order, created a computerized solution to control compliance with the rules prescribed by the state model.

This tool is an innovative and useful resource for management in terms of inspection and quick decision-making since it has the fundamental information to follow municipal and state decrees regarding the prevention of SARS-Cov-2. It is understood that the present work will contribute to the improvement and expansion of the use of technologies of this nature by other municipalities at this time of pandemic by the new coronavirus.

Table 1 - Total population (administrative/production and customers) according to area of establishments by scenario

Registered Entrepreneurs		Scenario 1 (May 1st to 12th, 2020)	Scenario 2 orange flag	Scenario 3 Red flag
		4.841	7.130	7.904
Áreas (m2)	Management or Productions	601.393	41.201	153.031
	Clients	969.894	168.211	40.793
	Total	1.571.287	209.412	193.824
Population	Management or Productions	191.849	11.093.928	1.576.888
Population (people)	Clients	308.967	1.172.776	1.354.193
	Total	500.816	12.266.704	2.931.081

Source: Municipal Health Department of Gravataí/RS (2020)

Table 2 – Scenarios based on the branch of activity à la carte restaurant – prepared dish

	Scenario 1 (May 1st to 12th, 2020)	Scenario 2 orange flag	Scenario 3 Red flag
Municipal Reduction Coefficient	-	0,8	0,6
Public normative coefficient	-	-	-
worker normative coefficient	-	0,5	0,5
Administrative or production area/Operation Ceiling	05	04	03
Client Area/Occupancy Ceiling	32	20	15

Source: Municipal Health Department of Gravataí/RS (2020)

REFERENCES

[1] Guan WJ, Ni ZY, Hu Y, Liang WH, Ou CQ, He JX, et a. Clinical Characteristics of Coronavirus Disease 2019 in China. New England Journal of Medicine. 2020, 382(18):1708-1720.

[2] Pascarella G, Strumia A, Piliego C, Bruno F, Del Buono R, Costa F et al. COVID-19 diagnosis and management: a comprehensive review. Journal of Internal Medicine. 2020, 288(2):192-206.

[3] Amorin MCS. Planejamento, incertezas e o uso da técnica de cenário. Organizações & Sociedade. 1997, 4(9):93-101.

[4] Christensen KS. Coping with Uncertainty in Planning. Journal of the American Planning Association. 1985, 51(1):63-73.

[5] Matus, C. (1998). Adiós, señor presidente. Argentina: EDUNLa, Cuadernos del ISCo.

[6] Rio Grande do Sul. Decreto Nº 55.240, de 10 de maio de 2020. Institui o Sistema de Distanciamento Controlado para fins de prevenção e de enfrentamento à epidemia causada pelo novo Coronavírus (COVID-19) no âmbito do Estado do Rio Grande do Sul, reitera a declaração de estado de calamidade pública em todo o território estadual e dá outras providências. Available at: http://www.al.rs.gov.br/legis/M010/M0100099.ASPHid_Tipo=TEXTO&Hid_TodasNormas=66393&hTexto=&Hid_IDNorma=66393.

[7] Rio Grande do Sul. Resolução nº 188, de 15 de junho de 2018. Diário Oficial do Estado do Rio Grande do Sul. Available at: https://saude.rs.gov.br/upload/arquivos/carga20180633/22173349-cibr188-18.pdf.

[8] Rio Grande do Sul.Decreto n. º 55.435, de 11 de agosto de 2020. Atualiza o Decreto nº 55.240, de 10 de maio de 2020. Institui o Sistema de Distanciamento Controlado para fins de prevenção e de enfrentamento à epidemia causada pelo novo Coronavírus (COVID-19) no âmbito do Estado do Rio Grande do Sul, reitera a declaração de estado de calamidade pública em todo o território estadual e dá outras providências. Available at: https://pge.rs.gov.br/upload/arquivos/202008/11161355-decreto-55435.pdf.

[9] Prefeitura Municipal de Gravataí. Decreto nº 17.896, de 1 de maio de 2020. Reitera a declaração de estado de calamidade pública em todo o território do município de Gravataí, conforme Decreto n 17.837/20, fixa novas medidas para fins de prevenção e de enfrentamento a pandemia causada pelo COVID-19 e dá outras providencias. Available at: https://gravatai.atende.net/?pg=diariooficial&texto=86043&edicao=1363.

[10] Rio Grande do Sul. Protocolos: Modelo de Distanciamento Controlado do RS. Versão de 15 de junho de 2020. Available at: https://distanciamentocontrolado.rs.gov.br/.

[11] Prefeitura Municipal de Gravataí. Decreto 17.934, de 13 de maio de 2020. Fixa novas medidas sanitárias para fins de prevenção e de enfrentamento à pandemia causada pelo COVID-19, revoga o Decreto Municipal nº 17.896/20 e dá outras providências. Disponível em: https://gravatai.atende.net/?pg=diariooficial&texto=86043&edicao=1363.

[12] Prefeitura Municipal de Gravataí. Decreto nº 18.014, de 23 de junho de 2020. Fixa novas medidas sanitárias para fins de prevenção e de enfrentamento à pandemia causada pelo COVID-19, revoga o Decreto Municipal nº 17.934/20 e dá outras providências. Available at: https://gravatai.atende.net/?pg=diariooficial&texto=86761&edicao=1398.

[13] Prefeitura Municipal de Gravataí. Decreto nº 18.134, de 20 de agosto de 2020. Fixa novas medidas sanitárias para fins de prevenção e de enfrentamento à pandemia causada pelo COVID-19, revoga o Decreto Municipal nº 18.084/20 e dá outras providências. Available at: https://gravatai.atende.net/?pg=diariooficial&texto=87528&edicao=1438.