



Volume 15, No. 4 Fall 2004

New Software for use with a Peak Flow Meter to Diagnose Work-Related Asthma

Peak flow monitoring is the most cost effective way to confirm a patient has work-related asthma. Peak flow monitoring has a sensitivity of 82% and a specificity of 94% (1).

This issue is devoted to the practical aspects of having patients perform peak flow monitoring. New software is available to make interpretation of peak flow results easier. The protocol for diagnosing work-related asthma when patients use a peak flow meter differs from the protocol for peak flow meters used to monitor the adequacy of a patient's therapy.

The following protocol outlines the procedures used to aid in the diagnosis of work-related asthma. The patient is advised to perform peak flow monitoring every two hours while awake, both at and away from work. At each two hour period the patient is advised to perform peak flow readings three times and record the best value. In addition to recording the three peak flow readings, the patient should record what they are doing and how they feel. Each day they should record any changes in medication. Peak flow measurement should be performed before a bronchodilator is used. The recordings should be conducted for a prolonged period, ideally two weeks at work and two weeks off work.

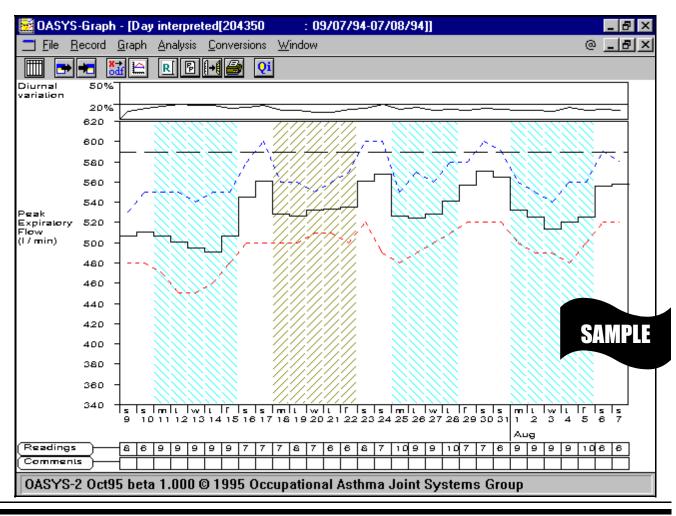


Table 1. Reasons Peak Flow Monitoring May Not Be Practical

- Patient no longer able to work for any reason (including asthma too severe to return).
- Patient unable to take 1-2 weeks off work
 (including patient afraid to take sick time because of employer's reaction).
- Patient on changing dosages and types of medication.

The sensitivity and specificity reduces to 70% and 82%, respectively if testing is only performed for one week at work and one week at home. Since patients will forget to carry around the peak flow meter or to conduct the peak flow measurements at different time periods, they need to be encouraged to start the monitoring up again even if they have missed some measurements. The reasons peak flow monitoring may not be practical are shown in Table 1. False negative results can occur if the patient is not off work long enough to recover and/or their medication blocks a reaction to exposures at work.

A major concern about relying on the results of peak flow monitoring is that it is self-administered and therefore the results may not be reliable (2,3). The results of the best two trials at each two hour period should be within 20 L/min to assure that the patient is performing the test properly. Table

Table 2. Changes Suggesting the Patient May Have Falsified the Record

- Absence of a morning dip in peak flow.
- 2. Presence of a long run of identical readings.
- Use of the same writing instrument to record measurements throughout the whole 2-4 week period.
- 4. Presence of the same starting time of measurement on work days and days off.
- Absence of signs of wear and tear on the paper used to record results. The paper should have been carried around for 2-4 weeks.

2 shows changes that might suggest the patient falsified the record. In one study, interpretation of the peak flow record was not altered by the falsified records (4).

A standard way to plot the results of peak flow monitoring is to calculate the maximum, mean and minimum peak flow measurements for each day. In the past, we used Harvard Graphics to plot the results. We recently upgraded to new software. Detailed instructions for plotting a graph using OASYS-2 software are on page 3 of this issue. If you have any questions about the instructions, you may call us on our toll free hotline at 1-800-446-7805.

The OASYS-2 software is particularly useful because it provides an interpretation of the results.

References

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- ²Quirce S, Contreras G, Dybuncio A, Chan-Yeung M. Peak expiratory flow monitoring is not a reliable method for establishing the diagnosis of occupational asthma. *Am J Respir Crit Care Med.* 1995;152:1100-1102.
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Creating Peak Flow Charts Using OASYS-2

The OASYS-2 is a computer program that allows a health care provider to store and interpret peak expiratory flow (PEF) meter results. It has a straightforward data entry format that generates a graph of the patient's peak flow measurements over time.

The graph results are accompanied by a report that produces an "OASYS work effect index." The index ranges between 1 and 4. An index value of 2.51 or greater is likely to indicate a work-related deterioration in PEF.

The OASYS-2 is not yet commercially available, however, the beta version can be obtained free of charge from the group that developed the software. This group maintains a website at: www. occupationalasthma.com/oasys. The website has contact information to request the software, and detailed information about the program. A copy of the Oasys-2 Beta can be obtained (for free) by emailing Pam Hayes (pam.hayes@heartsol.wmids.nhs.uk) with a postal address for the program to be sent to. A list of all recipients of the Oasys-2 Beta is kept. Please let us know if you attempt to obtain and have difficulty getting a copy (1-800-446-7805).

The following is a list of information you will need to collect for each patient, in order to graph the peak flow chart and obtain an interpretation from the program on the work-relatedness of your patient's asthma.

Information to Collect:

- -Patient identifier
- -Predicted PEF for this patient
- -Dates of peak flow readings
- -Patient name
- -The patient's daily times for: waking up, going to bed, starting work, and ending work (or indicate "did not work" when applicable)
- -Peak flow values for each day, indicating the time each reading was taken

The developers of OASYS-2 provide a PEF recording sheet for the above information on their website. We have modified the PEF recording sheet. A copy of our modified version can be obtained from our website: www.chm.msu.edu/oem.

STEP 1. INSTALL THE OASYS2 PROGRAM

Install the OASYS2 program, following the installation instructions in the users manual.

STEP 2. ENTER PATIENT DATA

To enter a new patient's record, click on "file" on the tool bar, and then "new record."

In the "Enter Record Details" window, enter the following information:

- --patient identifier
- --predicted PEF for this patient
- --start date of peak flow readings

(DD/MM/CCYY format)

--patient name

Then click the "OK" button.

STEP 3. ENTER PEAK FLOW VALUES

INDICATOR BUTTONS:

Using your number pad on the keyboard, input the first day's times for waking, going to bed, starting work, and ending work. In the appropriate time slot, use the following symbols ON THE NUMBER PAD of your keyboard:

- / <u>W</u>aking (a "w" will appear to the right of the time
- * **B**edtime (a "b" will appear to the right of the time slot)
- <u>S</u>tart of work (an "s" will appear to the right of the time slot)
- + End of work (an "e" will appear to the right of the time slot)

Note, if the patient did not work on a given day, there will be no start and end of work indicators. There must be a waking and bedtime indicator for each day. To change an indicator, simply press the correct indicator button (/, *, - or +). To delete an indicator from a given time slot, press the "Delete" button ON THE NUMBER PAD (the delete button on the main keyboard will not work).

PEAK FLOW VALUES:

In each time slot where the patient indicated they used their peak flow meter, enter the maximum of the three peak flow values the patient recorded.

REPEAT the above 2 steps until all the peak flow data has been entered. When completed, press the "Interpret" button on the left side of the screen. If there are any errors, such as incomplete wakebedtime markers or start-end of work markers, an error message will appear. The markers that need to be corrected will be identifiable by capitalized letters. Once any corrections are made, click the "Interpret" button again.

STEP 4. SAVE THE DATA

To save the data you have entered, before generating graphs and reports, under "file" on the tool bar, click on "save as" and assign a name to the file. This is the file with the raw data that will be used to generate

the graphs and reports, so it must not be deleted. It will have an ".odf" extension.

STEP 5. GRAPH THE RESULTS

Retrieve the record you saved by selecting "file" and then "open." A window will appear that lists the file names that have been saved. Click on the file you wish to analyze, and then click "OK."

Click on "record" and select the "Max, Min, Mean (day interpretation)" option. This interprets the peak flow results so that thefirst reading after a non-work day is not included as a workday reading.

A window will appear that lists the dates of the peak flow readings. The bottom file is always the one in use. Click on that file to highlight it, then click "OK."

A message window will appear that asks: "Do you wish to use the saved interpretation?" Click on the "yes" button.

A graph will then be created that shows the maximum, average and minimum PEF values for each day. Along the bottom lists the days of the readings, and the number of readings done each day. The side shows the peak flow measurements in L/min. Shaded portions of the graph indicate work and clear portions indicate time away from work. The small graph at the top show the diurnal variation. You can change the way diurnal variation is calculated by clicking on "graph," and selecting "amp % predicted PEF" at the bottom of the list of "graph" options.

STEP 6. GENERATE THE PEF RECORD REPORT

To generate a report that analyzes the patient's record, select the "R" button. Near the top of this report is the "OASYS work effect index." An index value of 2.51 or greater is likely to show a work-related deterioration in PEF. A score of less than 2.51 does not necessarily exclude a diagnosis of work-related asthma, especially if the data is of poor quality and quantity.

Further in the report is the Number Preference graph. If there are one or two bars on this graph that are much higher than the others, the patient may be rounding up to the nearest 50 or 100 when recording their PEFs. Or, it may suggest fabrication of the data if the patient recorded the same number many times.

Another graph generated in the report is the 24-Hour Plot, which shows the patient's PEF throughout the day, for both rest and work periods. From this graph, you can see if there is a difference between the mean work and rest period PEFs, and if there are any late or early reactions.



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In this issue:

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