

## DOES COMPUTER INTERPRETATION OF PFTs CORRESPOND TO PHYSICIAN INTERPRETATION?

by Herbert Patrick MD



For this issue of Focus we will discuss a Respiratory Care Practitioner Performance Improvement (PI) project. We will continue to discuss each research project using the traditional Scientific Method consisting of Background or Introduction, Question, Hypothesis, Methods, Results, Conclusions, Reflections, Clinical Implications, Future Research, Bibliography, Acknowledgement, and Conflicts of Interest.

Respiratory Care Practitioners (RCPs) with both competency and an interest in pulmonary function tests (PFTs) are assigned to our hospital's PFT Laboratory. Each PFT that was completed, whether for an in-patient or for an out-patient, was forwarded to the ordering physician with a computerized preliminary interpretation performed by the PFT equipment software. A physician performed the final interpretation of the PFT this was forwarded within 24 hours of completion of the test.

A desirable replacement of our older PFT equipment and replacement of the corresponding software took place in 2004. We were concerned that the new computerized preliminary interpretations, based on the new equipment and new software, may not correspond to the previous interpretations. A decision was made to assess the new computerized preliminary PFT interpretations to assure there were no inconsistencies from the prior preliminary PFT interpretations. This research was structured as a PI Project for Respiratory Care and the PFT Laboratory.

The ideal comparison would be between the prior versus the new computerized preliminary PFT interpretations where each patient could be tested on both systems at the same session. However, this design was prevented since all prior PFT equipment, including the software, were traded towards the purchase of the new system. Next, we considered a project that had each new patient tested on the new equipment, with numeric inputs of their PFT values manually inputted into the software of the prior system. However, this design was prevented since no local facilities were using the prior system. Therefore, for this PI project, we chose to compare the new computerized preliminary interpretation versus the physician's final interpretation.

The PFT equipment supplier had documented nearly identical preliminary computerized and physician PFT interpretations, but this was not a guarantee of reproducibility at our institution. Our RCPs wanted to assure the following PFT attributes would be accurately interpreted: restriction, obstruction, combined defect, bronchodilator responsiveness, flow volume loop defect, air trapping and diffusion capacity.

This project was designed as a PI project due to the nature of the proposal. Therefore, it did not require IRB approval as a research project since it was not to be presented at an outside meeting, representing a public display of the project. If such a presentation was planned, the IRB application was needed. Now let's review all steps of the project.

Background or Introduction explains interest in the topic and why the topic is significant. For this project, upgrade or replacement of PFT equipment occurs with advancing technology. Preliminary interpretation of PFT's by computer software improves the efficiency of clinicians seeking the preliminary interpretation with the PFT report instead of waiting for the physician interpretation that may lag by hours after the report. Of course, the computerized interpretation has a disclaimer that "this interpretation is subject to physician review and confirmation."

The Question being asked is: "Does the computerized PFT interpretation agree with the physician interpretation?" (Note: The Question asked in every research project always has the possible answers: "yes" or "no.")

The Hypothesis is the preconceived answer by researchers to the Question. For this project, the Hypothesis is: "Yes, the computerized PFT interpretation agrees with the physician interpretation."

Methods explain the mechanisms to gather, tabulate, graph and analyze data to answer the Question. This project was prospective and blinded. Each patient being tested over 1 month would be included. This made the study prospective. The new computerized PFT interpretation was not made available to the physicians performing the PFT interpretation during this project. This step blinded the study. The RCPs designed a data collection sheet for each subject's computerized preliminary interpretation based on the PFT equipment software and the physician's final interpretation. A manual inspection of the data collection sheet allowed a box to be checked for "Disagreement" or "Agreement" for the categories: restriction, obstruction, combined defect, bronchodilator responsiveness, flow volume loop defect, air trapping and diffusion capac-

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properties adjacent to very unstable alveoli collapse and or are injured as a result of sheer stress and incongruent opening and closing times. Non-homogenous time constants result in a rocking or tearing stress motion. Altered alveolar mechanics render inflection point measurements suspect and perhaps even useless.

**Ventilator Associated Pneumonia, (VAP)** - Manifests itself more that 48-72 hours post intubation. The intubated patient has an increased risk of VAP 6-21x greater than the non-intubated patient. The chances for VAP increase 3% per day for the first 5 days of ventilation, 2% per day at 5 to 10 days and 1% for every day after day ten. It is estimated that half of all VAP occurs within the first four days of mechanical ventilation. It has also been stated that VAP may be attributed to an increased mortality in the range of 33-50%. Indeed, it is again emphasized that the best way to avoid VAP is to aggressively avoid intubation and mechanical ventilation. If the patient *must* be intubated every possible strategy must be employed to craft a rapid extubation stratagem. Certain key behaviors connected spatially and chronologically at the patient's bedside have a significant effect on the prevention of VAP. Elevating the head of the bed greater than 30 degrees, DVT prophylaxis, PUD prophylaxis, daily sedation vacations, daily spontaneous breathing trials, aggressive mouth care and uncompromising weaning plans have a dramatic effect in preventing VAP.

**Volutrauma** – This is a form of VILI where large delivered tidal volumes overdistend alveoli with regionally differing time constants. These intimate lung units experience volume stress to alveolar capillary walls and significant intratidal sheer forces. This augments increased alveolar-capillary permeability, alveolar destabilization and loss of surfactant. The overdistension leads to inflammation, increase vascular permeability and loss of surfactant production. This excess stress is more prevalent in instances of high tidal volume ventilation without PEEP.

I believe it was Victor Hugo who said, "The human intellect is always on the march and with it; language is in constant movement." This is especially true in the discipline of critical care. The definitions in this column are changing as you read them. As our understanding of the mechanisms of lung injury develops, the language of VILI will evolve as well.

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*"Mr. Anderson, I've always had trouble dealing with authority figures... Would you mind if I started calling you Skip?"*

ity. To minimize possible confusion of clinicians by the new computerized PFT interpretation, the new computerized interpretation was withheld from the reports transmitted to the clinicians during this PI project. After one month of data collection, the percent agreements in each of the categories were tallied for all the patients. An agreement percentage above 90% in each category was deemed acceptable agreement. A Table was constructed with the categories and the agreement percentage. A statistical p value less than 0.05, derived using a non-parametric test for data that can only be "Disagreement" or "Agreement" meant there was only one chance in 20 that the percentage agreement was due only to chance.

Results are a summary and analyses of data. For this project, seventy-eight patients were studied in the month of interest. The agreement in each category was: restriction = 96%, obstruction = 100%, combined defect = 92%, bronchodilator responsiveness = 100%, flow volume loop defect = 100%, air trapping = 95% and diffusion capacity = 92%. This meant there was acceptable agreement, with all categories above 90%, with a p value statistically significant at 0.037.

The Conclusion is the computerized PFT interpretation using the new equipment agrees with the physician interpretation. Therefore, for this project, the Hypothesis was supported, corresponding to a "yes" answer to the Question. (Note: When writing the Conclusion, the Hypothesis must be addressed whether it was supported or not.)

Reflections offer an opportunity to critique the project by suggesting possible modifications that could improve the quality of future research. For example, comparison of the computerized interpretation performed by both the prior software and the new equipment software could have provided a better comparison than using the physician's interpretation. More categories for "Disagreement" versus "Agreement" could be added. Lastly, more than one physician could provide an independent interpretation so that an interobserver variability could be calculated. Reflections can also include a comparison with other similar research projects.

Clinical Implications explain the relationship between the research project and the clinical world. For this project, the new computerized PFT interpretation was validated and the preliminary PFT interpretation could be trusted.

Future Research follows the theme that completed research should lead to new research. For example, this project led to validation of the computerized interpretations using a method that could be applied to any new PFT equipment purchase, such as exercise or sleep equipment.

Bibliography lists references from similar research in journals or books and should also include the reference for the statistical methods.

Acknowledgement offers credit to those who assisted in the research project, both by time/effort and by financial support.

Conflicts of Interest (COI) list any COI for each person involved in the project. COI includes being a member of a speaker's bureau, being a consultant, owning stock, receiving services or receiving gifts from companies related to the project.

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