Fundação Oswaldo Cruz

Application of an antimicrobial stewardship program in Brazilian ICUs using machine learning techniques and an educational model


Antimicrobial agents are frequently used empirically and include therapy for both Gram-positive and Gram-negative bacteria. In Brazil, multidrug-resistant Gram-negative pathogens are the cause of most nosocomial infections in ICUs. Therefore, the excessive use of antimicrobials to treat Gram-positive bacteria represents an opportunity to reduce unnecessary antibiotic use in critically ill patients. Besides, the success of a program aimed at reducing the use of antibiotics to treat gram-positive bacteria could also evolve to include other micro-organisms, such as gram-negative bacteria and fungi. Analyzing data from the ICUs in our associated network of hospitals, we found high use of broad-spectrum antibiotics and vancomycin, even though MRSA infections rarely occur. Thus, if physicians could identify patients at high risk of infection by gram-positive bacteria, we could reduce antibiotic consumption. The more accurate treatments could result in better patient outcomes, reduce the antibiotics' adverse effects, and decrease the prevalence of multidrug-resistant bacteria. Therefore, our main goal is to reduce antibiotic use by applying an intervention with three main objectives: (i) to educate the medical team, (ii) to provide a tool that can help physicians pre-

scribing antibiotics, and (iii) to find and reduce differences in antibiotic prescription between hospitals with low- and high-resources. To achieve these objectives, we will apply the same intervention in ICUs of two hospitals with different access to resources. Both are part of a network of hospitals associated with our group.

The integration of data we performed is a relevant step for physicians and managers to better understand the hospitals' status regarding antimicrobial stewardship. The network of hospitals currently has three individual datasets that are not usually combined: microbiology tests, antimicrobial consumption, and ICU admissions. We developed a data curation and integration pipeline that combines the three datasets with the collaboration of data and physician specialists. The final dataset is an input for our proposed analytical platform. The platform has been internally validated for monitoring main AMR indicators in eight hospitals. The tools have encouraged the team and interviewees to pursue more information regarding antimicrobial stewardship, promoting multidisciplinary discussions that would not usually occur. Regarding the research outputs, one research article was published about prescribing antibiotics in Brazilian ICUs. The discussions among the team members during the platform development stage have generated research publications: One evaluates the impact of the COVID-19 pandemic on resistance and prevalence of microorganisms in ICU; and a second article regarding the clinical characteristics of community-acquired infections in ICU admission.

The benefits of collaboration with Global Bridges are related to the opportunity of engagement and connection with different research groups regionally and globally. During the current grant, we were able to conduct research with a multidisciplinary team (physicians, engineers, developers, researchers, and HICC members, etc.) that enabled a high-quality output of our deliverables. Globally, the Global Bridges meetings were very insightful and provided our group various perspective of how AMR has been addressed, according to the necessities of the corresponding country, which assisted our research steps.
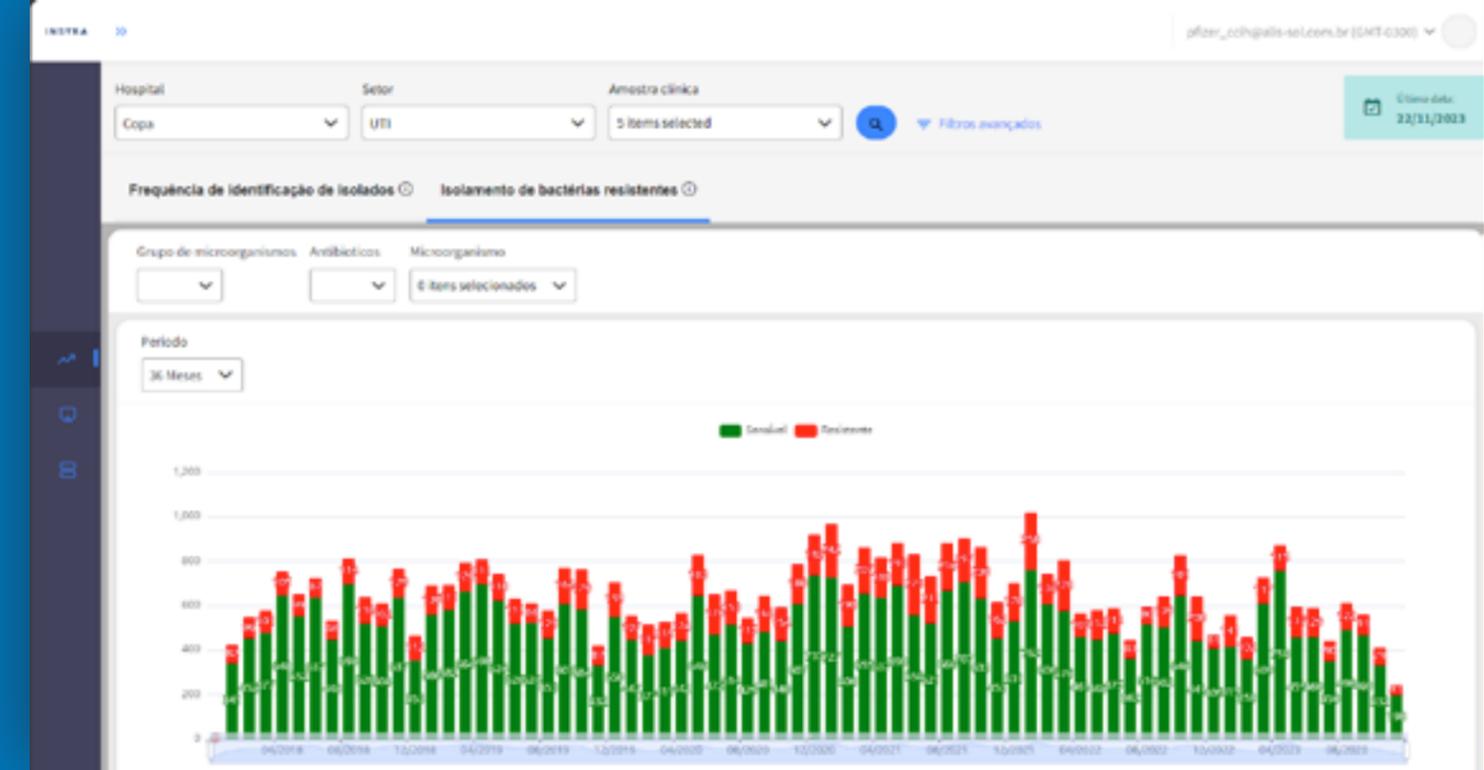
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