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A simple computerised Tuberculosis register with data collection in the field (suitable for a developing country)

BY

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An earlier communication¹ described the organisation of the tuberculosis service in Matabeleland, and how the simple card index register enables us to keep track of patients and control their treatment. This paper discusses the second major role of a tuberculosis register, that is as a repository of clinical and epidemiological information from which material can be extracted for statistical analysis; and how we have been able to introduce this second function at little extra cost and within our existing slender manpower resources.

There is sufficient tuberculosis in the province for any organised assault upon it to produce a demonstrable effect, and that the inception of

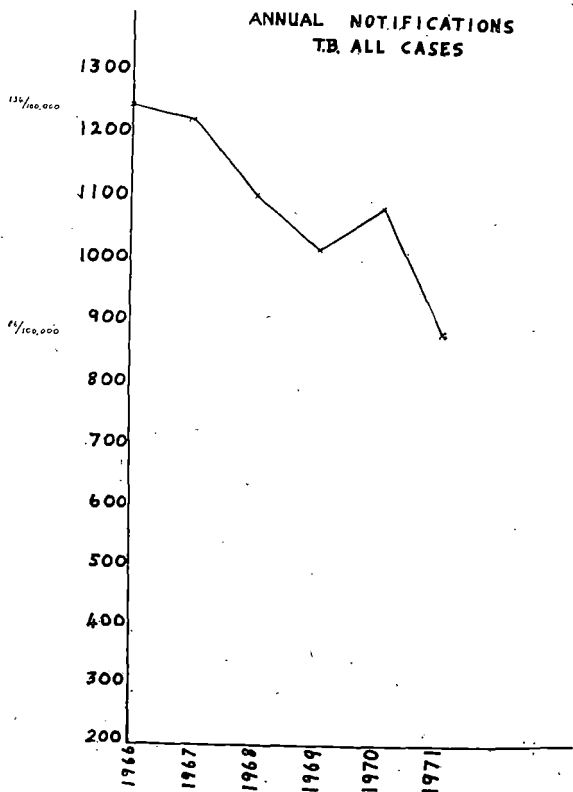


FIG. 1

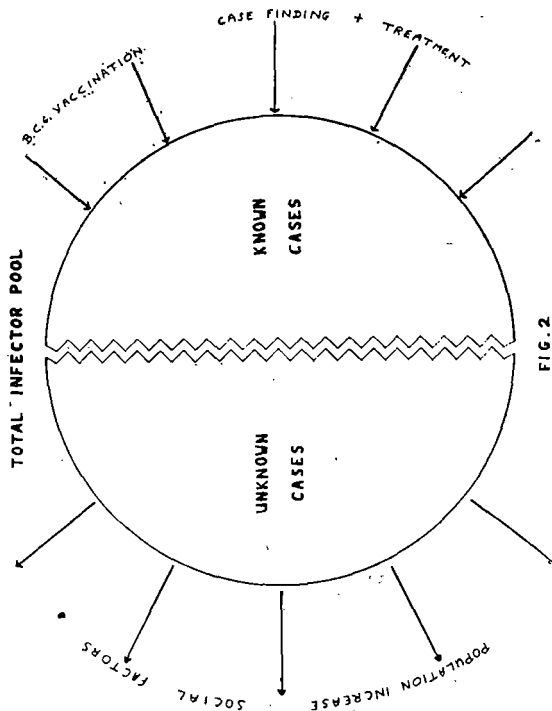


FIG. 2

the service was followed by a steady reduction in the number of cases being notified was only to be expected. This trend is shown in Fig. 1; but that no facile, and possibly erroneous, conclusion should be drawn from this is illustrated in Fig. 2. This shows a diagram of the total infector pool divided into its two components. The known part consists of all known cases of tuberculosis. The unknown part consists of people who, although sick, do not seek medical advice. Typical reasons for this are a fatalistic acceptance of ill-health, fear of losing jobs, a belief in traditional medicine, lack of funds to pay for available transport. The unknown part of the pool also contains people who, although suffering from the disease, are not yet aware that they are sick.

A large part of our rural population live in relatively densely populated tribal areas or on scattered farms and ranches. Many of these areas are remote and poorly served with both medical and transport services.

With the increasing acceptance of Western medicine by the indigenous people we hope that we know, and are treating, the greater part of our tuberculosis, but we do not know for sure whether or not this hope is justified, or to what extent. The two parts of the infector pool are shown in the diagram as being equal, but it would be a curious coincidence if this were in fact so. In dealing with a social disease it is reasonable to assume that if there is no improvement in

social conditions the amount of the disease will increase at least *pari passu* with the increase in population.

It may, of course, increase even faster if the population increase leads to an exacerbation of those social conditions such as overcrowding and malnutrition which predispose to the disease. It follows that, while our attack may be reducing the known amount of tuberculosis, the unknown amount may be tending steadily to increase. This would be particularly likely, for instance, if our mass B.C.G. vaccination programme was not being effective. The relative size of the two parts, and their rates of increase and decrease, are thus vital factors in determining what is happening to the infector pool as a whole.

Since some of it is unknown we can clearly never know the actual size of the infector pool. This does not matter; what we do need to know is whether it is getting bigger or smaller, and a valuable guide to this is the average age at which primary infection is occurring. The greater the amount of the disease present in a population the earlier the age at which infection will occur. If the average age of patients with primary infection is increasing then the total amount of tuberculosis is decreasing. It is possible that the proportions of the various degrees of positivity of the tuberculin test may provide a similar indication.

There are many other questions to which we do not, as yet, know the answers; only a few examples will be given. What is the incidence and severity of tuberculosis in patients who have had a previous B.C.G. vaccination? In other words, how effective are our mass vaccination campaigns in our field conditions? How effective are our drug regimes? What is the incidence of drug resistance (both primary and acquired) to the various drugs in use? What is our relapse rate and can it be related to any specific factors?

A vast fund of information which could give us the answer to these, and other, questions (if it could be analysed) was already recorded in the clinical records of patients receiving treatment or under surveillance at the 17 hospitals in the province which act as tuberculosis review centres, but we have had no effective method of extracting it for analysis. To answer just one particular question would mean employing staff to visit every hospital, scrutinise every T.B. record, extract the information relative to the investigation, consolidate it and analyse it either manually, or by coding and the use of punch cards. This is a laborious process and one which would have to be repeated on every occasion that a statistical analysis was required. It is an impossible undertaking in an under-developed country such as Rhodesia where all resources, and especially those of manpower, are strained to the utmost. We needed a system which would enable the information to be concentrated, and readily extracted and analysed when required.

Computers are highly sophisticated pieces of equipment which are frequently held to be the prerogative of the highly developed countries. To contemplate the use of a computer in an under-developed country to achieve the desirable goal set out above might be held to be trying to run before we could walk, and such opinions were, in fact, expressed. However, I believe that the more severe the labour shortage the more important it is to use labour-saving devices. If science produces a tool which will be useful to us, and it is available, then it behoves us to use it. The computer is such a tool.

Having decided to make use of a computer the first question to be decided was, "how to make use of it?" The storage and retrieval of medical records can achieve all levels of complexity, but it was clear that any system which we adopted would have to be limited in scope, and simple to operate at the level of data collection in the field, bearing in mind that the bulk of the data would have to be supplied by Health Assistants or by over-worked doctors or nurses in government and Mission hospitals.

T.B. NOTIFICATION & REPORT FORM

DATE NOW SUBMITTED		NEW CASE		SUPPLEMENTARY		CORRECTION		DONOTIFY	
Number of Months		Males		Females		Type of Death		Spec. Examine	
NAME									
ADDRESS 1 (if any address)			ADDRESS 2 (where most probably contracted)			ADDRESS 3 (if any of 6-10)			
Country									
City									
Province									
District									
Municipality									
Address 1 Code									
Address 2 Code									
Address 3 Code									
TYPE OF DISEASE (tick one or more boxes)									
TUBERCULOSIS		PULMONARY		SPINAL		MILIARY		OTHER	
No. of BONES AFFECTED		CANTATION		UNILAT		BIAT			
HOW DIAGNOSED (tick one box)									
SYMPTOMS		PHYSICAL		OTHER		UNKNOWN			
DATE OF NOTIFICATION									
HEALTH TEST		C.G.C.		1628		3035		Other 38	
SYMPTOM SIGNS									
DATE COLLECTED		Chest		Spinal		Central		Other	
EMPLOYMENT									
ASSOCIATED DISEASES									
COMPLICATIONS									
OPERATIONS									
CURRENT TREATMENT									
PATIENT INTERVIEW									
ORGANIC ASSISTANT									
REASON FOR CHANGE									
DATE OF CHANGE OF TREATMENT									
DATE OF COMPLETION OF TREATMENT AS IF									
DATE OF COMPLETION OF TREATMENT AS OF									
DATE OF RELAPSE									
DATE OF DEATH									
PRESENT STATUS									
STATUS SATISFACTORY									

FIG 3

	12	13	16	17	18	19
Prov.	REGISTER NO.	Check	Folio	DATE SUBMITTED	REPORT TYPE	REPORT AT
				M Y		MONTHS

4 MARDON BYO.-21184-1R 10

	20	1		20	2	
SEX	21			21		
RACE	22			22		
YEAR OF BIRTH	23			23		
ADDRESS 1	25			25		
ADDRESS 2	28			28		
ADDRESS 3	31			31		
TYPE OF DISEASE	34			34		
NO. OF ZONES AFFECTED	37			37		
UNILAT OR BILAT	38			38		
CAVITATION!	39			39		
UNILAT OR BILAT	40			40		
HOW DIAGNOSED	41			41		
DATE OF NOTIFICATION	42			42		
DATE TREATMENT STARTED	46			46		
B.C.G.	50			50		
HEAF TEST	51			51		
MANTOUX TEST	52			52		
SPUTUM SLIDE POS./NEG.	53			53		
DATE COLLECTED	54			54		
SPUTUM CULTURE POS./NEG	58			58		
DATE COLLECTED	59			59		
CONTACTS LISTED	63			63		
.. INVEST	65			65		
.. T.B.	67			67		
.. NON T.B.	69			69		
PREVIOUS EMPLOYMENT	71			71		
ADMISSION	73			73		
POST TREATMENT	75			75		
YEARS SINCE PREVIOUS TREATMENT	77			77		
ASSOCIATED DISEASES	21			21		
COMPLICATIONS	23			23		
OPERATIONS	25			25		
CURRENT TREATMENT	27			27		
PATIENT INTOL	33			33		
ORGANISM RESIST.	39			39		
SENSITIVE TO 1 st DRUGS	45			45		
NO OF WEEKS MISSED	46			46		
DATE OF TREATMENT CHANGE	48			48		
REASON FOR CHANGE	52			52		
DATE OF DESIGNATION	53			53		
EFFECTIVE DATE	54			54		
PRESENT STATUS	58			58		
X-RAY STATUS	60			60		
SPUTUM STATUS	61			61		
CLINICAL STATUS	62			62		

FIG. 4

In introducing a new procedure of this nature it is of paramount importance that it be acceptable to those who will have to use it. It must be primarily a medical tool and not just an exercise in computer expertise. Failure to appreciate this fact is to court disaster, as Ofit and Woodroffe report from University College Hospital.²

With this in mind from the beginning a number of fundamental concepts were formulated. We must not be too ambitious in the amount of data we wanted to collect, it should be limited to what could be collected on a single form. It was felt that to have more than one form would immediately cause difficulty and confusion. The new system must create as little extra work as possible

as we should have no extra staff to operate it. It was decided, therefore, that completion of the data collection forms should involve as little writing as possible; that the information required would be printed on the forms in such a way that in most cases the addition of a date or a tick in an appropriate box would be all that was required. Since such material as names and addresses would have to be entered on the initial form it was decided that this would take the place of the standard form of notification of infectious diseases in so far as tuberculosis was concerned, thus avoiding unnecessary duplication.

A list of useful data for statistical purposes was then compiled, and a form was eventually de-

A COMPUTERISED T.B. REGISTER

00003

DETAILS MISSING FROM MASTER RECORD AS AT 23 MAY 1972

HOSPITAL NO 84 ST: ANNER/BRUNAPEG

KEY	00 NAME	08 NO ZONE AFFECTED	16 YEARS SINCE PREV TRX	24
01 SEX		09 UNILAT / BI-LAT (1)	17 EMPLOYMENT PREVIOUS	24 SPUTUM CONVERSION (Designation)
02 RACE		10 CAVITATIONS	18 EMPLOYMENT ON ADMISSN	24 SPUTUM CULTURE RESULT
03 YEAR OF BIRTH		11 UNILAT / BI-LAT (2)	19 EMPLOYMENT POST TRX	27 SENSITIVITY RESULT
04 PLACE OF BIRTH (ADD 3)		12 B C G	20 CONTACTS LISTED	28 DRUGS TO WHICH ORGANISM RESISTANT
05		13 HEAF OR MANTOUX TEST	21 CONTACTS INVESTIGATED	29 CURRENT TREATMENT
06 TYPES OF DISEASE		14 WHERE ADMITTED	22 CONTACTS T B	30 REASON FOR CHANGE OF TREATMENT
07 HOW DIAGNOSED		15 WHERE CONTRACTED	23 CONTACTS NON T B	31

SERIAL NUMBER	NAME	DATE TRX												20	DATE SPUT COLL	DATE TRX CHNG												
		01	02	03	04	05	06	07	08	09	10	11	12				13	14	15	16	17	18	19	23	24	25	26	27
511946	LUNIKA NCUBE					0171																						
512898	AARON NCUBE					1171																						
512945	GANI NCUBE					1971																						
512994	ROBERT DJBE					1971																						
512995	ANNA NKOMO					1971																						
513095	BILEYI NKOMO					0972																						
513117	EARNEST NDEBELE					0972																						
513201	TAMECHANDU NCUBE					0472																						
513204	BINA NCUBE					0971																						
513256	KAROLINE DJBE					0971																						
513261	PILATE NKOLOVU					0871																						
513286	BEYI TSIPI					1171																						
513294	MOLIBANI NKOLOVU					1971																						
513297	SIDNEY NCHENYA					1971																						
513333	VINCENT JANA					0172																						
513244	CHADREK NKOMO					0472																						
513270	MAGOLIA PHUTI					0472																						
513228	FIOSE NKOMO					1170																						
513267	NOKUTULA DJBE					1070																						
513245	BITHWANI NKOLOVU					0171																						

FIG. 5

00007

REVIEW OF TB PATIENTS AS AT 23 MAY 1972

HOSPITAL NO 84 ST: ANNER/BRUNAPEG PAGE 3

SERIAL NUMBER	NAME	S A D I A G N O S E S			DATE CURRENT	X B C		I N S T R U C T I O N S																				
		0	1	2		3	R	P	L	TCA	NEXT TRX	CON D/P	ON	ABS	TO	DIR	DEL	TRANSFER										
OUTPATIENTS - NEGATIVE																												
511828F	FIOSE NKOMO	M	23	PRIM	05-71	Y	Y																					
511867Y	NOKUTULA DJBE	F	3	PRIM	03-71	Y	Y	Y																				
511945M	BITHWANI NKOLOVU	F	26	PTB	07-71	Y	Y	Y																				
512038U	MATONZI NCUBE	F	26	ADEN	07-71	Y																						
512033M	ELIZABETH NKUNGHANA	F	42	PLEUR	08-71	Y	Y	Y																				
512242F	MHEMHEHE TSHUMA	F	31	PTB	10-71	Y	Y	Y																				
5122430	THADEUS SWERU	M	41	PTB	10-71	Y	Y	Y																				
5123120	BUTTERFLY NCUBE	F	61	PTB	10-71	Y																						
512340M	SOLOMON NEMBA NCUBE	M	40	PTB	11-71	Y																						
512341N	JAPHET NKOLOVU	M	5	PLEUR OTHER	02-72	Y																						
512352A	MACHINDA NKOLOVU	F	70	PTB	02-72	Y																						
512386M	MAKEYI HOYO	M	4	PRIM	11-71	Y	Y	Y																				
512387N	LAURENCIA NKUNGHANA	F	19	PERIC	11-71	Y																						
512524Y	ELLIS HOYO	F	40	PTB	12-71	Y	Y	Y																				
512525N	MAVIS HOYO	F	5	ADEN	01-72	Y	Y	Y																				
512575S	MARGARET SIBANDA	F	21	PTB	02-72	Y	Y	Y																				
5125960	THOMAS NCUBE	M	31	PTB PLEUR	11-71	Y	Y	Y																				
512597R	BERI DJBE	F	61	PLEUR	01-72	Y	Y	Y																				
512598B	MAREKO NKOMO	M	68	MILRY	12-71	Y	Y	Y																				
512622E	HEBI NCUBE	M	51	ADEN	02-72	Y																						
512816E	RHODA DJBE	F	29	PTB	04-72	Y	Y	Y																				
512817F	TSHETE NDEBELE	F	61	PTB	04-72	Y	Y	Y																				
512854M	WINFILDA NKUNGHANA	F	10	PRIM	04-72	Y	Y	Y																				

FIG. 6

* TREATMENT HAS EXCEEDED TWO YEARS

signed which accommodated as much of this list as possible within the compass of a single foolscap sheet. With the advent of decimalisation this was transposed in the printing to the decimal size DIN A4. Certain items of the original list had to be omitted because it was found not possible to fit them in. So, after a somewhat difficult delivery, was born our original T.B. Notification and Report Form (Fig. 3).

Having produced the means whereby simple basic data might be collected at the periphery for central storage and processing, the next step was to sell the idea to all concerned. This, in the event, proved easier than had been anticipated. Every doctor in the province likely to be involved indicated his or her willingness to co-operate, though some expressed misgivings about the extra work involved or about their ability to have the forms completed properly. At the regular T.B. reviews the idea of a computerised register was sown and fostered over a considerable period of time by discussions and the reporting of developments. Detailed instructions for the completion of the form, box by box, were prepared and circulated with the initial issue of books of forms. Health Assistants spent one full afternoon of their annual conference being instructed in the forms and their use, and at ensuing reviews forms were completed by myself as illustration.

This careful preparation of the ground to ensure user acceptability brought results which far exceeded even my hopeful expectations, and confounded the pessimists who had predicted that the whole exercise would prove far too complicated for our staff to cope with. It was explained to all concerned that forms incorrectly or incompletely filled in would be returned and that they must not be upset or resentful about this. We were all learning as we went along and this was the best way to ensure familiarity with forms and accuracy in their compilation in the shortest possible time. In the event a far smaller number of forms had to be returned than had been anticipated. In many cases information omitted from a form would be pointed out at the next review and a supplementary form including the missing data would be completed at that time.

A simple coding sheet (Fig. 4) had been prepared for us by a member of the staff of the computer bureau and the T.B. Clerk began to code the information from the data collection forms as they arrived in the office. As data collection started before the computer bureau could begin programming, all this paper had to be held in the provincial T.B. office until the bureau could accept it for punching. This was in some ways not a bad thing as during this period we were able to make corrections to the forms before they were

submitted for processing. Most of these corrections were necessitated by our unfamiliarity with coding or with the programming requirements, but some resulted from alterations to the programming after coding had been completed. Correcting the material beforehand involved the individual checking of the stock-pile of thousands of forms on several occasions. It must have enormously reduced the number of pages of error listings printed by the computer after processing had started and, though it may have increased the total amount of work, it did serve to spread the load. Also, and very valuably, it provided the bureau with a considerable bulk of reasonably accurate material which could be used for testing the various programmes.

Throughout the ensuing 12 months numerous lengthy meetings were held with an officer of the computer bureau. The object of these meetings was to determine the best way in which the material should be held on the computer in the light of the probable demands upon it. The design of the various print-outs which we should be requiring (review sheets, annual report statistics, etc.) was agreed. We learned what the computer could do easily, what could be done only with difficulty, and what it could not do. Not least, we learned how to avoid errors and received much help with the corrections.

T.B. STATISTICS

BATCH CONTROL VOUCHER

SYSTEM NO. & TYPE	839		01			
	Cols. 1 - 5					
BATCH NO.	Y	Y	X	M	D	D
	0	0	0	0	7	
	Cols. 6 - 15					
NO. RECORDS IN BATCH						
	Cols. 16 - 18					

NOTES

1. Use current date for Batch No. but do not create more than one batch with the same date.
2. All input documents must be batched and submitted in a logical sequence.
3. If both sides of an input document are coded, treat as TWO records; otherwise treat as ONE record.

TOTAL NO. DOCUMENTS IN BATCH

SIGNED

Fig 7

00001

ANNUAL ANALYSIS OF TUBERCULOSIS NOTIFICATIONS IN MATABELELAND IN 1971

PAGE 1

DISTRICT WHERE NOTIFIED	DIAGNOSIS ON NOTIFICATION	(0-2-5)		(2-5-5)		(5-10)		(10-20)		(20-30)		(30-40)		(40-50)		(50-60)		(60-70)		(70 +)		(ALL AGES)			
		M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	TOT	
		BEIT BRIDGE	PULMONARY POS			1				2		3	1	2	1	3	2	1		2	2			1*	6
	PULMONARY NEG	1		2	2	1						1		1								5	3	8	
	NON PULMONARY	1								1														2	1
	TOTAL	2		3	2	1		2		3	1	3	1	4	2	1		2	2			19	11	30	
BINGA	PULMONARY POS	1	1					1		2		7	1	1		1				2		3	14	17	
	PULMONARY NEG	2	4		2	1		1								1	1					3	7	10	
	NON PULMONARY																								
	TOTAL	3	5		2	1		1		2		7	1	1		1	1			2		6	21	27	
BULAWAYO MUB	PULMONARY POS	2		1		1	3	3	8	32	10	29	5	21	4	10	4	1		1		111	39	150	
	PULMONARY NEG	8	5	8	6	8	6	8	4	7	2	4	3	5	3	4		5	1			97	30	87	
	NON PULMONARY	1	2	1		1		1		4	2	4	1	2		3						17	8	25	
	TOTAL	11	7	10	6	10	9	12	12	43	19	37	9	38	7	17	4	6	1	1		185	74	259	
ESSEXVALE	PULMONARY POS									1		1	2			1	1					3	3	6	
	PULMONARY NEG	1	2											1		1						3	2	5	
	NON PULMONARY											1	1									1	1	2	
	TOTAL	1	2							1		2	3	1		1	1			1		7	6	13	
FILABUSI	PULMONARY POS	1		1				1	2	2	2	1	6	2		1	2	2		1		11	13	24	
	PULMONARY NEG	1	2	1	1	1		2	2					1		1						4	5	9	
	NON PULMONARY	1						1														1	1	2	
	TOTAL	3	2	1	1	1		1	5	2	2	1	6	3		1	3	2		1		16	19	35	

FIG. 8

TEN YEAR SURVEY OF T.B. NOTIFICATIONS IN MATABELELAND AS AT 31 DECEMBER 1971

RACE	YEAR NOTIFIED	(PULMONARY)			(NON PULMON)			(ALL CASES)		
		BYO	OTH	TOT	BYO	OTH	TOT	BYO	OTH	TOT
		AFRICAN	1962							
	1963									
	1964									
	1965									
	1966	115	672	1057	23	170	193	208	1042	1250
	1967	206	844	1050	24	155	179	230	999	1229
	1968	207	733	940	22	147	169	229	880	1109
	1969	214	674	888	24	112	136	238	766	1024
	1970	232	695	927	25	139	164	257	634	1091
	1971	308	470	778	35	75	110	343	545	888
COLOURED	1962									
	1963									
	1964									
	1965									
	1966									
	1967									
	1968									
	1969									
	1970									
	1971	5	2	7	1	1	2	6	3	9
ASIATIC	1962									
	1963									
	1964									
	1965									
	1966									
	1967									
	1968									
	1969									
	1970									
	1971	1		1				1		1
EUROPEAN	1962									
	1963									
	1964									
	1965									
	1966									
	1967									
	1968									
	1969									
	1970									
	1971	2	1	3	1		1	3	1	4

FIG. 9

In view of the large number of people involved in the process of data collection the possibility of human error assumes major proportions. It was our wish, therefore, that the computer would monitor our activities and draw attention to our errors and omissions. This has been done by linking various items of data either to other items or to specific dates. In only a few cases, however, will an entire record be rejected as invalid. In general, the computer will accept as much valid data as possible and reject only those *fields* within a record which are invalid or incomplete. Attention is drawn to *incorrect* material by means of error listing print-out for each batch of documents processed, and to *incomplete* records by means of a print-out of "missing details" (Fig. 5) concurrently with each hospital review sheet.

The various items of data are listed at the top of the print out and are each provided with a code number. These code numbers are arranged horizontally across the page while the patients' names are listed vertically down the left-hand side of the pages. Asterisks opposite the names under various numbers show the missing details required to bring each patient's record up to date. A few examples will serve to show the sort of linkages with which the system has been programmed in order to achieve this. A sputum culture result must be recorded for every month in which a sputum slide has been recorded, and each positive culture must have a corresponding sensitivity result. If only a slide result is available the culture result must be recorded fictitiously as "contaminated". If this is not done the computer will continue to ask for a culture result until 12 months have elapsed. Reports of cultures and sensitivities will not be accepted if no slide result for the corresponding month has been recorded.

A change of treatment must show a reason for the change and the new treatment regime, and if this is due to drug reaction or patient intolerance the drug or drugs implicated must be shown also. A sputum positive in-patient cannot become an out-patient without evidence of previous sputum conversion. Information regarding contacts will be asked for if the information has not been recorded by the time treatment as an out-patient has been completed, and so on.

We discovered as a result of these discussions that there were various ways in which the computer could help us by way of a bonus, as it were, apart from its primary function. For example, the review sheets list all the patients who fall within the aegis of each hospital, arranged in numerical order within each of the four groups,

In-patients, Out-patients, Surveillance, Absconder/Defaulter. They provide name, age, sex, diagnosis, the date when the last change in status was notified, columns for the current status and for the various possible disposal instructions. Instructions are recorded by making a circle round a printed dot in the appropriate column. Review sheets were introduced so that register cards could remain in the provincial T.B. office and not accompany the doctor to the various hospitals. This automatic printing is not merely a tremendous saving of typist's time, but the computer also prints an asterisk against the name of every patient who is shown as having been in hospital for more than six months, or who have been receiving continuous treatment for more than two years, or who has defaulted for more than six months. To have ones attention drawn to such cases visually is of considerable value at a busy clinic when one is pressed for time and such things are easily overlooked. Furthermore, one copy of the review sheet is sent to the hospital in advance so that the Health Assistant has an opportunity to investigate and prepare a report on such cases prior to the doctor's visit.

The Tuberculosis and Report forms are completed in duplicate on admission, and whenever additional clinical information comes to hand or there is a change in the patient's status—such as from In-patient to Out-patient. The original copies are sent to the Provincial tuberculosis office and the duplicate remains in the patient's hospital record. The discharge form which comes back to the hospital has the patient's register number on it, and this is entered in the space provided on the T.B. Notification & Report form, together with the suffix "OI". The first digit represents the province and is followed by the register number (five digits). The check letter is a safeguard against accidental transposition, or mis-reading by punch operators, of badly written numbers or letters. The suffix is the folio number of the particular clinical record being stored and each subsequent form will bear the same register number with the folio suffixes rising by successive integers. This permits a total of 99 "pages" in the patient's record—which we hope will be sufficient even for a patient with multiple relapses.

When a T.B. Notification & Report form is received in the T.B. office the information thereon is transcribed on to Coding Sheets. Two copies are made, the duplicate being filed with its data collection sheet in numerical order. The originals are batched and sent to the computer bureau. After processing and when the information has been transferred to the Master File on the computer, the originals are returned to the T.B. office

A COMPUTERISED T.B. REGISTER

RECORD DETAILS EXTRACTED FROM THE MASTER FILE 02/05/72

SERIAL NUMBER 51220 G

FIG. 10

SEX	RACE	YEAR BORN	PLACE OF BIRTH	DATE NOTF	NO RELAPSES	CURRENT DESIG.	CURRENT STATUS	NAME
M	AFR	192*	BULANAYO RC	6911	0	DIED	DIED TB	MTONISELMA XABA

D I A G N O S I S A T S T A R T O F T R E A T M E N T												
DATE TRX	YEARS SINCE TRX	INITIAL STATUS	TYPES OF DISEASE	HOW DIAGNOSED	NO NEG	UNL BIL	OR ITS	UNL BIL	HEAF TEST	MANTOUX TEST	WHERE ADMITTED	WHERE CONTRACTED
6910		INPAT +	PTB	STMP	6	BIL	NO			16-20	INYATI	INYATI

DATE TRX	ASSOC. DISEASE'S				COMPLICATIONS									OPERATIONS													
START	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
6910																											

DATE TRX	EMPLOYMENT PREVIOUS		CATEGORIES ON ADMISSION		CONTACT LISTED		DETAILS T.B.		NON T.B.	
6910	FARMING		FARMING							

DATE TRX	KEY	PAT INJOL	T R E A T M E N T (D R U G)															D E T A I L S																		
START	ORG	RESIS	A	B	C	D	E	F	G	H	J	K	L	M	N	P	R	S	A	B	C	D	E	F	G	H	I	J	K	L	M	N	P	R	S	
6910	BOTH		STREP	PAS	INH	THI	PZI	ETH	CYC	KAN	VIO	CAP	ETHAM	RIF	SPARE	SPARE	SPARE	SPARE																		

DATE TRX	REASON FOR CHANGE			WEEKS	T R E A T M E N T (D R U G)															D E T A I L S																	
CHNGE	RTN	P/Z	O/R	DISSEC	A	B	C	D	E	F	G	H	J	K	L	M	N	P	R	S	A	B	C	D	E	F	G	H	I	J	K	L	M	N	P	R	S
6910	X				X	X	X																														
7006	X				X	X	X	X																													
7007	X			37	X	X	X	X																													
7103	X				X	X	X	X																													

I N P U T D O C U M E N T													D E T A I L S																							
FOL NO	DATE	MOSP	REP	FOL NO	DATE	MOSP	REP	FOL NO	DATE	MOSP	REP	FOL NO	DATE	MOSP	REP	FOL NO	DATE	MOSP	REP	FOL NO	DATE	MOSP	REP	FOL NO	DATE	MOSP	REP	FOL NO	DATE	MOSP	REP	FOL NO	DATE	MOSP	REP	
01	7203	70	1																																	
02	7203	70	2																																	
03	7203	70	2																																	
04	7203	70	2																																	
05	7203	93	2																																	
06	7203	93	2																																	
07	7203	70	2																																	
08	7203	70	2																																	
09	7203	70	2																																	

S P U T U M -				D E T A I L S													S T A T U S				D E T A I L S													
DATE	SLDE	CULT	SENS	A	B	C	D	E	F	G	H	J	K	L	M	N	P	R	S	EFFEC	DATE	DESIGNATION	EFFEC	DATE	STATUS	EFFEC	DATE	STATUS						
6910	POS	POS	YES																	6910	INPAT +	6910	INPAT +	7006	INPAT =	7007	IP COMP	7007	OUTPAT =	7008	ABS/DEF			
6912	NEG	POS	NO	1																7006	SPUT CONV	7007	IP COMP	7103	INPAT +	7103	INPAT =	7103	INPAT =	7106	DIED TB			
7002	NEG	POS	NO	1																7103	SPUT CONV	7106	DIED											
7003	NEG	POS	NO	1																														
7102	POS	POS	YES																															
7105	NEG	NEG																																

with the error-listing print-out. After checking the errors and making corrections where necessary the originals are destroyed. The use of the computer to monitor the material makes it unnecessary to keep copies of all folios, but we always have the most recent folio for every patient on file and can thus ensure that folio numbers are neither omitted nor duplicated. Should this happen the offending document can be returned to the submitting hospital for correction.

In order to reduce the risk of documents going astray, and to assist the punch operators, they are sent to the computer bureau once a week in batches. Each batch has a cover sheet (Fig. 7) bearing a serial number and the total number of both documents and records in the batch. Each coding sheet, or "document" in this context, may bear one or two "records", each representing the format of a punch card. For the serial number we use the year, the month, and the number of batches sent in during the month. e.g. the fifth batch sent in during September, 1972 would bear the number 720905.

Apart from the validation and up-dating error listings for which corrections are required, and which are produced weekly for each group of batches processed, the following print-outs are produced routinely.

1. The various tables of annual statistics which have previously been compiled manually (and laboriously) (Fig. 8 and 9).

2. The review Sheets (Fig. 6) for the bi-monthly reviews at the various hospitals. These were previously typed from the card index register.

3. A list of "missing details" (Fig. 5) needed to bring up to date the records of the patients at each hospital. This is produced in conjunction with the review sheets.

4. A complete case record print-out of every case that is denotified.

5. A complete case record print-out (Fig. 10) of any case on request. Such a request is made by completing an "interrogate" form and attaching it to the next batch of documents to be processed.

Extremely useful though these print-outs are, they are, in a sense, by-products of the main function of the system which is simply to collect and store clinical data in easily retrievable form.

From this repository we should be able in the future, by the writing of simple special programmes, to obtain a wealth of statistics and a clear idea of the natural history of the disease in this country, and the effect we are having on it. This should give valuable guidance in the planning of future moves in the campaign against tuberculosis.

In conclusion I must pay tribute, and give thanks to the Rhodesian Association for the Prevention of Tuberculosis (R.A.P.T.) and to the General Manager of the Rhodesian Railways without whose help this work would not have been done. R.A.P.T. paid for the printing of the data collection forms and coding sheets and made the initial approach to the General Manager of the Rhodesia Railways, who then agreed to donate the services of the Railways' computer bureau as a charitable donation to R.A.P.T. to assist in the fight against T.B.

The co-operative effort by the public health service assisted by non-government medical personnel, voluntary organisation, and public-spirited private concern, has made this an outstanding community effort in disease control.

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