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CHALLENGE 1: ACRA (Avoiding Care Re-Admission.)

Pitch:

Development and validation of an effective algorithm that identifies patients susceptible to get complications that cause readmissions in Intensive Care Units, avoiding costs and mortality.

Motivation and description

The Challenger -Servicio Murciano de Salud (SMS)- has the need to reduce the risk of patients having a re-entry to the Intensive Care Unit (ICU) within the next 72 hours after discharge.

Unscheduled re-entry of the patient in the ICU is an adverse event that causes an increase in morbidity, mortality and consumption of hospital resources. A recent meta-analysis has reported an average re-entry rate between 4 and 7%, although it can reach up to 14%. The average mortality of patients with unintended readmission in the 72 hours after discharge from the ICU is 33%.

This type of patients is likely the most complex and costly. Therefore, knowing what factors are key to their poor evolution would allow the Challenger to improve care processes. For example, by incorporating preventive alerts or early detection tools, that allow a rapid healthcare intervention to avoid complications in its preclinical phase.

The piloting scenario will use historical data extracted from the Challenger corporate repositories. The Solver will have access to two fractions of the data:

1. One for initial construction and training of the algorithm, to be stored in a devoted *data lake*.
2. The rest to measure the predictive success and continuous improvement of the algorithm.

Main objective

Develop and validate a predictive algorithm or analytical model that allows ICU professional to recognize which patients will be most likely to get complications and facilitate decision making to prevent a readmission. Additionally, the Challenger would like to get insight about what clinical factors are critical in these situations to optimize ICU internal processes.

Pilot functional scope: Compulsory requirements

1. Design and set up the *data lake* to be used during the pilot.
    a. Patient data must be extracted from corporate repositories, cleaned and consolidated in it.
    b. Data for the training will be stored here. The technology must be able to process it in different forms (structured, free text, etc) and formats (pdf, word documents, tables, etc).
    c. Security and privacy is a must. Anonymization may be required depending on final setup.
2. Build the algorithm/analytical model with the training data.
3. Set up a mechanism to simulate a new patient interaction from data not used for the training.
    a. The system must make a prediction, indicating the readmission risk of that simulated patient.
    b. Mechanism to assess the degree of prediction success, both at at individual and group level.
4. Deliver documentation about hardware and software requirements, scalability and other information relevant for system setup and optimal performance.

Desirable requirements:

- The Challenger would like to get insight about what clinical factors are critical in these cases. A valuable output would be that technology helps ICU professionals to better understand what triggers readmissions.
- An interactive reporting system that visually analyzes the results, including segmentation based on demographics and clinical variables.

Pilot set up (requirements and compliance)

The data lake will be constructed with data from approximately **15.500 patients.**

Clinical and Ethical and Data Protection

The approach of the pilot must be previously validated by an Ethics Committee of the Servicio Murciano de Salud. The Committee will pay special attention to the protection of personal data, observing the requirements established by the new European data protection Regulation (EU 2016/679) and the Spanish law. Among others an Impact Analysis document, with identified risks and proposed measures, will be required to the Solver.

If deemed necessary, the Solver will be asked to anonymize the data according to mechanisms established by the Challenger. At any case, the Solver cannot exploit or make use of the data for different purposes than the ones agreed with the Challenger and, after pilot end, all copies of the data must be transferred back to the Challenger or deleted.

Technological

The Solver will build and manage the corporate data lake of the SMS with historical data extracted from the different data sources. If necessary, data will be anonymized according to mechanisms established by the Challenger. The pilot set up must enable audit capabilities, that at least include user access, task execution and changes in configuration.

The anonymized data lake can be hosted by the Solver. If complexity of the connections was too high or privacy could be at risk, the data lake will then be hosted at the Servicio Murciano de Salud. This will be set in a technical session at the beginning of the pilot.

Data sources

- Application of the ICU Service (ICCA by Philips) - Relational database and the possibility of formatted files in a structured way.
- Application of HC (Agora plus by SMS) - Relational database.
- Application of HC (Selene by Cerner) - Relational database, pdf files, word files and the possibility of formatted files in a structured way.
- Laboratory application (Modulab of Werfen and Gestlab by Cointec) - Relational database and pdf files.
- Pharmacy application (Silicon by Grifols). Relational BBDD

Anyway, the data interchange should be based in HL7 V2.x. It is used the following codifications: Loinc for the laboratory tests, Snomed for the medicaments and CIE 10 for diseases.

Expected impact and KPIs

The pilot success will be determined by the effectiveness of the predictive algorithm to identify patients at risk when complications can be avoided. The main indicator will be its percentage of success, at least 80%. All this would subsequently translate into impact on different dimensions of quality of care:

Health:
- Decrease in hospital deaths.
- Decrease in avoidable complications in these patients admitted to the hospital.
- Increase in patient safety.

Efficiency:
- Less consumption of resources derived from the lower morbidity and mortality measured in hospital stays.

The SMS will study the possibility of carrying out an impact analysis using the Social Return of Investment (SROI) methodology, to support the decision to scale-up the pilot.

Business opportunity

Avoiding the fact that bad evolution of UCI discharged patients is probably one of the most effective actions regarding hospital savings. It is also applicable in resuscitation, stroke units and other departments treating critical and semi-critical patients. Similarly, the model could be extended to patients who are discharged from the conventional hospital beds to Primary Care.

To compute the cost savings, the following figures can be considered:

- Per year, between 160 and 180 patients are ICU readmissions in all SMS hospitals. The average cost of a stay (day of admission) in the ICU is € 1,120 compared to € 610.
- The median stay in the ICU of readmitted patients is 4 days longer than the average, which means an increase of € 4,480 per patient. There is an additional cost due to the prolongation of the stay in the hospital ward, which is also higher in these patients.
- The consumption of resources and morbidity and mortality have been reported significantly unfavorable. A multicenter study reports a doubling of the median stay (8 days vs. 15 days) and an increase in mortality 7 times higher (4% vs. 21%).