

Evidence-Based Monitoring (Educational)

EBMe

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1. Introduction

Monitoring of physiological variables is a mainstay of medical practice. In the acute specialties (anaesthesia, recovery rooms, intensive care and accident and emergency areas) there is particular emphasis on minute by minute changes.

Detection of adverse events involves the integration of multiple signals, recognition of artefacts and the recognition of patterns that are pathognomonic of certain states.

This software will enable the student to play and replay clinical scenarios and compare their performance with the algorithm that detects the events.

Current anaesthetic monitors generate alerts from individual physiological variables using threshold values. For example, an alarm may be generated if the blood pressure falls below a set value, say 90 mmHg.

External or internal influences on the body result in organised physiological responses that compensate for the perturbation; different adverse events having different patterns of adaptation.

EBM stands for Evidence-Based Monitoring. The adverse events detected by the software are based on pieces of evidence extracted from the patient monitor. Individual measurements are used as evidence, like parts of a jigsaw, to identify patterns pathognomonic of an event.

The patterns are based on data from patients with known physiological profiles that allow the program to take advantage of past relevant history and present live data.

The program incorporates several processes:

- a. The input of specific patient information
- b. The processing of all the usual physiological data
- c. The raw data is presented as trend displays
- d. Significant changes in the variables can be displayed
- e. Computer identification of events can be displayed
- f. The user can indicate when they diagnose an event

With EBMe the alert is a clear statement in the user's language that suggests what condition may exist, based on all the evidence.

2 Hardware and software requirements

a) Microsoft Windows 7 to 10.

b) .net Framework v4.5

Can be downloaded free from

<http://www.microsoft.com/download/en/details.aspx?id=17718>

Check installation is complete after downloading.

c) Latest version of EBMe (www.custos.co.nz)

3 Accompanying material

- i. Student introductory tutorials are available through the Custos website: These contain the basic physiology of the adverse events and how the events can be recognised.
- ii. There are simulated patient files: They are prepared to highlight specific events. Some are very specific and some contain realistic time series of the physiological responses to anaesthesia and surgery.

4 Setting up

The first time the program is run a screen appears indicating an evaluation period. If you wish to install a license please follow the instructions.

The next screen contains a disclaimer that is also found on the clinical version.

License Agreement



The EBMI is an advisory system that uses the physiological changes during anaesthesia to suggest functional diagnoses.

It is for use by anaesthetists and the anaesthetist has total responsibility for the interpretation of the diagnostic output. Any clinical decision, action, or inaction will be the total responsibility of the user.

Each change in a physiological variable is used as a piece of evidence; that evidence is weighed and integrated with other changes to reflect the organised physiological response of the patient.

The user can interact with the device to set the patient's age (this device is for adult anaesthesia only), to indicate that some disease processes exist, and ultimately, to query the output.

I accept that any clinical decision, action, or inaction will be my responsibility.

The next screen allows you to search for an appropriately formatted .csv. file...this can be done by using the BROWSE button or selecting from the list of previously used files.

The next screen:

This allows the input of patient details.

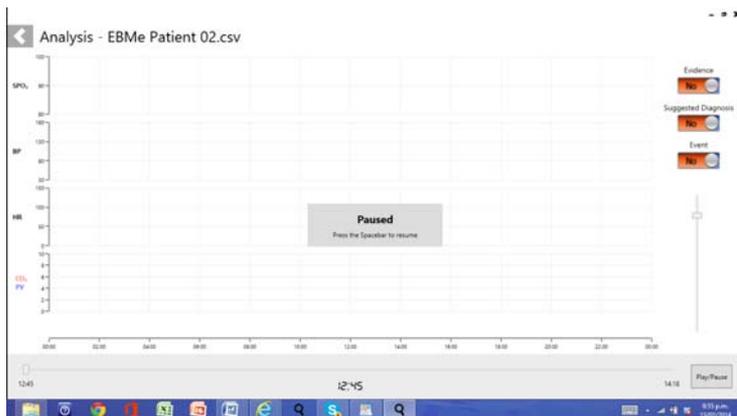


The screenshot shows a window titled "Patient Details" with a "Close" button in the top right corner. The form contains the following fields and options:

- Approximate Age:** A slider control with the value "15" on the left and "100" on the right. The text "undeclared" is centered above the slider.
- Ischaemic heart disease / Recent stroke:** A button with a left-pointing arrow and the text "No".
- Aortic stenosis:** Radio buttons for "None" (selected), "Mild", "Moderate", and "Severe".
- Dysrhythmia:** A button with a left-pointing arrow and the text "No".
- Pacemaker:** A button with a left-pointing arrow and the text "No".
- Beta-blocker:** A button with a left-pointing arrow and the text "No".
- Type of Anaesthesia:** Radio buttons for "Volatile" (selected), "TIVA", and "LA".

A "Next" button is located at the bottom right of the window.

Press NEXT and BEGIN and the software will run.



The screen is frozen until all the data has been uploaded. The settings for the display of 'evidence' and the 'suggested diagnoses' can be changed now or later (the default is to not display). The speed of the progression of the trend displays is controlled by the sliding cursor on the right hand side. The lower limit is 'real-time' ...i.e. the trend data is updated every 10s, as in real life.

Depending on teaching requirements the settings can be fixed.

To start the data processing press the SPACEBAR.

5 Use

The purpose of the exercises is to create familiarity with the adverse events and to practice scanning the data so as to recognise adverse events. Some will be obvious, some very subtle.

The clinical version (EBMi) has all the following alerts.

Note that EBMe also has all these alerts but the last four do not have the basic data displayed so you will not be able to make those diagnoses.

Damped arterial trace

Sympathetic response

Achronotropic sympathetic response (lacks heart rate component due to pacemaker, β -blockade or high dose TIVA)

Hypovolaemia possible

Cardiac output down

Cushing response

Malignant hyperpyrexia

Inadequate anaesthesia – low MAC calculated using age and temperature.

Inappropriate ventilation

Hypovolaemia likely (RAPPV)

Failure to ventilate after CPB

In situations where the heart rate is fixed; fixed rate pacemaker, β -blockade, high dose opiate (total intravenous anaesthesia) the full adrenergic pattern cannot be seen because of the obtunded heart rate changes.

The diagnosis of 'achronotropic sympathetic response' only uses changes in blood pressure and pulse volume/amplitude.