

Answer: Índice de Saturación Modificado (ISM) in emergency rooms. Another index else?

Carlos Polanco González^{1*}, Thomas Buhse², Rocío Arreguín Nava³, Jorge Alberto Castanón González⁴, José Lino Samaniego Mendoza⁵ and Sebastián Villanueva Martínez⁶

¹Subdirection of Epidemiology and Medical Care Quality Control, Instituto Nacional de Ciencias Médicas y Nutrición Salvador Zubirán, Mexico, D.F.; ²Center of Chemical Research, Universidad Autónoma del Estado de Morelos; ³Division of Post-degree in Accounting and Administration, Universidad Autónoma de Querétaro, Mexico; ⁴Faculty of Health Sciences, Universidad Anáhuac; ⁵Department of Mathematics, Faculty of Sciences, Universidad Nacional Autónoma de México; ⁶Faculty of Medicine, Universidad Autónoma del Estado de Morelos, México

We read with interest the Letter to the Editor submitted by Dr. Takao Kaneko-Wada commenting our article¹. There, he mentions that although emergency department overcrowding can be subjectively determined, already validated in clinical practice saturation indices “have emerged” and are even available in the Internet such as the National Emergency Department Overcrowding Scale (NRDOCD); but that “currently” none of them has demonstrated to be superior to another. On the other hand, he mentions that in our virtual scenario it is necessary for the meaning of 245,280 “censuses” or random “transactions” to be clarified and that our modified saturation index (ISM) has not been validated from the clinical point of view and, therefore, we cannot support that an elevated ISM or, in other words, oversaturation of the department, inversely correlates with quality variables of the department.

In response: Subjective perception of an event corresponds to a simplified mental representation of reality as perceived by the observer. This perception is based solely on partial, superficial and evident elements with which the observer, based on his experience, tries to interpret and give coherence to the observed event. By excluding part of the underlying reality, but especially when failing to subject it to an objective analysis, this perception is frequently erroneous.

We acknowledge that emergency department saturation can be subjectively determined², but we also acknowledge that subjectivity is difficult to measure, graduate and reproduce, and that it has great inter-observer variability since it is modulated by experience.

As investigators we are interested on identifying and selecting the parameters and factors internal and external to the emergency department contributing to emergency department saturation in an objective and quantitative manner and with reliable, reproducible and auditable methods. With this working vision in mind, we have realized that the diversity with regard to size, location (urban, suburban or rural), type of hospital where the department is based, geographical area, coverage, infrastructure, number and training of the staff, equipment and budget, among other factors, make all emergency departments different, which partly explains the heterogeneity in the degree of control of processes, the diversity of used indicators and the inherent difficulty of encompassing them in a saturation index³.

Traditionally, two types of measurement have been used: “patient counts”, which are measurements in “real time” and which involve exclusively the emergency department (number of patients in the waiting room, number of patients on observation, etc.), and time intervals,

Correspondence:

*Carlos Polanco González
Subdirección de Epidemiología Hospitalaria
y Control de Calidad de Atención Médica
Instituto Nacional de Ciencias Médicas
y Nutrición Salvador Zubirán
México, D.F., México
E-mail: polanco@unam.mx

Date of modified version reception: 17-12-2014

Date of acceptance: 18-12-2014

which are “flow” measurements that due to its nature are necessarily “retrospective”. The latter frequently fall outside the emergency department area of influence, such as the time interval between the laboratory or radiology tests request and the reception of results, etc.

From these premises, we constructed the ISM as a medical-administrative tool for widespread utilization, which uses only real-time variables or measurements involving exclusively the emergency department, easy to access and, once stored and processed, allow us to visualize fine-grain “time series” to identify possible “bottlenecks” and deviations of the attention process in order to correct them.

Multidimensional scales, such as the NEDOCS (which use among other indicators patient counts and time intervals) perform well only in the hospitals where they were created⁴, since due to the heterogeneity of emergency departments, not all of them have the capacity to capture all the data and components required by these scales, which makes its widespread adoption unlikely. A rapid review of the NEDOCS calculator referred by Dr. Takao Kaneko-Wada allows to identify seven variables, out of which two are time intervals (Last door-bed time and Longest admit) that, curiously, are fragments of another indicator, which is “length of stay in the department” and that conceptually measure the same!; these and other inconsistencies were the starting point to develop our ISM.

From the computational point of view, we consider the test to be thorough, as illustrated in the “Virtual Scenario” section of our article, since it was necessary to randomly produce 7 variables, hourly monitored for 4 years (7 variables x 24 h x 365 days x 4 years = 245,280 variables) and this latter figure for each of all 7 hospitals (Table 5). This calculation is

close in magnitude to the instability value (10^8) of the random numbers congruential generators of commercial computing equipments, not to that of high-performance computing equipments and, therefore, a square units generator was used, which was first mathematically and then computationally verified (degree thesis. Carlos Polanco). With regard to the validity of this computational test, we consider appropriate mentioning that in the mathematical field related to the “graph theory”, at least one accepted computational test is mentioned for mathematical demonstration, due precisely to the thoroughness employed in the computational aspect of the experiment.

Finally, we state, and not “subjectively” but with the mathematical and computational validation employed in the ISM, that it measures medical emergency departments oversaturation, and that there is scientific evidence demonstrating that the degree of saturation inversely correlates with a least two quality of medical care variables (timely care and safety for the patient) of all six quality indicators proposed by the National Institute of Health in the United States of North America⁵.

References

1. Polanco-González C, Castañón-González JA, Buhse T, et al. Índice de saturación modificado en el servicio de urgencias médicas. *Gaceta Médica de México*. 2013;149:417-24.
2. Castañón-González JA, Polanco-González C, Camacho-Juárez S. La Sobresaturación de los Servicios de Urgencias Médicas. *Cir Cir*. Enviado a publicación.
3. Castañón González JA. Una herramienta administrativa para evaluar la Sobredemanda de atención en los Servicios de Urgencias Médicas. *Convergencia Administrativa-Matemático-Computacional*. Tesis de Maestría en Administración de Organizaciones de la Salud. Facultad de Negocios, Universidad La Salle, México, D.F., 2014.
4. Raj K, Baker K, Brierley S, et al. National Emergency Department Overcrowding Study tool is not useful in an Australian emergency department. *Emerg Med Australas*. 2006;18:282-8.
5. Bernstein SL, Aronsky D, Duseja R, et al. The effect of Emergency Department crowding on clinically oriented outcomes. *Acad Emerg Med*. 2009;16:1-10.