A STUDY OF PATIENTS ADMITTED TO MIRI HOSPITAL, SARAWAK, BY AIRBORNE MEDICAL EVACUATION

ANDREW KIYU DAWIE

SUMMARY

From January 1980 to December 1982, there were 222 MEDEVAC patients admitted to Miri Hospital, out of whom 206 had their case notes available for this study. The median age of the 206 patients MEDEVAC was 24.5 years and the male to female ratio was 1.2 : 1. The Kenyah, Iban, Punans, Kelabit, Kayan and Murut ethnic groups contributed most of the cases. There was some seasonal variation in the number of MEDEVAC done, the high months being July and December and the low periods in May/June and October/November. Most of the MEDEVAC were requested by ground staff at the remote rural clinics and also district hospitals. The median duration of stay of the patients was 9.7 days. The top five causes for MEDEVAC were: bronchopneumonia; accidental falls; gastroenteritis; peptic ulcers; and appendicitis. 7.8% of the MEDEVAC died in hospital. The management of cases ranged from conservative management to blood transfusions to surgical interventions. Based on the criteria set, 63.6% of the MEDEVAC were considered justified.

INTRODUCTION

The Fourth Division of Sarawak is the biggest division in the state with an area of 39,094/sq km but a population of only 199,518 in 1980,[1] giving it an average population density of 5.1 persons/sq km. The population is not evenly distributed, with about half the population in Miri District (population density of 19.2 persons/sq km), slightly more than a quarter in Bintulu District (population density of 4.6 persons/sq km) and the rest in the sparsely populated Baram District (population density of 2.2 persons/sq km).

Each of the three districts in the Division has a hospital, but specialist care (surgeon, physician and obstetrician/gynaecologist) was available only in Miri Hospital. In the rural areas were found 16 *Klinik Desas*, 12 subdispensaries, one mission clinic, and one maternal and child health clinic, in 1982. Transport and communication was (and still is) a major constraint in the Division. In some of the very remote rural clinics, the only means of transport was by air and communication by radio-call services. Referrals of patients from these clinics to the hospitals were very difficult.

The availability of the Flying Doctor Services (FDS) and the use of the service to do airborne medical evacuation (MEDEVAC) of very ill patients or patients needing specialist care, had eased the problem a little. MEDEVAC of patients may be done during the FDS itself, if the doctor decided so. It may also be requested for by the paramedical staff in the rural clinics *via* radio call service. Most of the very remote rural clinics

Andrew Kiyu Dawie, MBBS, MPH
Divisional Medical Office
Fourth Division
98000 Miri, Sarawak, Malaysia

were equipped with a radio-call set each. Requests for MEDEVAC may also be made through non-medical staff, for example, teachers in the remote villages.

While most of the doctors agreed that the MEDEVAC services were useful, there were some who expressed the opinion that most of those who were MEDEVAC need not have been sent that way at all. The purpose of this study are to determine: the characteristics of the patients who were MEDEVAC; the categories of staff who requested for those MEDEVAC; the health facilities calling for them; and whether those MEDEVAC were justified.

MATERIAL AND METHODS

The lists of patients for whom MEDEVAC were requested from 1 January 1980 to 31 December 1982, the dates they were requested and the persons requesting for the MEDEVAC were obtained from the records kept at the Divisional Medical Office, Miri. From those lists, the records of patients who were MEDEVAC to Miri Hospital were traced and their case notes obtained. Patients who were MEDEVAC to Bintulu and Marudi Hospital and those MEDEVAC to Miri Hospital, but whose case notes could not be traced, were excluded. Table I shows the number of requests for MEDEVAC, by year and receiving hospital, Fourth Division, Sarawak, 1 January 1980 to 31 December 1982. There were 206 patients included in the study.

From each case note, the age sex, race, diagnosis, treatment and duration of stay of the patients were obtained. All the patients (including paediatric) were also classified into medical, surgical, obstetric and gynaecological, and ophthalmology cases. The final diagnosis was classified according to the International Classification of Diseases[2] (ICD) rubrics and also grouped according to the ICD Chapters.

The seasonal variation was analysed by the method of moving average over 12 month periods, from which the centered averages were calculated. The seaconal variation was obtained as: (actual figure ÷ centred average) x 100.

The MEDEVAC were considering justified if they satisfied one of the following criteria, and in the following order: A – all the patients who died either on the trip or later in hospital, the reasoning being that they were so ill that they died of their illnesses; B – all the patients (excluding those in A) who later needed to be referred to a bigger hospital for treatment, the reasoning being that

TABLE I

REQUESTS FOR MEDEVAC BY YEAR AND RECEIVING HOSPITAL, FOURTH DIVISION, SARAWAK: 1 JANUARY 1980 TO 31 DECEMBER 1982

Receiving Hospital	No. of requests			
	1980	1981	1982	Total
Marudi	11	11	1	23
Bintulu	4	8	1	13
Miri	74 (69)	67 (63)	82 (74)	222 (206)
Total	89	86	83	258

( ) figures in brackets indicate the number of patients whose case notes were traceable from Miri Hospital, and included in the study.

their illnesses cannot be managed adequately even by Miri Hospital, whatmore by the smaller peripheral units; C – all the patients (excluding those in A and B) who needed some form of surgical or gynaecological operations, specialised procedures and investigations, assisted deliveries, and immobilisations, the reasoning being that these cannot be done in the rural clinics; D – all the patients (excluding those in A, B and C) who needed only blood transfusions, the reasoning being that blood transfusion is not available in the rural clinics; E – all the other patients (excluding those in A, B, C and D) who needed to be hospitalised for ten days or more. The figure of ten days was chosen as it was about one and a half times the average duration of stay of 7.25 days of inpatients in Sarawak.

RESULTS

Out of the 222 patients MEDEVAC to Miri Hospital from 1 January 1980 to 31 December 1982, 206 (92.8%) had their case notes available for this study.

Age, sex and racial distribution

The youngest patient was a 21-day-old infant with severe bronchopneumonia, while the oldest was a 75-year-old female with fracture of the left wrist sustained after a fall while walking. The median age of the patients was 24.5 years. The modal class was the age group between zero to nine-year-old, which formed 26.7% of the total patients. 113 (54.9%) of the patients were male while 93 (45.1%) were female. The male to female ratio was 1.2 : 1. Table II shows the distribution by age and sex of the patients MEDEVAC to Miri Hospital, Fourth Division, Sarawak, from 1 January 1980 to 31 December 1982.

187 (90.8%) of the patients were from the non-Malay indigenous ethnic groups; the largest number was from the Kenyahs with 67 (32.5%) of the patients. Of the remaining 19 (9.2%) patients, nine were Malays, eight were Chinese and two were Europeans. Of the two Europeans, one was a pilot injured in a plane crash while the other was ill while on an expedition to the Mulu Caves. Table III shows the distribution by ethnic group and sex of the patients MEDEVAC to Miri Hospital, Fourth Division, Sarawak, from 1 January 1980 to 31 December 1982.

Monthly and yearly distribution

The number of MEDEVAC by month during

TABLE II

DISTRIBUTION BY AGE AND SEX OF PATIENTS MEDEVAC TO MIRI HOSPITAL, FOURTH DIVISION, SARAWAK: 1 JANUARY 1980 TO 31 DECEMBER 1982

Age (years)	Sex		Total (%)
	Male	Female	
0 – 9	32	23	55 (26.7)
10 – 19	16	15	31 (15.0)
20 – 29	19	20	39 (18.9)
30 – 39	13	14	27 (13.1)
40 – 49	12	10	22 (10.7)
50 – 59	10	6	16 (7.8)
60 +	11	5	16 (7.8)
Total	113 (54.9%)	93 (45.1%)	206 (100.0)

TABLE III

DISTRIBUTION BY ETHNIC GROUP AND SEX OF PATIENTS MEDEVAC TO MIRI HOSPITAL, FOURTH DIVISION, SARAWAK: 1 JANUARY 1980 TO 31 DECEMBER 1982

Ethnic group	Sex		Total (%)
	Male	Female	
Indigenous groups:			
Kenyah	35	32	67 (32.5)
Iban	30	22	52 (25.2)
Punan	10	8	18 (8.7)
Kelabit	7	8	15 (7.3)
Kayan	6	7	13 (6.3)
Murut	5	5	10 (4.9)
Malay	5	4	9 (4.4)
Other indigenous*	9	3	12 (5.8)
Non indigenous groups:			
Chinese	4	4	8 (3.9)
Others**	2	0	2 (1.0)
Total	113 (54.9)	93 (45.1)	206 (100.0)

* includes Saban (3), Berawan (3), Kedayan (2), Sebob (2), Bisaya (1) and Melanau (1).

** both Europeans.

the three years under study are as shown in Fig. 1. The number of MEDEVAC done per month ranged from one to 16, with a median of five MEDEVAC/month. There were 69 MEDEVAC done in 1980, 63 in 1981 and 74 in 1982 giving a total of 206. When the seasonal variation is analysed, the high months for MEDEVAC over the three year period were in July and December, and the low months were in May and June and also in October and November.

Types of staff and station requesting for MEDEVAC

Only 11 (5.3%) of the 206 MEDEVAC cases during the period were requested by a doctor accompanying the Flying Doctor Service Team; the other 195 (94.7%) were requested by the ground staff. Six of the cases called by ground staff were from locations where there were no health facilities.

Table IV shows the types of stations from which the MEDEVAC to Miri Hospital were requested from 1 January 1980 to 31 December 1982. The four rural health facilities that requested for the most MEDEVAC were Lio Mato *Klinik Desa* (46 cases), Ulu Teru Subdispensary (28 cases), Long Loyang *Klinik Desa* (25 cases) and Long San Mission Clinic (16 cases).

200 (97.1%) of the requests for MEDEVAC were made by medical staff; only six (2.9%) were made by non-medical government staff (all

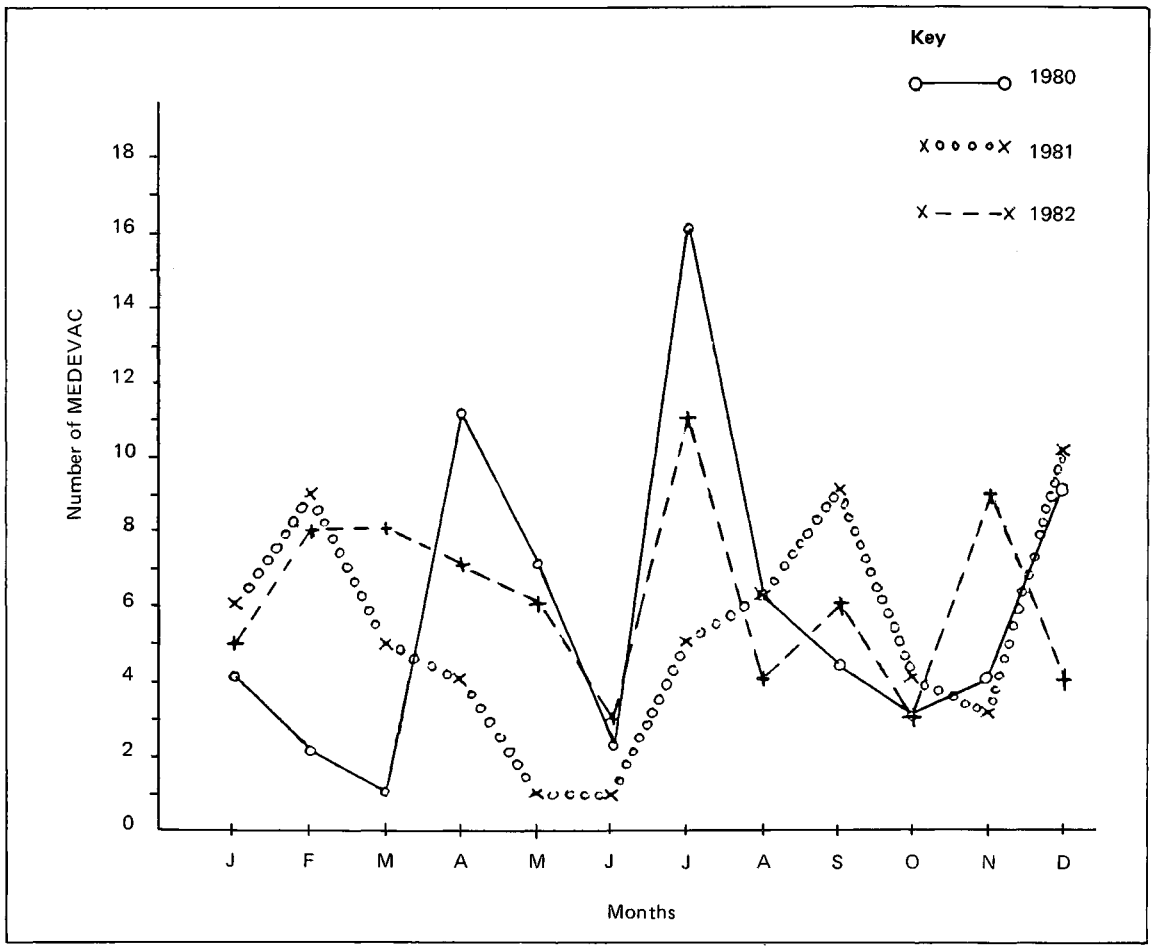

Fig. 1 Number by year and month of the MEDEVAC cases to Miri Hospital, Fourth Division, Sarawak, 1 January 1980 to 31 December 1982.

TABLE IV

TYPES OF STATIONS FROM WHICH MEDEVAC TO MIRI HOSPITAL WERE REQUESTED BY YEAR, FOURTH DIVISION, SARAWAK: 1 JANUARY 1980 TO 31 DECEMBER 1982

Type of station	Number of MEDEVAC			Total
	1980	1981	1982	
Flying Doctor Service Locations	1	6	4	11
District Hospitals in Fourth and Fifth Divisions	24	16	11	51
Rural Clinics and Subdispensaries	44	41	53	138
Non-clinic locations	0	0	6	6
Total	69	63	74	206

teachers). Of the 200 requests made by medical staff, 67 were from doctors, 68 from hospital assistants, 30 from junior hospital assistants, 19 from ulu dressers and 16 were from the midwife at Long San Mission Clinic.

Duration of stay

The duration of stay of the MEDEVAC patients ranged from one day (in 11 patients) to 150 days for a patient involved in a logging accident. Four of those with one day stay actually died in the hospital within 24 hours of admission. The median duration of stay for those MEDEVAC in 1980 was 8.7 days, 9.9 days in 1981 and 11.3 days in 1982; the figure was 9.7 days if the figures for the three year periods were considered together. 46 (22.3%) of them stayed between zero to four days, 62 (29.6%) stayed between five to nine days and 40 (19.4%) stayed between 10 to 14 days while the 59 (28.6%) others stayed from 15 to 150 days. Table V shows the duration of stay of the patients MEDEVAC to Miri Hospital, Fourth Division from 1 January 1980 to 31 December 1982.

TABLE V

DURATION OF STAY OF MEDEVAC PATIENTS TO MIRI HOSPITAL, FOURTH DIVISION, SARAWAK: 1 JANUARY 1980 TO 31 DECEMBER 1982

Duration of stay (days)	Number of patients	(%)
0 – 4	46	(22.3)
5 – 9	61	(29.6)
10 – 14	40	(19.4)
15 – 19	18	(8.7)
20 – 29	13	(6.3)
30 – 59	21	(10.2)
60 – 89	4	(1.9)
90 +	3	(1.5)
Total	206	(99.9)

Types of conditions and cases

92 (44.7%) of the patients were admitted to medical unit, 87 (42.2%) were admitted to the surgical unit, 22 (10.7%) were admitted to the Obstetrics and Gynaecology unit while 5 (2.4%) were admitted to the Ophthalmology unit.

55 (26.7%) of the cases MEDEVAC fell into ICD Chapter XVII : Injury and Poisoning; 51 (24.8%) fell into ICD Chapter IX : Diseases of Digestive System; the remaining 100 were in other ICD Chapters. Table VI shows the distribution by disease chapters of the MEDEVAC cases to Miri Hospital, Fourth Division, from 1 January 1980 to 31 December 1982. When the diseases were classified further according to the ICD list of three-digit rubrics, it was found that the top five causes for MEDEVAC during the three year period were: bronchopneumonia (ICD 485) with 15 (7.3%) cases; other falls from one level to another (ICD E-884) with 14 (6.8%) cases; other non-infective gastroenteritis and colitis (ICD 558) with 12 (5.8%) cases; peptic ulcers of unspecified sites (ICD 533) with nine (4.4%) cases; and appendicitis (ICD 540-542) with nine (4.4%) cases. These top five diseases constituted 28.7% of the cases MEDEVAC.

Management of cases and outcome

Out of the 206 patients MEDEVAC, 16 (7.8%) died in hospital while the other 190 (92.2%) lived. Two of the latter were subsequently referred to bigger hospitals for further treatment. Of the 16 that died, four did so within one day of admission, seven died between the second and seventh day, while the other five died during the second and third weeks of admission.

In 67 of the 190 patients who did not die, some form of surgical procedures and immobilisations of fractures were done. Among the 123 patients who did not die and who did not have any form of surgical procedures done on them, 5 had blood transfusions for severe anaemia (haemoglobin of 2.0g% to about 5.0g%). The remaining 118 patients were managed by means other than surgery and blood transfusion.

TABLE VI

DISTRIBUTION OF CASES BY ICD* DISEASE CHAPTERS, MEDEVAC TO MIRI HOSPITAL, FOURTH DIVISION, SARAWAK: 1 JANUARY 1980 – 31 DECEMBER 1982

	ICD Disease Chapter	No. of Cases (%)
800-999	Injury and poisoning	55 (26.7)
520-579	Diseases of digestive system	51 (24.8)
460-519	Diseases of respiratory system	21 (10.2)
630-676	Complications of pregnancy, child birth and the puerperium	21 (10.2)
001-139	Infectious and parasitic diseases	14 (6.8)
580-629	Diseases of genito-urinary system	11 (5.3)
390-459	Diseases of the circulatory system	8 (3.9)
780-799	Symptoms, signs and ill-defined conditions	7 (3.4)
140-239	Neoplasms	4 (1.9)
280-289	Diseases of blood and blood-forming organs	4 (1.9)
320-389	Diseases of nervous system and sense organs	4 (1.9)
	Other ICD Chapters	6 (2.9)
	Total	206 (99.9)

* International Classification of Diseases.

Two of the patients were found to have been MEDEVAC again for the same condition. One of them had acute gastroenteritis while the other had nephrotic syndrome.

Analysis of justification of MEDEVAC

Based on the criteria set earlier on in the methodology, 131 (63.6%) of the MEDEVAC done were justified, while the other 75 (36.4%) did not fit the set criteria. Fig. 2 shows the steps used in determining the justifications, and the number of cases that fit each justification, of the MEDEVAC cases to Miri Hospital, Fourth Division from 1 January 1980 to 31 December 1982. 108 of the 131 cases considered justified were due to their having surgical or other procedures done (67 cases) or due to their duration of stay being ten days or longer (41 cases).

When the percentages of cases MEDEVAC by various categories of staff were analysed, it was found that in the 67 cases MEDEVAC by doctors, 55 (82.1%) were considered justified according to the criteria set, while in the 139 cases MEDEVAC by the other staff 76 (54.7%) were considered justified according to the criteria set. This was significant at P between 0.01 and 0.001. There was no significant difference between those MEDEVAC by the hospital assistants when compared with those MEDEVAC by other paramedical staff.

The percentages of MEDEVAC considered justified according to the criteria set, by the other paramedical staff are as follows: by junior hospital assistants, 46.7%; midwife, 75.0%; ulu dresser, 36.8%. Out of the six MEDEVAC requested by teachers, four were considered justified according to the criteria set. Table VII shows the distribution by category of referring staff and criteria used in determining the justification of the MEDEVAC cases to Miri Hospital, Fourth Division, Sarawak from 1 January 1980 to 31 December 1982.

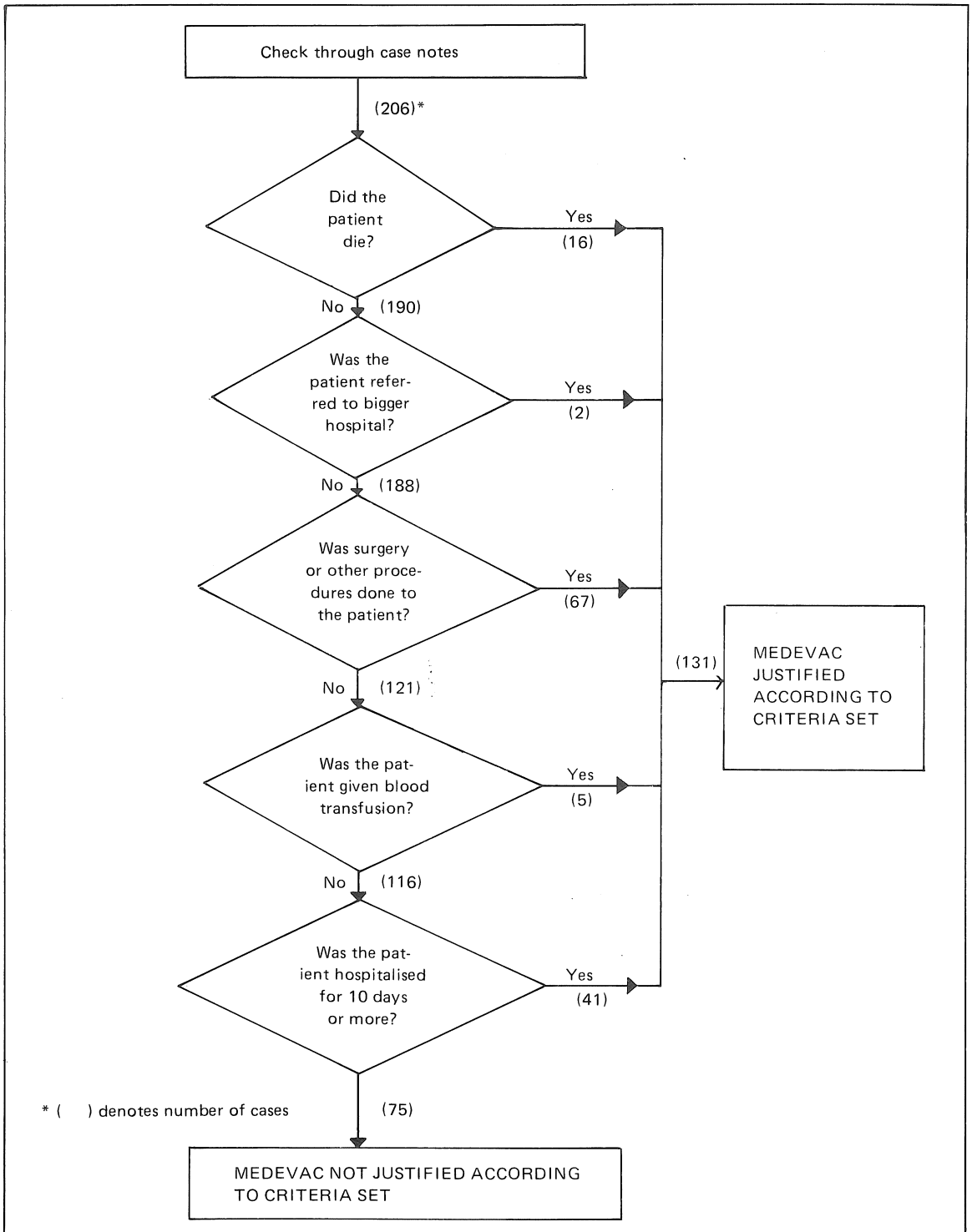

Fig. 2 Flowchart showing the steps used in determining the justification and number of cases that fit each justification, of the MEDEVAC cases to Miri Hospital, Fourth Division, Sarawak.

TABLE VII

DISTRIBUTION BY CATEGORY OF REFERRING STAFF AND CRITERIA USED IN DETERMINING JUSTIFICATION OF MEDEVAC CASES TO MIRI HOSPITAL, FOURTH DIVISION, SARAWAK: 1 JANUARY 1980 TO 31 DECEMBER 1982

Category of referring staff	Criteria used in determining justification of MEDEVAC						Total
	Justified*					Not justified	
	1 Patient died	2 Patient referred to bigger hospital	3 Surgical and other procedures done	4 Blood trans-fusion given	5 Duration of stay 10 days or more	Other outcomes/ treatment	
Doctor	4	1	35	3	12	12	67
Hospital Assistant	8	1	12	2	16	29	68
Junior Hospital Assistant	2	0	6	0	6	16	30
Ulu Dresser	1	0	5	0	1	12	19
Midwife	1	0	8	0	3	4	16
Others (teacher)	0	0	1	0	3	2	6
Total	16	2	67	5	41	75	206

* Patients classified into the preceding criteria (from 1 to 5) are excluded from the remaining criteria.

DISCUSSION

Many thousands of lives have been saved by airborne medical evacuation since the first such recorded incident in 1870 during the seige of Paris.[3] In the more than 100 years since that balloon lifted off, aviation and medicine have formed a partnership, with emergency medical helicopter services being one of the newest members of that association. In Sarawak, the Flying Doctor Service (FDS) was first started as a pilot project in October 1973 as a joint venture between the State Government, the Royal Malaysian Air Force (RMAF) and by the Medical Department, and the FDS was first run by the RMAF. Later, the medical department ran the FDS independently of other agencies with helicopters rented from private air company; since January 1974, the FDS had been a more or less permanent part of the medical department.[5] Part and parcel of the FDS is the use of the helicopter for medical evacuation (MEDEVAC) of patients from the smaller rural health facilities or district hospitals, who need to be managed in a bigger centre. There were 222 such MEDEVAC to Miri Hospital from 1 January 1980 to 31 December 1982 out of whom 206 had their case notes available for study.

More than a quarter of the patients who were MEDEVAC were in the age group zero to nine years; 60.6% of them were below 30-years-old. This is a reflection of the age groups of the general population where 28.68% were from zero to nine years and 69.3% were below 30-years-old during the 1980 census.[1] The male to female ratio of 1 : 1.2 among those MEDEVAC is different from the ratio of 1.00 : 1.007 in the general population.

Nearly a third of the MEDEVAC cases were Kenyah while about a quarter were Ibans. Almost all the indigenous ethnic groups, apart from the Malays, live in the remote areas of the state. The

Punans are the group that stay in the most remote areas, followed by the Kenyahs. The Ibans, even though they do not stay in the very remote parts, are more numerous. That was why these three ethnic groups together form 66.4% of the MEDEVAC cases.

It is interesting to note that the low periods for MEDEVAC during the three years were in May/June and October/November. Most probably, this may be due to the Gawai festival around May/June when people tend not to seek treatment unless they are very ill. In October/November the people may be staying in their farms during weeding time.

Only 5.3% of the MEDEVAC were done during Flying Doctor Service; the others being called by ground staff from static health facilities. This is not surprising as the static health facilities see many more patients compared to the Flying Doctor Service. Of the rural health facilities, Lio Mato *Klinik Desa*, Ulu Teru Subdispensary and Long Loyang *Klinik Desa* called for the most MEDEVAC. These facilities had big operational areas and were also very remote and difficult to reach.

The average duration of inpatient stay in the hospitals in Sarawak in 1982 was 7.25 days.[5] In the group of patients MEDEVAC, the range of stay was very wide from one day to 150 days. The median length of stay was 9.7 days.

Going by broad disease groups, slightly more than a quarter of the cases were due to injury and poisoning and just below a quarter were due to diseases of the digestive system. This is in contrast to the main causes of general admission to Miri Hospital during the period. While the top five causes of MEDEVAC to Miri Hospital during the three year period were: bronchopneumonia (7.3%); other falls from one level to another (6.8%); other non-infective gastroenteritis and colitis (5.8%); peptic ulcers (4.4%); and appendicitis (4.4%), the top five causes of admission to Miri Hospital in 1982[6] were: symptoms and other ill-defined conditions forming 9.6% of all admissions; enteritis and other diarrhoeal diseases (9.3%); abortions (6.0%); delivery without mention of complications (5.4%); pneumonia (3.5%); and motor vehicle accidents (3.5%).

It was also found that 7.8% of those who were MEDEVAC to Miri Hospital during the three-year period died. In comparison to that, out of the 4,544 patients admitted to Miri Hospital in 1982,[6] 158 died giving a death rate of 3.5%. The hospital death rate for patients MEDEVAC was about twice that for the general patients and this may be a reflection of the more severely ill condition the MEDEVAC patients were in.

According to the modest criteria set, 63.6% of the MEDEVAC done were considered justified. The drawback of the criteria set was that conservative medical care of some of the cases were not given recognition as means of justifying MEDEVAC unless the patient happened to stay for ten days or longer. For example, a young child with severe dehydration from acute gastroenteritis may well have his life saved by intravenous fluid replacement in hospital and yet be discharged within nine days and thus his MEDEVAC would not be counted as justified. There is no scalp vein drip set in the rural clinics.

Furthermore, this analysis has been done retrospectively when the diagnosis was already known. Faced with uncertainties of diagnoses and prognoses, the staff in the remote areas have to give the patient the benefit of doubt and call for a MEDEVAC. There is also the pressure by the relatives to MEDEVAC and in the rural areas the cost of a mistake can be disastrous; if a patient is not MEDEVAC and dies in the rural clinic, the people in that area may not have faith in the clinic in future. The credibility of the service can suffer. The cost of the MEDEVAC is not taken into account because of the complexities involved in the data collection and analysis. According to the criteria set in this study, the percentage of cases MEDEVAC by doctors found to be justified was significantly higher than those

MEDEVAC by the paramedics. This is not surprising considering their degree of training.

In an article[3] on Ontario's MEDEVAC programme, J.C. Fallis of the Sick Children's Hospital in Ontario, commenting on the programme was quoted as saying "Advantages of the helicopter team have been very marked on about a third of the cases, very evident on another third, and the balance could have come just as well by road. But for every one whose life is saved, I don't care how many come unnecessarily". Even though the criteria for that judgement was not given in that article, the conclusions are similar to the present series.

The MEDEVAC has definitely been useful to those who are staying in the very remote areas of the state and the service should be continued and improved.

REFERENCES

1 Department of Statistics Malaysia (Sarawak Branch). *Annual Statistical Bulletin.* Sarawak, 1983.

2 World Health Organisation. *International Classification of Diseases.* Geneva, 1977.

3 Randall K. Ontario's Flying 'Bandages' – Help make it all better. *Rotor and Wing International* 1982; March: 69–72, 155.

4 Doraisingam P. *An analysis of Sarawak Flying Doctor Service: A study done in Baram District.* A University Malaya MPH dissertation, 1978.

5 Medical Department Sarawak. *Anggaran Belanjawan* (Medical Care Services), 1982. Mimeographed document.

6 Divisional Medical Office, Miri, Sarawak. *Annual Report,* Fourth Division, 1982. Mimeographed document.