

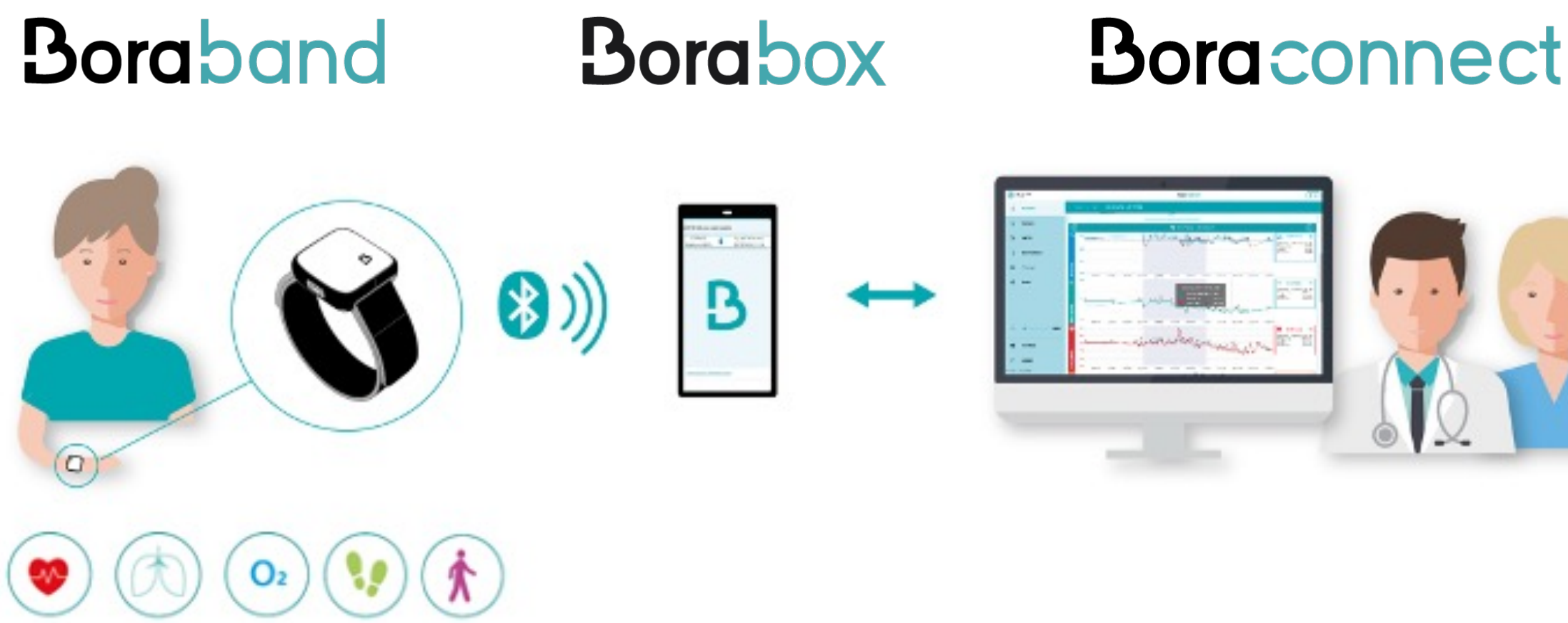
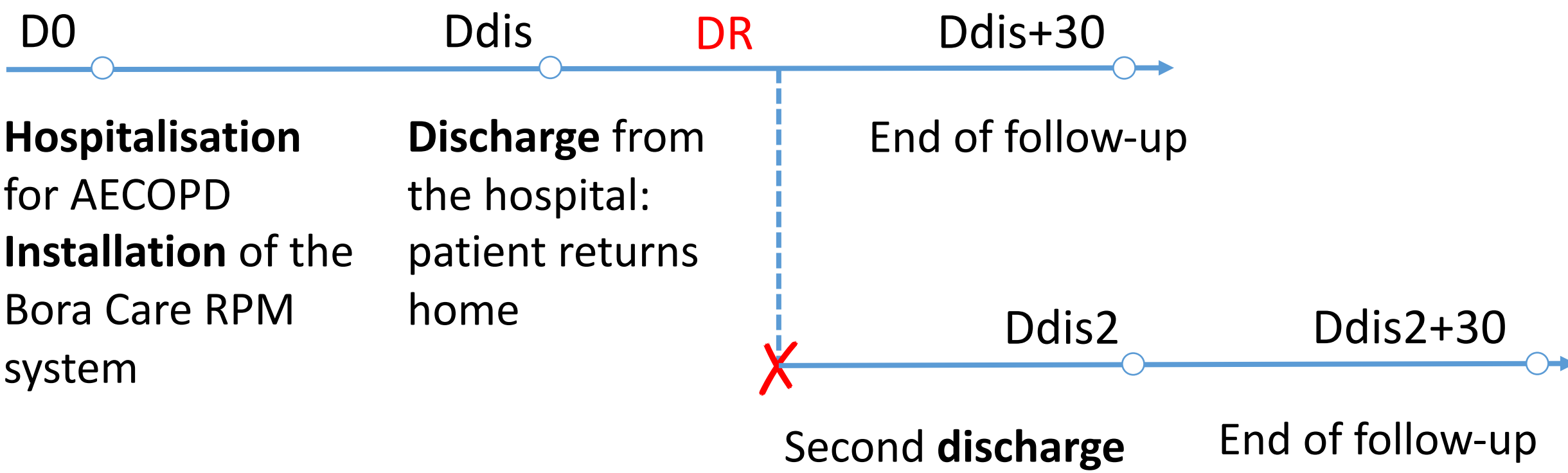
Introduction

- Hospital readmission after acute exacerbations of chronic obstructive pulmonary disease (AECOPD) concern between 9% and 26% of all COPD-afflicted patients[1].
- It has been previously showed[2] that remote patient monitoring (RPM) is paramount to prevent readmission by collecting patient's vital signs and performing early detection of AECOPD using algorithms that perform anomaly detection of these vital signs.
- The DACRE study is a multicentric prospective study that collects COPD patient's vital signs during their hospital stay due to an AECOPD and for up to 30 days after their hospital discharge.

Objectives

- Perform **patient's vital signs analysis** in the context of RPM for AECOPD early detection
- Find the most suitable vital signs **thresholding strategy** as an **algorithm measuring risks of hospital readmission**

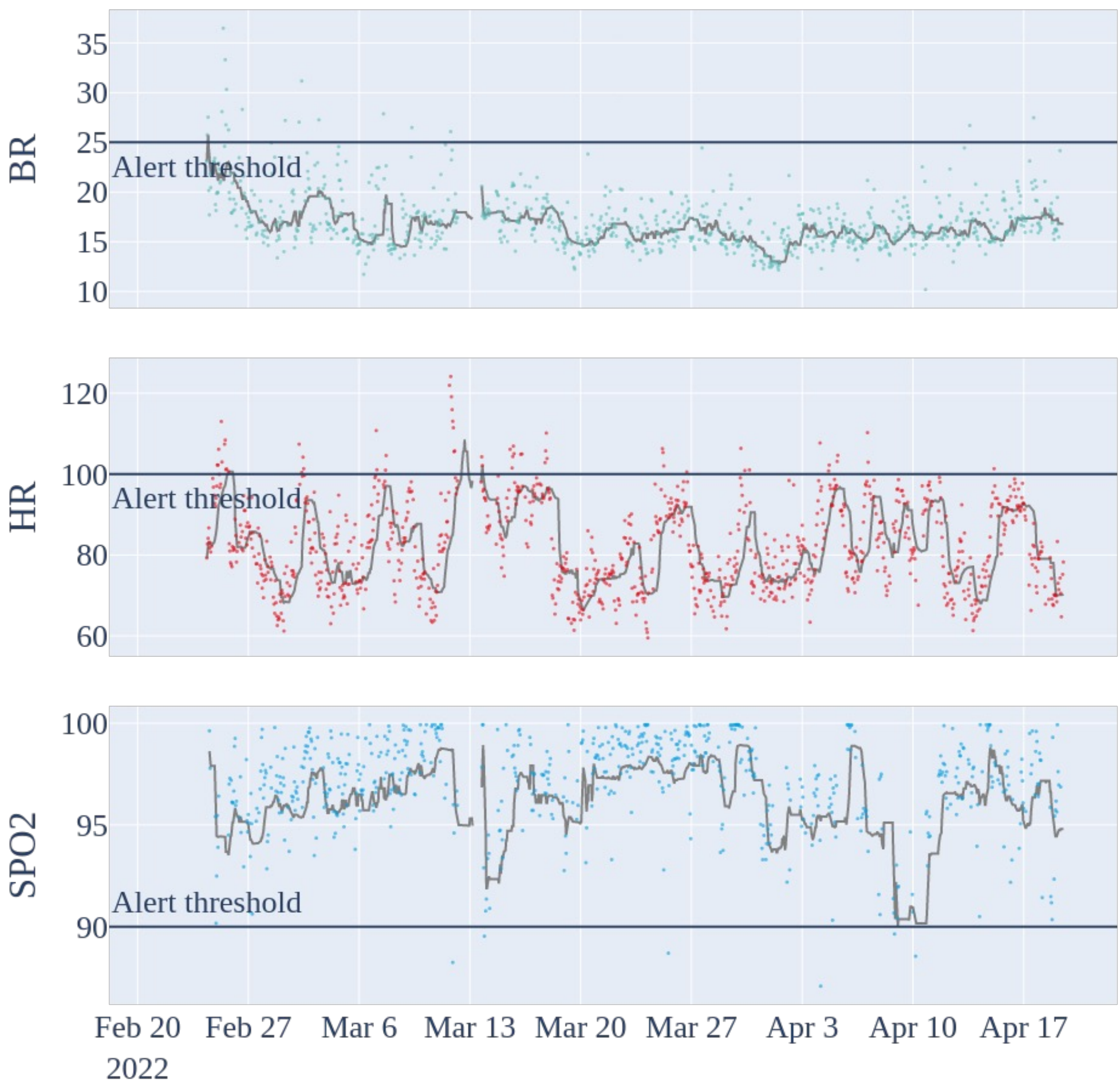
Study



Vital signs (heart rate, respiratory rate, pulse oxygen saturation) as well as patient's activity are measured during hospital stay and for up to 30 days at home using the BoraBand® device and the Boraconnect RPM platform. Vital signs (VS) are collected every 10 minutes, when possible.

After monitoring, data is collected in the form of three vital signs time-series per patient spanning the length of the follow-up. Each of these time-series has a sampling rate of one vital sign every 10 minutes, with missing values when the device could not acquire a vital sign.

Methods



All patient's median (grey curves) are computed over a one-day rolling window.

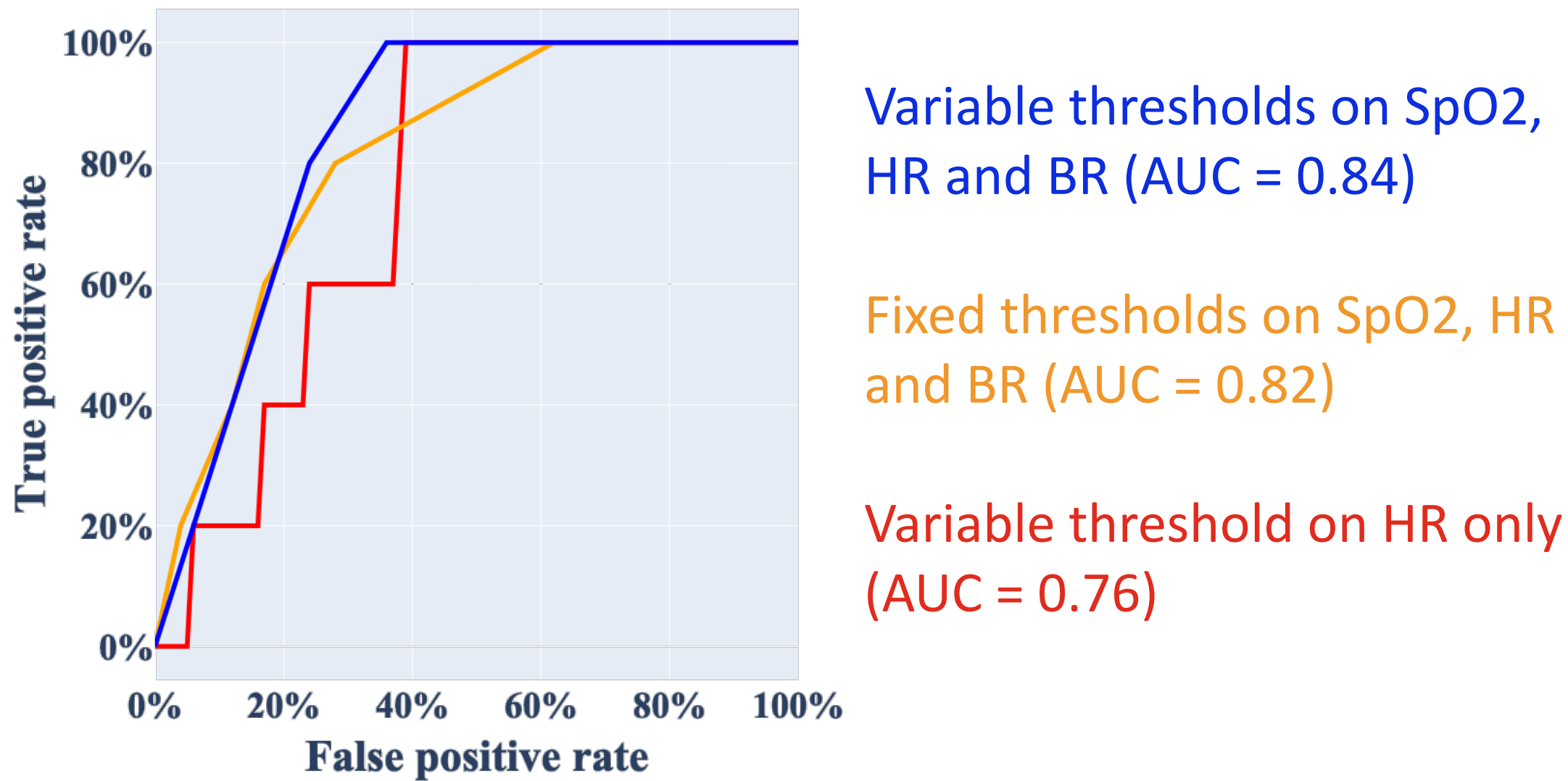
Three thresholding strategies of patient's daily medians were elaborated to automatically detect AECOPD. A variable threshold computed over HR data (*i.e.* a fraction of the patient's measured HR, 110% median HR for instance);

- Fixed thresholds set over all three vital signs;
 - Variable thresholds set over all three VS;
- Medians for variable thresholds where computed with a rolling window spanning the last 15 days. Performance was evaluated in the detection of 5 AECOPD events that occurred during the study.

Results

Demographics		
Total	Readmission	5 (24%)
	No readmission	16 (76%)
Gender	M	12 (57%)
	F	9 (43%)
Age	Median (Min-Max)	65y (52-86)
IMC	Median (Min-Max)	24.7 (17.5-33.6)
GOLD	A	2 (10%)
	B	4 (21%)
	C	7 (33%)
	D	5 (24%)
	NC	3 (14%)
Observance	Median (Min-Max)	87% (58%-96%)
Follow-up length	Median (Min-Max)	37d (21-61)

- VS analysis during RPM is very promising for early detection of AECOPD. By performing automatic thresholding of each patient's VS, most events can be detected with relatively few false alarms (AUC=0.84) and thus prevent hospital readmissions.
- It is best to **use information from all available vital signs simultaneously and use patients specific, variable thresholds** rather than fixed.



Main Finding

Early detection of a patient's risk of readmission is optimized when SpO2, HR and BR daily medians all exceed variable thresholds derived from the patient's 15-day baseline.

A more elaborate algorithm of AECOPD early detection based on RPM will be tested in the future on a larger study.

