

## The Origins of the EMIS System

What everyone now knows as EMIS has its ultimate origin in the fact that in 1961 I succeeded to a single handed practice with 1,800 patients on the North Yorkshire Moors. It was situated in and around the valley of the river Esk before it runs into the sea at Whitby. It comprised the five villages of Egton, Egton Bridge, Grosmont, Glaisdale and Lealholm and the scattered farms in the dales of Glaisdale, and Little Fryup, and elsewhere on the surrounding Moor. There was a surgery in each of the five villages, each with its own dispensary. These were only one or two miles distant from each other, but each was separated from its neighbour by a steep hill, all but one of them more than half a mile long. This is what justified their existence in the days before everybody drove a car.

At the time I had no thought of getting rid of all those branch surgeries. The difficulty lying in wait for me was that enough people drove a car to enable them easily to attend any surgery that happened to be open at a convenient time. Place did not matter to them, unless there was snow on the ground. The records were kept at the surgery nearest to their home. But as often as not they did not attend that surgery. Adequate record keeping was a nightmare and drove me to invent some bizarre ways of dealing with the problem.

The final solution was to keep all the original records at my home, where there was no surgery, but where I installed a young lady from the village who could type. At first she could only work in the evening. Later, Anne Coates proved to be a very competent young woman who soon learned all the skills required of an early day practice manager.

Anne's primary task was to keep the records. I acquired a portable dictation machine that recorded onto cassette tapes. It was an expensive Swiss machine that proved utterly reliable for 8 years. Onto these tapes I would dictate all the records as I travelled around the practice. Each day I would do up to 25 home visits, visit 3 or 4 patients in the Cottage Hospital in Whitby and consult with about 8 patients in one or two of the branch surgeries.

At any convenient moment I would drop off the current tape for Anne to get to work on. She then typed up the original record, and at the same time, a carbon copy. This copy was added on to the current continuation sheet of the record of any patient I had just seen in a surgery. This would then be replaced in the duplicate envelope kept at the surgery next time I was at the appropriate surgery.

If they had been visited at home or in the hospital I would have the record with me, unless it was a call that had come in after I left home. In either case I somehow had to remember to pick up the duplicate record and return it to Anne for safe keeping until the episode was over. Of course this often fell down, but only in the case of patients with short term illnesses. If they were patients who were never likely to attend the surgery, their records were kept at home and their records needed no duplicate.

This somewhat cumbersome procedure remained in place for 8 years or so, until the day we finally closed all the branch surgeries. The patients were persuaded to accept this Draconian measure by providing them with a bus service to bring those without cars into the one remaining surgery at Egton. The bus ran for a few years until almost everyone did have a car. But until that day the system worked. It also revealed to me how much easier it was to read my records! More significantly I noticed that my standard of record keeping improved. It was easier and much quicker for me to dictate a record than to write it, and I now had the time to include detail whenever it was needed. Also, because I could not very well dictate while I was with the patient, I had to discipline myself to remember what I had to record. The benefit of this was that the record became edited during dictation, and became a much more coherent account of what had transpired.

The record also acquired a structure, if only to improve its readability on the page. The only structure I was aware of was that given to students at Guy's Hospital; the 'Source Orientated' structure of History, Examination, Diagnosis, Investigation, Treatment. It soon became apparent that this did not meet the needs of general practice. After trying to create my own structure for some time, I eventually adopted Laurence Weed's Problem Orientated system of record keeping. This was the first revolution in general practice that I became aware of. The word revolution might sound like overkill. But not to me. For me it proved a revelation too. I became aware that such a record was not only much easier to read through; much could be gleaned from a mere glance directed to the headings where the same category of information would always be recorded.

From that moment on you could say that the computer was lying in wait for me; especially in this moorland practice! But at that moment I had not heard of the beast.

During these early years I was also busy furthering the goal that had been at least partly responsible for taking me to Egton in the first place; research. I had been fascinated by the careers of the great James Mackenzie and of William Pickles and wanted at least to try to emulate them.

An opportunity soon presented itself. Soon after I arrived in Egton I became aware of occasional outbreaks of diarrhoea that would suddenly lay low a whole village, or most of it. These would last for only one day. No one was really ill. And the village would be back to normal the next day. By 1967 or thereabouts, it was clear that these were not just occasional outbreaks; they were fairly regular occurrences.

Slowly, with the help of an observant member of the local Water Board, and my first attempt at epidemiological record keeping, a clearer pattern emerged. It looked as though the drinking water might be the villain; perhaps the rather acid water from the moor was leaching Lead from old pipe work or even from the soldered joints in the copper pipes of newer homes. This clearly merited research.

As soon as it became known that I was planning to do this, one of my patients, Tom Nosworthy, who worked with computers at ICI in Billingham, only 30 miles away, offered to put my research records on a computer data-base. ICI also offered to teach me the Dartmouth BASIC programming language. The bait was being set!

Ironically the research was never done. The Water Board got wind of what I was up to. They had, unbeknown to me, already laid all the pipe-work to connect a new reservoir, at the head of the valley in Westerdale, to supply mains water to all the villages in Eskdale. This included all those where the intermittent diarrhoea was a problem. They now turned on this new supply, with its carefully controlled pH, after cutting off all the old reservoirs. There never was another outbreak of diarrhoea.

In 1971 I began a survey of Farmer's Lung in the practice; a scourge of the local farmers who were rarely able to make good hay because of the wet summers, with their rain and drenching 'frets' (fog). This condition had hitherto gone unrecognised on the East coast. Someone had read the local rainfall figures from data taken on the coast; not on the moors! It was therefore assumed that conditions were not conducive to the appearance of the fungal spores that cause this distressing disease. Reading my predecessors excellent records, it was not difficult to identify the case histories where a variety of misdiagnoses had been made. Among these were Asthma, Pneumonia, Bronchiectasis and burned out Tuberculosis. Again, to my dismay, although all the data was collected, nothing was ever published because some of the data was inadvertently destroyed. And there were no copies. Oh for the ease of computer backup!

Alongside clinical research, I was also anxious to extract epidemiological data from the records. I soon became one of those who could be found madly spinning Cope-Chat Cards on knitting needles through the watches of the night. Mad it was, and I never did make a success of it. So I turned to a machine developed by Kalamazoo. These cards were bigger and held much more data. By devious means I managed to get all the important College Codes assigned round the edges, together with a few of my own. To carry out a search the cards were placed in a tin box into which plastic rods were slotted at the bottom. Pressing a button would set this machine vibrating in the fond hope that the cards holding the records of the patients one was searching for, would drop over the rods at the bottom. The rest could then be extracted from the top and set aside. Such was the intention. The accomplishment did not quite match up to it. The vibrations, transmitted to its rubber feet, would set the machine off on a demented dance across the table. If it was to be left unattended, it had to be fenced in to prevent it dropping over the side. Worse, the cards had a very shiny finish so that surface tension conspired powerfully to stick them together. It could take a long time to get just a few cards to drop, and many never dropped completely. If I had persisted, it would have been me that became demented. Sanity demanded that I throw it into a skip.

Later the practice became involved in collecting data for the first National Morbidity Survey. This was epidemiological research for real. We were able to simplify the task by instituting a practice day sheet. This was where we recorded every encounter with a patient throughout the day. This included home visits, surgery consultations, telephone calls, even casual encounters in the street. A separate column was allotted to the codes (from the College's own coding system) required by the RCGP's E-Book onto which all the records for the Morbidity Survey had to be transcribed. The codes were entered by whoever dealt with the encounter, and on the same day when memory was fresh. The day sheet enabled us to perform this task with little disturbance to normal routine and most importantly, without taking the Lloyd George record out of circulation. I discovered, to my surprise and delight, that in 2001 these day sheets are still found indispensable. In any otherwise paperless practice, these records are, I believe, not only an efficient way of keeping track of the day's events, and an invaluable resource in their own right, but also an essential resource when computer systems (inevitably!) fail.

I already knew the value of having a structured record that was dictated and then printed. I now realised how easy it would be to simply place a computer keyboard where my secretary previously had a typewriter keyboard. This happy coincidence was to greatly ease the transition from paper to electronic records at Egton.

Slowly I also came to believe that electronic records might actually improve the quality of care. Not only would they inevitably simplify record keeping, they would make it possible, if I chose, to make better records and better use of them too. But only if I chose. It might even be possible to make the machine spontaneously prompt me about the presence of vital information that I might easily overlook or have forgotten. But there would be no choice about this! Allergies and potential drug interactions immediately came to mind. The generic idea, which is what Americans call a 'tickler file' is very difficult to implement with paper records. What first made us aware of it was the realisation that numbers of patients on regular medication were running out for one reason or another and consequently becoming ill. But there were other reasons too. Managing courses of immunizations and repeated Cervical smears spring to mind. It was essential to find a practical way of doing it; of discovering those patients who should have contacted us, but failed to do so. A diary was really not good enough, but had to suffice.

When Alan Brighthouse joined me later he suggested that all the records should be filed by families or households. This immediately made it easier when a mother brought little Mary to the surgery, but forgot, until she was already in the consulting room, that young John had had earache last week, and could the doctor just have a look at him as well please. But it also made one aware of the whole family every time any one of them was seen, or their record looked at. It was our first efficient 'tickler file'.

There was also the possibility that I might have numbers of terminals driven by a single computer, making these records available in more than one place at the same time. No more missing records while they were borrowed! To all this was now added a built in facility for research. And I had early visions of diagnostic assistance! The all embracing, but more immediately practical concept of 'decision support' had not yet been invented.

It was not just a case of it being all too apparent that I would benefit from having a computer. It was more a question of how long I could live without one! But although the benefit was now clear, the money just was not there. The cheapest machine that could support the 5 terminals I needed was the DEC PDP11. This machine came onto the market in 1970 at a cost, in the USA of \$20,000! And it was not only the computers that were expensive; the software was too. I was assured that cheaper machines would arrive and that one could prepare for the day. That day did not arrive until some time after the branch surgeries had been closed!

It was sometime before 1977 that I visited Graham Thompson, then senior systems analyst at ICI. He it was provided the crucial help and encouragement I needed. He was the only person who assured me that my ideas were not hopelessly unattainable, and pointed the way forward. He told me about MUMPS and he offered me the use of ICI's in-house machines to try out my ideas. I only had to pay the telephone bills! I seem to remember that the estimate for the annual cost of these was about £10,000!

Alan Brighouse came with me on that visit, driving from his own practice in Hull. It took place at ICI's computer centre in Alderley Edge. He must have sensed the excitement in the air, because I was too bemused and excited to explain to him what I had really only dimly become aware of. He was certainly well aware of what it was I was trying to do, and was to prove an unfailing source of support ever after.

It was soon after this visit that a surprising number of people then living in Teesside decided that they could afford to live on the Moors and commute to their jobs in the town. My single handed list grew from 1,800 to 2,500 in the course of just 3 years. Life alone was no longer sustainable. Alan joined me to share the burden in 1978. The practice had been too much for one man. It was now easy work for two. I had time on my hands to start programming in earnest.

At the same time affordable machines began to appear, among them the Apple and the Commodore PET. I plumped for the Apple which seemed to be the faster and more sophisticated machine. I ordered one and went to collect it one Saturday afternoon, from somebody's garage in North London. But no-one was at home. Instead I collected a PET from an agent in Teesside the next week. It was a model 4032 which had 32 KB of RAM and twin disk drives each capable of storing (I think) 16 KB of data. The beauty of the PET was that you could write code on the screen, and then run it from the screen to debug it, before storing it. Easy though this was, I quickly realised the enormity of the task I had set myself if I persisted with it; the disruption it would cause to the practice and to my family.

I agonised over this decision for weeks. It quickly became apparent that it would eventually become necessary to turn this into a commercial enterprise. I would need more resources to develop the system I now envisaged, for it was a larger task than I could accomplish by myself. It was about this time that I wrote a primitive algorithm that is, in one form or another fundamental to all decision support systems. This brought the possibility of real time decision support much nearer to achievement. It was this discovery that clinched it. But for the moment, I put my head down and started to write the code. I would think about setting up a business later.

The devil in the PET did not appear for quite some time. I had written the first version of the registration software and had started on the code for managing repeat prescriptions and dispensing. Julia Agar had entered nearly half the practice into the register when it struck. It was like this: If the last character of a record should happen to light upon the penultimate byte of the floppy disc, the whole system crashed! It was amazing just how often this could happen. And there was no way of getting round it. We would have to wait for Commodore to fix the bug. There was despair all round.

The very first version of EMIS was thus abandoned. But it was not a case of six month's work wasted. I had learned that the PET was never going to be capable of handling the amount of data it would be required to. And I learned a lot about programming. The only thing to do was to wait until something like MUMPS appeared on an affordable machine.

During this waiting period, as part of my quest to see how far I could push a computer, I decided I would try to write some software that made use of the algorithm mentioned above, to help certain trainees overcome the transition from the ways of thinking they were taught as medical students, to the ways used by the majority of competent GPs. It did not really work in the way I had anticipated! But the attempt left me in no doubt that it could be done. Perhaps the idea of providing true decision support, by enabling the software to suggest the 'Next best question', was not pie in the sky. If it had failed completely I would have been very disappointed. As it was it increased my determination to keep going.

I knew that MUMPS would move the goal posts. I only had to read the manual to know that this system, that was operating system and programming language in one package, offered far more than any other. But it was expensive, and would only run on a mini-computer, or a main frame! Eventually Mike Davy, who had been DEC's Europe support manager for MUMPS systems, brought out his own version of MUMPS that would run on one of the new DEC PCs. The whole project suddenly became financially feasible.

I shall never forget the day the box arrived and we started MUMPS up for the first time. It took ages to get it going. But when we did there followed some very exciting days as the power and utility of this system became apparent. We could not believe how fast it was, or how easy it was to write the code.



I later learned that it was perhaps too easy, as time would tell! I also learned to appreciate the unique structures made available by the operating system and into which data could be stored. It was these structures that enabled us to produce with relative ease, the very flexible and adaptable system that EMIS was when it first appeared.

It came as no surprise to learn that MUMPS had been written by a physician at MITS, Dr Octo Barnett, and that MUMPS was an acronym for Massachusetts Utility Multi-user oPerating System!

Code that had taken me months to write on the PET was re-written in two weeks. This was magical. I can never forget the enormous satisfaction of watching code perform on the screen, that I would have despaired of writing in BASIC, and only after spending many more hours. To cut a dull story short, by 1984 I had completed most of the functions that were made available in the first commercial version of EMIS, and we had the system up and running in the new Surgery at Egton. It was not without its faults. Memory seems to have kindly barred the door to what these were! But David Stables will be delighted to tell you what they were if you should be unkind enough to ask! Nevertheless, I carefully kept a printed copy of this code.

It was around this time that David joined the practice. This was a singular stroke of good fortune. Alan and I took him on as a trainee. We had no idea that he would show any interest in computers. I doubt if he had heard of their existence. He once told me a few years later that he had believed there were no other worth-while intellectual challenges left in life: Until he met a computer. But in no time at all, David was writing games for his children in machine code on a Commodore 64 machine. He too, was now hooked. From there on it was but a small step for him to learn how to write code in MUMPS.

He then temporarily left the practice to complete the hospital side of his vocational training. When he returned he had a better grasp of MUMPS than I had and soon began the task of re-writing much of my code. This is a good place to admit that I was more interested in devising new ways of using the code to do the things I wanted it to do. The discipline required to produce code that could be edited and expanded by others was not something I happily submitted to. But if others were to take part in development this would have to be done. I could not have done it all myself. David's contribution to the system before it was marketed was essential. Without David Stables EMIS would have been still-born.



Finally it is now time to thank all those other people, not yet named, who helped me, in so many different ways during all the long years of conception and gestation.

These included all those who bore the brunt of suffering the bugs and failures of the early hardware, the inconstant power supplied by the North Eastern Electricity Board at Egton and the constant changes to the system that were regrettably unavoidable as the system developed and grew. They were, and many still are, the staff and receptionists at Egton Surgery:

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My debt to them is not really measurable.