How metabolic control was shown to be a delusion

Peter Swift

My response to being asked to contribute to *The Paper That Changed My Life* series was fairly immediately a resounding 'yes' because I thought of a paediatric paper which, even in its title, threatened to undermine our beliefs and yet strengthen our prejudices (Malone et al, 1976): 'Good Diabetic control – a study in mass delusion'. What a title for 1976!

At the time of publication I was a Senior Registrar and had been asked by the newly appointed consultant paediatric endocrinologist to 'set up' the first diabetes clinic in the Bristol area. After a few weeks into this venture he was of the strong opinion that 'if we get the insulin right' successful control of diabetes would follow. At this time also, as emphasised in the Malone paper, there was still great debate about the relationship between diabetes control and related future complications. Interestingly, though, the earliest reference relating control to complications was in a paediatric journal (Jackson et al, 1950).

I searched for my photocopy of the Malone paper through somewhat haphazardly organised files with a sense of mounting excitement but increasing frustration. Not under 'metabolic control'… 'monitoring'… 'psychology'… 'families'… where next? When did I last reference this paper? Ah. Yes. There it was filed under 'camps' – somewhat brown (perhaps 'glycated' over the years) and dog-eared.

The study involved asking 220 children and adolescents (aged 7–18 years) attending the Florida Camp for Children and Youth with Diabetes, who were routinely performing urine tests thrice daily, to save two samples on two separate days for further analysis. They were asked also to save one 24-hour collection. The results of the camp attendees' urine reducing-sugar tests on the saved samples (using the infamous Clinitest tablets, a test tube and a colour-coded chart) were compared with the results of tests performed by trained laboratory technicians at the camp. In addition, blood samples were taken on four occasions to test for fasting and postprandial plasma glucose. The results of all these tests were compared with what, at that time, was felt to be good or poor control. *Table 1* shows the defining parameter values.

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The scientific question posed by the researchers was: 'Is the carbohydrate metabolism of individuals found to have good control different from those found to have poor control?' The results were astonishing: out of 880 possible urine tests 656 were completed by the young people (75% compliance), only 336 of the test results agreed with the laboratory technicians' (51% agreement), and 24-hour collections were completed by only 54 out of the 220 individuals (25% adherence). Overall, after analysing all the urine and blood test criteria only 5 individuals (2%) could be considered to have 'good control'. Repeated blood levels fluctuated widely and 50% of the population had control which varied between good and poor on the same day.

So, even though this was a 'captive cohort' in an environment encouraged by peers and staff, adherence was exceedingly poor, there was widespread fabrication (or at least results that appeared to reduce the severity of urinary glucose excretion) and the methodology did not help to distinguish good from poor control. The results showed that (Malone et al, 1976):

'Glucose homeostasis in different patients judged by these criteria to be significantly different may indeed be very similar and vice versa… strict control as defined by these indicators may all be delusions in the mind of the observer… physicians should not use non-discriminating criteria as prognostic indices to compare diabetes therapies.'

To a gullible diabetes trainee these results and conclusions were dynamite. We knew that urine testing was time consuming, tiresome, potentially dangerous and difficult but surely more than 50% of tests were reliable

Table 1. Definitions of good and poor diabetes control.

	Good control	Poor control
Urine glucose (grams per 24 hours)	<25	>100
Urine specimens free of glucose (%)	>75	<50
Urine acetone (mg/dl)	0	>30
Fasting plasma glucose <6.6 mmol/l (%)	>85	<70

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and surely our criteria for defining control had some discriminating value especially in a 'research environment'. Yet here we find that not only are the criteria of control imprecise but even the results of urine testing were far less accurate than we ever thought. Were we therefore totally deluded?

How did this paper change my life? On the positive side I was fascinated that this American camp (organised by Arlan Rosenbloom and John Malone – now my heroes) seemed so well organised that research was possible at such a level of sophistication. It confirmed my rapidly developing prejudice that the complexity and burden of diabetes in young people often leads to major psychological difficulties and was here being reflected in high levels of non-adherence and inaccuracy even in this captive group of youngsters enjoying their holiday.

The paper encouraged me to try to help with or publish research from camps (Swift, 1982; Frost et al, 1986; Chadwick and Brown, 1992) and I was able to visit the Florida camp and other American camps in 1983 to see what lessons we and our team could learn. From that visit evolved our own local 'Camp Charnwood', which has now been running for 23 years helping hundreds of local children and parents towards new experiences while on holiday by, for example, meeting others 'in the same boat' (Swift and Waldron, 1990). These experiences have taught me and my team to appreciate the difficulties of diabetes at first hand and that one can learn more about diabetes in a week at camp than half a lifetime behind a desk. Also, that the personal, nutritional and psychological aspects of diabetes are far more important than fiddling with insulin doses to try to 'get it right' (Braatvedt et al, 1997; Swift, 1997).

Fortunately, soon after the Malone paper was published the management and monitoring of diabetes became far more scientific, discriminating and evidence based. Although self-monitoring of blood glucose is also subject to major fabrication, the introduction of 'the gold standard' measurement of glycated haemoglobin has given much greater insight into the accuracy and reliability of monitoring. Even more important has been the confirmation that glycaemic control and glycaemic exposure really are related to both microvascular (Diabetes Control and Complications Trial [DCCT] Research Group, 1994; 1995) and macrovascular complications (Larsen et al, 2002). The DCCT has also enabled us to confirm the importance of dietary behaviour (Delahanty and Halford, 1993) and to visualise the astonishing correlations between blood glucose and HbA_{1c} (Rohlfing et al, 2002) – a long way from camps in Florida and Clinitests.

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