Short Communication

Ventilator Mode Finder: An Android application to find equivalent of a mode on different ventilators

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There are hundreds of ventilator modes on different ventilators. Despite different names, many are similar in functions and options. Educational institutions only teach a limited collection of ventilator modes of a few numbers of models; therefore, graduates may have substantial difficulties encountering new ventilator models with unfamiliar mode names on them. In this article, an Android application for finding similar modes on different ventilators is presented. The aim is to help an intensive care practitioner to easily find a familiar mode on a new ventilator.

Key words: Android applications, computer programs, mechanical ventilation, ventilator modes

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INTRODUCTION

There are increasing complexities in the field of mechanical ventilation, its scientific basics, and advanced topics, devices, and adjuncts to ventilate a patient. Intensive care physicians should be able to select an appropriate mode for a particular patient and apply the right settings on the selected mode.[1] One of the most basic needs of a practitioner to manage mechanical ventilation of patients with different pathologies and breathe patterns is to select an appropriate ventilator mode to deliver the supporting volume, flow, and pressure. Many vendors have produced mechanical ventilators in different parts of the world, each having many modes and options installed on them. Unfortunately, there are no naming conventions and function consensuses among ventilator vendors. Therefore, a mode with a particular brand name on a certain ventilator may exist on another device under a totally different name but with completely or partially similar functions to the original ventilator.[2] Usually, the decisions to provide types of ventilators selected for use in a local hospital setting are made by people with insufficient knowledge of mechanism of ventilator functions and modes. Therefore, each part of the world may use to work only with limited collections of ventilator modes. The problem arises when graduated people from a university hired by a hospital with different ventilator types which are unfamiliar to them. This problem may lead to malpractice among the users and damages to the patients. Actually, this confusion has found its way into reference textbooks. For example, there are many words for the same concept of quantifying and qualifying the delivery of inspiratory gas to the patient including control, limit, and generator, which has been the focus of attention by some respiratory working groups to develop taxonomy for naming different modes of ventilators.[3]

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Modern ventilators actually may have more than 10 ventilatory modes and functions installed on them, many with extensive application of artificial intelligence technologies. The net result of this diversity of modes and functions on modern mechanical ventilation is considerable confusion among clinicians. The 2009 edition of "Mosby's respiratory care equipment" has listed more than 200 modes on 34 ventilator models.[2] By now, this figure certainly has been raised to more than 500 modes.

One way to resolve this confusion is to categorize ventilator modes according to basic needs and functions they provide, the so-called ventilator taxonomy which has been defined and developed by Chatburn *et al*.[4-10]

Using computer application to help recognizing this categorization may facilitate clinical decision to select an appropriate ventilator mode according to user's preferences. An Android application has been developed to find similar modes on different ventilators. "Ventilator Mode Finder" application is presented in details in this article.

IMPLEMENTATION

The primary aim of Ventilator Mode Finder is to list compatible modes in a new ventilator based on the user preference from a previous ventilator. The main usage scenario is when a clinician used to work with certain modes on particular ventilators confronts a new unknown ventilator. Using this application, the user selects a known ventilator mode on a known model and then requests a list of compatible modes on another (unknown) ventilator.

A database of more than 400 different ventilator modes with their corresponding vendors, model names, and function details (control, target, sequence, etc.) has been used from previous works.[11,12] The decision logic to propose a list of suitable modes is summarized as follows:

1. User selects the vendor (i.e., company name) of the favorite ventilator (Draeger, for example)
2. User selects a familiar model from this selected vendor
3. User selects a known mode on the selected model
4. User selects the vendor of the new ventilator
5. User selects a ventilator model from this new vendor
6. Application builds a list of modes compatible to the mode selected by the user on the original ventilator.

To build the list of compatible modes, the program first compares the sequences of all modes on this new ventilator with the known mode on original ventilator. After this step, the program processes the resultant list based on the similarity of tags between modes. Finally, the application lists the found modes with their compatibility index as percentage.

The code is in Java language for Android system using Room database infrastructure and material design, developed using Android Studio Integrated Development Environment.

RESULTS

The main screen consists of four parts [Figure 1a]:

- Source model: Touching this part shows the model selection screen [Figure 1b]. User selects the model of the original ventilator and return to the first page
- Source mode: Touching this part shows the mode selection screen [Figure 1c]. User selects a mode for the model and return to the first page
- Target model: Similar to the first step, user selects the model of the new ventilator and return to the first page
- Report: Program displays a list of modes compatible with the original mode. For each entry in the list, the vendor and model name, the mode tag, and the compatibility percentage are reported. Entries are sorted by the value of compatibility.

DISCUSSION

The program has a menu entry for producing a random combination of source and target models for testing purpose.

Selecting a ventilator mode in the generated report shows the details of the selected mode.

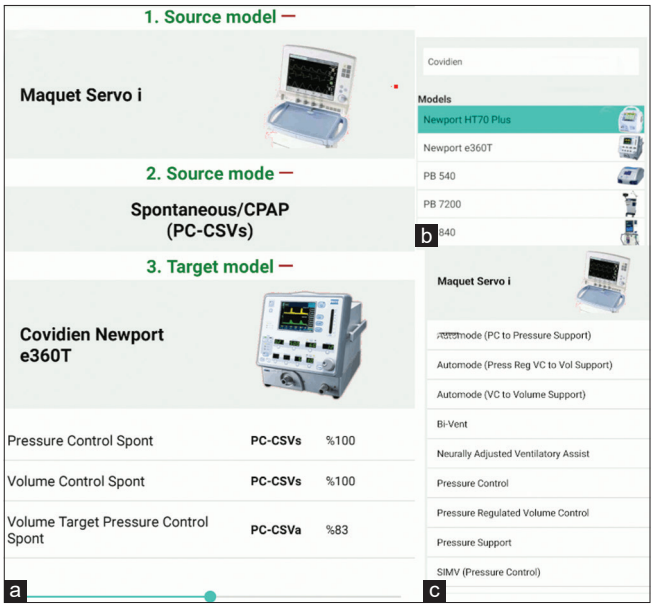

Figure 1: Different screens of the Ventilator Mode Finder. (a) Main screen, (b) model selection screen, (c) mode selection screen

At the bottom of the screen, there is a precision tool for setting threshold of compatibility. The default value is 50%. This means only modes that are at least 50% compatible to the original mode are selected.

A major limitation of this system is that most functions in this application are based on the data provided by different vendors. To our best knowledge, these data are valid, but readers are advised to take precautions such as seeking expert advices when in doubt.

Further, new ventilators must be added to the application when their data released. This is one of the main update aspects of the future releases.

While artificial intelligence and computer technologies may facilitate and enhance patient care, nothing will substitute physician's clinical judgment. We must take care when using the so-called smart apps because there may be flaws and bugs which necessitate rational usage by intensive care providers.

Download link: http://saghaei.net/VentilatorModeFinder.apk

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Conflicts of interest
There are no conflicts of interest.

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