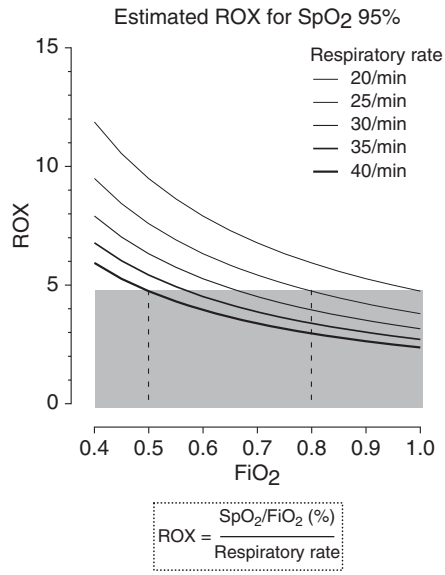

Figure 1. Relationship between $F_{I_{O_2}}$ and the ROX index at Sp_{O_2} 95% for a range of respiratory rates between 20 and 40 breaths/min. Respiratory rates are shown in the same order as in the key. The gray area indicates ROX < 4.88. $F_{I_{O_2}}$ values of 0.5 and 0.8 are marked with dashed vertical lines. Sp_{O_2} = oxygen saturation as measured by pulse oximetry.

The ROX index was calculated for Sp_{O_2} of 95% and respiratory rates of 20–40 breaths/min using a range of $F_{I_{O_2}}$ values from 0.4 to 1.0. The gray area indicates ROX values below a cutoff point of 4.88 (1).

Respiratory rates in oxygen-dependent patients are expected to be increased. The figure reveals that the ROX index is unlikely to drop below 4.88 with $F_{I_{O_2}}$ values of up to 0.5, and it would be under the cutoff point with $F_{I_{O_2}}$ values of 0.8 or higher for the anticipated range of respiratory rates. $F_{I_{O_2}}$ values of 0.5 and 0.8 are marked with interrupted vertical lines. If Sp_{O_2} is under or above 95%, all of the presented curves of the calculated ROX will shift slightly downward or upward, respectively.

The index is very simple and has the potential to become a routine parameter in clinical practice when supplemental oxygen is used with NHF therapy. The presented figure may help to predict when a patient is expected to fail and could be considered for escalation of care. ■

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Success or Failure of High-Flow Nasal Oxygen Therapy: The ROX Index Is Good, but a Modified ROX Index May Be Better

To the Editor:

Predicting the failure of oxygen therapy or noninvasive ventilation has remained an important area of study, and late intubation has been shown to be associated with poor clinical outcome (1). High-flow nasal oxygen (HFNO) therapy is gaining popularity, and overenthusiastic use leading to delayed intubation cannot be denied (2). In this situation, an objective method to identify patients who are likely to fail to respond to HFNO is very much needed. Thus, we read with interest the article by Roca and colleagues (3). Their article evaluates the capability of the ROX index to predict failure of HFNO therapy. First, we congratulate the authors for their contribution and effort, which is definitely going to impact clinical practice. There is no doubt that the authors have done commendable work; still, we believe that there is scope for further thinking.

Roca and colleagues have calculated the ROX index using the respiratory rate and oxygen saturation as measured by pulse oximetry ($Sp_{O_2}/F_{I_{O_2}}$. Although the $Sp_{O_2}/F_{I_{O_2}}$ ratio compares well with the $Pa_{O_2}/F_{I_{O_2}}$ ratio when a patient is receiving low concentrations of supplemental oxygen, whether the relationship fares well with an $F_{I_{O_2}}$ of 1 is not well established. Even the relationship of $Sp_{O_2}/F_{I_{O_2}}$ with $Pa_{O_2}/F_{I_{O_2}}$ is not so linear (4). Similarly, the fall of Sp_{O_2} and Pa_{O_2} is also not linear (5). In their study, Roca and colleagues have used HFNO therapy with up to 60 L/min and $F_{I_{O_2}}$ of 1. Considering the facts mentioned above, an expectation of better results and correlation using a modified ROX index calculated from respiratory rate and $Pa_{O_2}/F_{I_{O_2}}$ cannot be ruled out. Moreover, during noninvasive/assisted breathing, especially HFNO therapy, oxygenation will depend on the respiratory pattern of the patient as well. Therefore, $Pa_{O_2}/F_{I_{O_2}}$ data, which can provide data from blood levels, probably would have given more predictability or accuracy. If the authors have correlated their data with $Pa_{O_2}/F_{I_{O_2}}$ and prediction of failure, this information will be more contributory in further validation.

Oxygen-carrying capacity correlates with Sa_{O_2} and Pa_{O_2}. Sa_{O_2} can fall drastically from the Sp_{O_2} below 90%, as evident from the oxyhemoglobin association–dissociation curve. Moreover, Hb of the patient is a major determinant of oxygen-carrying capacity and oxygen delivery. Therefore, we believe that the ROX criteria need to be assessed using $Pa_{O_2}/F_{I_{O_2}}$ as well and for different Hb levels. Use of ROX criteria with $Sp_{O_2}/F_{I_{O_2}}$ as described by Roca and colleagues and of modified ROX

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criteria using Pa_{O_2}/Fi_{O_2} in patients with different severity of respiratory failure will further help researchers in the future. ■

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Predicting the Outcome of Nasal High-Flow Therapy: A Proposed Representation of the Data and a Supplemental Analysis

To the Editor:

I read with interest the paper by Roca and colleagues that followed up on their initial publication in 2016 (1, 2). One aspect of the report that makes interpreting the results difficult is that the authors did not provide graphs with the individual data points for the respiratory rate, the oxygen saturation as measured by pulse oximetry (Sp_{O_2})/Fi_{O_2}, and the ROX to compare successes and failures, and only provided comparisons of summary data in the tables. In a manner similar to the graph used by Yang and Tobin when they validated the frequency-to-V_T ratio to predict extubation success (3), I suggest that Roca and colleagues provide a graph with the respiratory rate on the *x*-axis and the Sp_{O_2}/Fi_{O_2} on the *y*-axis, plot the failures and the successes in different symbols, and mark the isopleth with a slope of 4.88. Such a graph allows the reader to see the positions of successes and failures in relation to the cut point of 4.88 and the role that tachypnea and hypoxemia played in those positions. I also suggest to the authors testing the index with the respiratory rate squared. The range of the respiratory rate is narrow. This transformation increases the range of the denominator and might create clearer separation between the successes and the failures. ■

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Reply to Tatkov, to Karim and Esquinas, and to Tulaimat

From the Authors:

We read with great interest the letter by Stanislav Tatkov and thank him for his interest in our work. Dr. Tatkov's thoughts are interesting, and the figure he provides is insightful.

The figure shows that two distinct combinations of respiratory rate and Fi_{O_2} (which may reflect two different clinical situations in terms of disease severity)—a respiratory rate of 20 with Fi_{O_2} of 0.8, and a respiratory rate of 40 with Fi_{O_2} of 0.5—provide the same ROX index. The figure further shows that the ROX index is unlikely to drop

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