

Statistical Analysis & Buteyko Exercise Results

I would like practitioner's comments on the attached idea of statistical analysis of patient's workbook results.

While patients are on the course it is relatively easy to maintain their enthusiasm and application but once back home and left on their own it is very easy to get despondent and let practice slip especially if progress is slow and erratic.

I have found my patients have been very well motivated by doing the analysis of their results as in the example illustrated below.

It is difficult for patients to assess progress from the crude results when there are wide variations from day to day and from week to week, a trend is not easily identified except with a trained eye and even then it is almost impossible to quantify it.

I remember reading an excellent book on the Glen Doman Method of teaching brain injured children many years ago and I was most impressed not only by the concepts behind the method but also by the fact that he had developed a reliable measure of a child's progress such that it was possible to forecast how long it would be before the child became competent in various developmental abilities like able to read, able to speak etc. This in turn gave the helpers a way of better allocating time and effort to those areas that were slow and that held back the child's overall development. It was based on the comparison of the child's actual age as opposed to its developmental age for each neurological field.

I feel there is such a need for students of Buteyko. With many cases the progress may be so fast and rewarding that no such monitoring is really necessary. It is for the chronic long suffering students with emphysema or other deeply established hyperventilation habits that may need months and even years of attention to their breathing to get maximum benefits.

Some would argue that any improvement should be enough to encourage them to keep at it but in reality we are all rather impatient today and want to see results quickly or at least know for sure we are making progress.

The analysis I do is shown below.

1. From the workbooks we record first CP and First Pulse then End CP and End Pulse for each exercise.
2. As these are recorded the Excel programme automatically calculates the mid CP and Mid Pulse values for each session. I believe this mid value is the most useful measure of progress.
3. It then automatically computes a 6 session moving average to iron out the violent variations.
4. It then automatically produces graphs of both CP and Pulse moving average results.
5. It then calculates a best fit straight line trend line for the CP and an logarithmic best fit trend line for the Pulse as the pulse tends to bottom out at a stable value.
6. From the CP trend line it is then easy to produce an equation that will forecast the CP at any time in the future (assuming the patient continues doing the Buteyko work at the current pace and application)
7. $CP \text{ at day } N = \text{Start CP (from chart)} + \{\text{End CP (from chart trend line)} - \text{Start CP}\} / n \times N$
where n= number of days since start of training

So in this example we have $CP \text{ at day } N = 13 + (15-13)/12 \times N$

Eg at 30 days from start $CP = 13 + 0.17 \times 30 = 18$

At 60 days from start $CP = 23$.

As more data is analysed the forecasts get more reliable.

The accuracy of such a forecast can be questioned but the benefits of demonstrating progress and seeing the possibility of a high CP after some weeks of effort spurs people on.

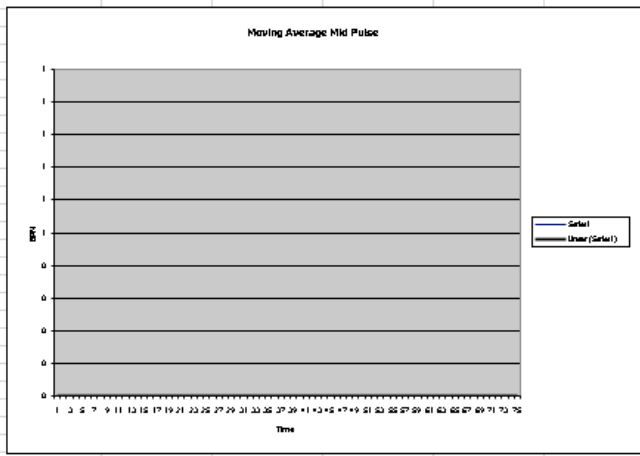
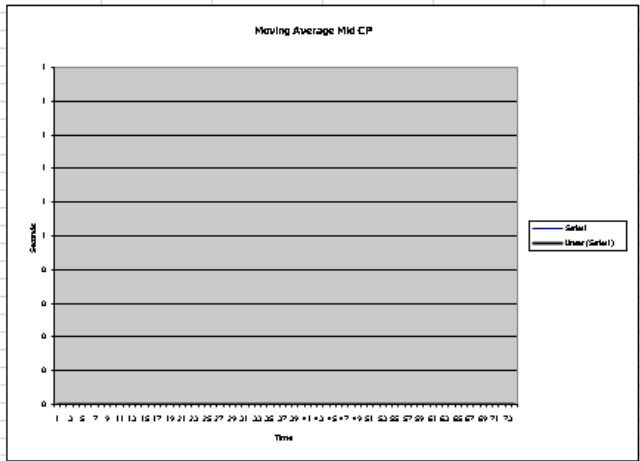
Do you think this is worth developing further? I have tried to make it patient user friendly. If they have Excel I send a pre-programmed spread sheet for them to complete themselves.

Michael Lingard 24th November 2009

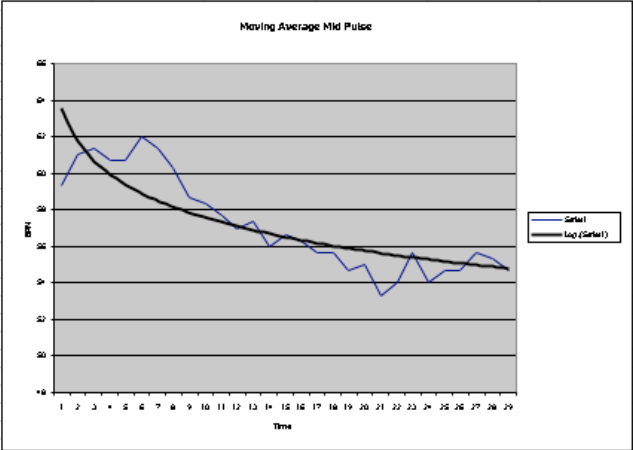
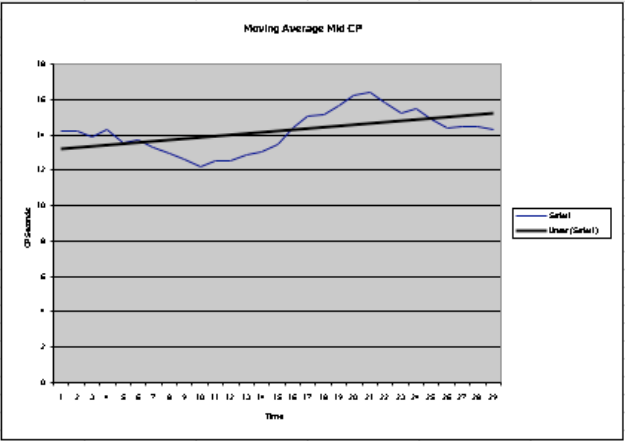
Date	Time	CP	Pulse	RB	CP/EP	RB	CP	Pulse	Medication
7/10	6:45	12	56	5	13	5	14	56	
	20:30	12	60		15		23	64	
8/10	7:30	10	64		16		15	60	
	17:30	12	64		15		20	56	
9/10	7:05	10	56		14		14	52	
	20:20	11	60		14		18	64	
10/10	17:35	10	68		17		16	64	
11/10	17:35	10	68		17		16	64	
	9:30	16	72		14		15	56	
12/10	20:15	15	64		14		15	52	
	8:45	9	56		12		14	64	
13/10	20:55	12	60		14		14	64	
	6:45	9	60		12		14	56	
14/10	18:25	11	64		13		11	56	
	19:20	14	52		12		13	56	
14/10	7:15	12	52		10		13	60	
	13:45	13	56		15		14	56	

Date	Time	CP	Pulse	RB	CP/EP	RB	CP	Pulse	Medication
15/10	18:20	14	56		10		12	60	
	19:10	15	56		12		12	64	
15/10	6:45	9	56	3	9	3	15	48	
	17:25	15	56		15		18	60	
16/10	20:25	17	52		17		19	56	
	21:30	17	52		16		18	52	
16/10	6:50	9	64		14		18	52	
	10:25	13	52		17		20	56	
17/10	12:30	13	56		18		18	52	
	20:15	15	48		16		20	48	
17/10	8:20	13	60		15		16	56	
	9:20	12	60		13		16	64	
Su 8/10	20:20	13	48		18		17	48	
	8:10	10	60		14		16	56	
Su 8/10	16:30	11	56		17		14	52	
	18:20	17	56		16		19	52	
Su 8/10	21:50	13	60		16		16	52	
	6:45	11	64		18		18	52	

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	BUTEYKO PROGRESS CHART				Instructions: From your workbook record the Start CP and End CP and Start Pulse and End Pulse for each session in columns ABC & D. When you have finished see results on graphs.									
2														
3	First CP	First Pulse	Last CP	Last Pulse	Mid CP	Mid Pulse	MAve CP	MAvePulse						
4					0	0								
5					0	0								
6					0	0								
7					0	0								
8					0	0								
9					0	0	0	0						
10					0	0	0	0						
11					0	0	0	0						
12					0	0	0	0						
13					0	0	0	0						
14					0	0	0	0						
15					0	0	0	0						
16					0	0	0	0						
17					0	0	0	0						
18					0	0	0	0						
19					0	0	0	0						
20					0	0	0	0						
21					0	0	0	0						
22					0	0	0	0						
23					0	0	0	0						
24					0	0	0	0						
25					0	0	0	0						
26					0	0	0	0						
27					0	0	0	0						
28					0	0	0	0						
29					0	0	0	0						
30					0	0	0	0						
31					0	0	0	0						
32					0	0	0	0						
33					0	0	0	0						
34					0	0	0	0						
35					0	0	0	0						
36					0	0	0	0						
37					0	0	0	0						
38					0	0	0	0						
39					0	0	0	0						
40					0	0	0	0						
41					0	0	0	0						
42					0	0	0	0						
43					0	0	0	0						
44					0	0	0	0						
45					0	0	0	0						
46					0	0	0	0						
47					0	0	0	0						
48					0	0	0	0						
49					0	0	0	0						
50					0	0	0	0						
51					0	0	0	0						
52					0	0	0	0						
53					0	0	0	0						
54					0	0	0	0						
55														
56	DATE: From		To		Number of days from start(n)				(From CP trend line)	$CP(at\ day\ N) = CP\ start + (CP\ end - CP\ start)/n * N$				
57														



	A	B	C	D	E	F	G	H	I	J	K	L	M	N
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2														
3	First CP	First Pulse	Last CP	Last Pulse	Mid CP	Mid Pulse	MAve CP	MAvePulse						
4	12	56	14	56	13	56								
5	12	60	23	64	18	62								
6	10	64	15	60	13	62								
7	12	64	20	56	16	60								
8	10	56	14	52	12	54								
9	11	60	18	64	15	62	14	59						
10	10	68	16	64	13	66	14	61						
11	16	72	15	56	16	64	14	61						
12	15	64	15	52	15	58	14	61						
13	9	56	14	64	12	60	14	61						
14	12	60	14	64	13	62	14	62						
15	9	60	14	56	12	58	13	61						
16	11	64	11	56	11	60	13	60						
17	14	52	13	56	14	54	13	59						
18	12	52	13	60	13	56	12	58						
19	13	56	14	56	14	56	13	58						
20	14	56	12	60	13	58	13	57						
21	15	56	12	64	14	60	13	57						
22	9	56	15	48	12	52	13	56						
23	15	56	18	60	17	58	14	57						
24	17	52	19	56	18	54	14	56						
25	17	52	18	52	18	52	15	56						
26	9	64	18	52	14	58	15	56						
27	13	52	20	56	17	54	16	55						
28	13	56	18	52	16	54	16	55						
29	15	48	20	48	18	48	16	53						
30	13	60	16	56	15	58	16	54						
31	12	60	16	64	14	62	15	56						
32	13	48	17	48	15	48	16	54						
33	10	60	16	56	13	58	15	55						
34	11	56	14	52	13	54	14	55						
35	17	56	19	52	18	54	15	56						
36	13	60	16	52	15	56	15	55						
37	11	64	15	52	13	58	14	55						
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(From CP trend line) $CP(\text{at day } N) = CP \text{ start} + (CP \text{ end} - CP \text{ start})/n * N$