ORIGINAL ARTICLE

Role of Persistent Diarrhea Control in Declining Infant and Childhood Mortality in Indonesia

Rusdi Ismail

(Department of Child Health, Medical School, Sriwijaya University, Palembang, Indonesia)

ABSTRACT In diarrheal diseases control program (CDD), the mechanism of diarrheal diseases (DD) death can be classified into: dehydration, dysentery, complication, and persistent diarrhea. The aim of the presentation is to predict the share of these components and to highlight the role of persistent diarrhea. Demographic figures were inferred from the Census and the 1985 Inter-Censal Survey data. Rates on DD were inferred from the National Household Health Surveys and relevant reports. The mechanisms of death were inferred from the pattern of DD death in Palembang General Hospital. By fair prediction, in infants, 1.5 lives will be saved per 1000 live births through CDD Program, 88% is the share of persistent diarrhea control, and 20% of better management of DD complicated with other diseases. In 1-4 years of age, the figures are 68% and 38%, respectively. The share of promoting rehydration and dysentery management will be minimal in declining infant mortality rate (IMR) and childhood death rate (CDR) between 1992 and 2000. The share of CDD in declining IMR and CDR must depend on a better management of persistent and complicated DD **[Paediatr Indones 1994; 34:187-196]**

Introduction

The diarrheal diseases control (CDD) Program has contributed a significant share in declining infant mortality rate (IMR) and childhood (1-4 years of age) age specific death rates (CDR) in Indonesia. The IMR had declined from 140 in 1970 to 55 in 1992. The magnitude of diarrheal diseases (DD) problem is reflected by the DD cause specific death rate (DDDR) in infants, i.e., 28/1000 (20% of infant death) in 1970 and had declined to 7.5/1000 (14%) in 1992. The CDR had declined from 25/1000 in 1970 to 10 in 1992. The childhood DDDR was 8.3/1000 (33% of childhood death) in 1970 and 3.2/1000 (27%) in 1992.

Accepted for publication: May 22, 1994. Author's address: Rusdi Ismail, MD. Dept. of Child Health, Medical School, Sriwijaya University. Jalan Jenderal Sudirman km 3.5, Palembang, Indonesia.

Despite this success, the above mentioned figures show that DD still have a significant role in causing death in infants and in 1-4 years of age children. In other words, maintaining and intensifying promotion of CDD Program will still contribute a substantial proportion in declining further the IMR and CDR.

Clinically the mechanism of DD death can be classified into: (1) dehydration, where death is directly due to consequences of dehydration such as irreversible shock, encepalopathy due to hypertonic dehydration or renal failure; (2) dysentery or invasive bacterial diarrhea, where death is caused by the consequences of inflammation such as endotoxic shock or HUS; (3) complicating diseases, where death is due to other diseases which directly complicate DD such as low respiratory tract infection (LRTI), malignant convulsion; and persistent diarrhea, where death occurs due to the vicious cycle of diarrhea, infection and PEM. This clinical variations define the priority setting and specific aspect of the CDD Program.

The aim of this textual study is to highlight the role of persistent diarrhea in causing death in infants and children, so that the urgency for controlling and managing them can be elucidated and the share of CDD Program in declining further IMR and CDR through appropriate control and management of persistent diarrhea can be predicted.

Methods

In this study a number of figures were inferred from various sources. The demographic figures, i.e., the number of population by age, the crude and age specific death rates were inferred from the 1970, 1980, 1990 Census, 1985 Inter-Censal Survey data, and relevant analysis based on these data.

Incidence rate of DD, age specific incidence rate, and proportion of incidence according to age were inferred from official estimates by the Ministry of Health, Republic of Indonesia, and relevant survey reports. Proportion of incidence of dysentery, acute DD prolonging to persistent diarrhea were inferred from relevant survey reports.

Age specific DD death rates were calculated from age specific proportion of death due to DD based on nationwide house hold health surveys (HHHS) conducted by the Research and Development Center, Ministry of Health, in 1970/1971, 1980, 1986 and 1992, and age specific death rates were based on Census data.

The proportion of DD deaths which occurred due to dehydration, dysentery (invasive diarrhea), persistent diarrhea or complicating diseases were inferred from the proportion reported by the Department of Child Health, Palembang General Hospital. This was a provincial hospital, located in swampy lowland area, in the South-Eastern part of Sumatra, Indonesia, where DD are still highly endemic if compared with some other parts of Indonesia. These figures were calculated for the year 1970, 1980, 1986 and 1992, in line with the available nationwide HHHS data.

Prediction of the figures for the year 2000, were inferred based on predictions made by official authorities (Ministry of Health and Bureau of Census) and the relevant workers.

In predicting the IMR and CDR for the year 2000, there were 3 scenarios, i.e., the optimistic, pessimistic, and fair one. These scenarios were based on the prediction of the achievement of child survival programs. They were: neonatal tetanus control through tetanus toxoid (TT) immunization; ARI control through appropriate treatment; breast feeding promotion through baby friendly hospital campaign; lowering perinatal death and low birth weight through safe motherhood programs; CDD itself for lowering IMR; and ARI control, EPI, nutrition promotion, and CDD itself for lowering CDR. These figures were rounded, so that the numbers, rates, and proportions did not comply exactly. Based on these figures, the role of persistent diarrhea and DD in general in causing death in infants and children, and the gain that would be achieved if appropriate persistent diarrhea control was carried out, were inferred.

Results

Table 1 shows the population, crude death rate, age specific death rate, DD incidence, DD death rate and proportion of death by age in Indonesia in 1970, 1980, 1986, 1992 and the prediction for year 2000. The figures for year 2000 in Table 1 were based on the prediction using the fair scenario. The whole figures for the three scenarios are shown in Tables 2 and 3.

Figures 1 and 2 show the decline of IMR as well as CDR, and their respective DD mortality rate; these were meant to illustrate the share of CDD Program in lowering the IMR and CDR.

Figures 3 and 4 show the mechanisms of DD death in infants and children, to illustrate the role of persistent diarrhea. Data for year 1970 could not be presented, due to lack of relevant data from Palembang General Hospital to infer them.

Discussion

Based on the 1970 and 1980 Census and the 1985 Inter-Censal survey, in 1987 the National Bureau of Statistic predicted the population of Indonesia will be 182.7 million in 1990 with the rate of natural increase (RNI) 2.11, and 216.1 million in year 2000 with RNI 1.60.[3] The 1990 Census yield the total population number of 179.2 millions. Based on this finding, and the estimate of the pacing of the total fertility rate reduction, it is estimated that the total population of Indonesia in the year of 200 will be 205 million. Despite the increase of the total number of population, the number of underfive children will be steady around 21 to 22 million and the total number of infants around 4 million.

The DD incidence rates reported as the result of several surveys in Indonesia were always lower than the official estimates, ranging between 125 to 250 per 1000 population per year.[12] Up to 1981, the official estimate for DD incidence was 400/1000, and in 1993 300/1000. The figures used in this paper closely comply to the official estimate.

The death rates calculated based on census data are always higher than the

Table 1. Diarrhoeal diseases incidence and death rate / proportion in Indonesia in 1970, 1980, 1986, 1992 and 2000

	Number, rate, or proportion				
Indicators	1970	1980	1986	1992	2000
Population[1-4]					
Total	116.000.000	148.000.000	167.000.000	183.000.000	205.000.000
Underfive	18.000.000 (15.5%)	21.000.000 (14.8%)	22.000.000 (13.1%)	21.000.000 (11.5%)	22.000.000 (10.7%)
1-4 yrs of age	12.000.000	16.000.000	17.000.000	17.000.000	18.000.000
Infant	4.000.000 (3.5%)	5.000.000 (3.3%)	5.000.000 (3.0%)	4.000.000 (2.2%)	4.000.000 (2.0%)
Death[5-8]					
Total	1.500.000 (13.1/1000)	1.800.000 (12.1/1000)	1.300.000 (8.0/1000)	1.300.000 (6.9/1000)	1.300.000 (6.4/1000)
Underfive	860.000 (48/1000)	820.000 (39/1000)	550.000 (25/1000)	390.000 (18/1000)	320.000 (14.5/1000)
1-4 yrs of age	300.000 (25/1000)	320.000 (20/1000)	200.000 (12/1000)	170.000 (10/1000)	140.000 (8/1000)
Infant	560.000 (140/1000)	500.000 (100/1000)	350.000 (70/1000)	220.000 (55/1000)	180.000 (45/1000)
DD Incidence[9,10]					
Total	50.000.000 (430/1000)	60.000.000 (400/1000)	55.000.000 (330/1000)	45.000.000 (250/1000)	40.000.000 (200/1000)
Underfive[11-13]	36.000.000 (72%-2.0 ep/yr)	42.000.000 (70%-2.0 ep/yr)	40.000.000 (75%-1.8ep/yr)	34.000.000(74%-1.6ep/yr)	30.000.000(75%-1.4ep/yr)
Persistent	1.000.000 (2.8%)	1.200.000 (2.9%)	1.000.000 (2.5%)	800.000 (2.4%)	700.000 (2.3%)
Dysentery	5.000.000 (13.9%)	5.500.000 (13.1%)	5.000.000 (12.5%)	5.000.000 (14.7%)	4.000.000 (13.3%)
1-4 yrs of age	32.000.000 (2.7 ep/yr)	37.000.000 (2.3 ep/yr)	35.000.000 (2.1 ep/yr)	29.000.000 (1.7 ep/yr)	26.000.000 (1.4 ep/yr)
Infant	4.000.000 (1.0 ep/yr)	5.000.000 (1.0 ep/yr)	5.000.000 (1.0 ep/yr)	5.000.000 (1.0 ep/yr)	4.000.000 (0.8 ep/yr)
DD Death[5-10]					
Total	300.000 (2.6/1000-20%)	340.000 (2.3/1000-19%)	160.000 (9.6/1000-12%)	104.000 (0.6/1000-8%)	96.000 (0.5/1000-7%)
Underfive	210.000 (11.7/1000-25%)	240.000 (11.4/1000-29%)	115.000 (5.2/1000-21%)	70.000 (3.3/1000-18%)	60.000 (2.7/1000-19%)
1-4 yrs of age[14,15]	100.000 (8.3/1000-33%)	120.000 (7.5/1000-37%)	55.000 (3.2/1000-27%)	40.000 (2.4/1000-23%)	36.000 (1.9/1000-24%)
Dehydration	110.000 (28/1000-20%)	39.600 (33%)	4.950 (9%)	2.800 (7%)	2.520 (7%)
Dysentery		18.000 (15%)	8.250 (15%)	5.200 (13%)	7.200 (20%)
Complicating		10.800 (9%)	11.550 (21%)	8.000 (20%)	5.400 (15%)
Persistent		51.600 (43%)	30.250 (55%)	24.000 (60%)	20.880 (58%)
Infant		120.000 (24/1000-24%)	60.000 (12/1000-17%)	30.000 (7.5/1000-14%)	24.000 (6.0/1000-13%)
Dehydration		33.600 (28%)	5.400 (9%)	2.100 (7%)	1.680 (7%)
Dysentery		14.400 (12%)	9.000 (15%)	3.900 (13%)	4.800 (20%)
Complicating		9.600 (8%)	10.800 (18%)	4.800 (16%)	3.600 (15%)
Persistent		62.400 (52%)	34.800 (58%)	19.200 (64%)	13.920 (58%)

Table 2. Prediction of the share of DD in declining IMR from 1992 to 2000 based on optimistic, pessimistic and fair scenarios

	1992	Prediction in the year 2000 scenario		
		optimistic	fair	pessimistic
IMR	55	40	45	50
Decrease of IMR		15	10	5
DD death rate	7.5	5	6	7
Share DD		2.5 (17%)	1.5 (15%)	0.5 (10%)
DD death rate due to:				
dehydration	0.52	0.40	0.42	0.42
share		0.12 (5%)	0.10 (7%)	0.10 (20%)
dysentery	0.98	0.98	1.20	1.20
share		0.00 (0%)	-0.22 15%)	-0.22 (-44%)
complicating diseases	1.20	0.84	0.90	0.98
share		0.36 (14%)	0.30 (20%)	0.22 (44%)
persistent diarrhea	4.80	2.78	3.48	4.40
share		2.02 (81%)	1.32 (88%)	0.40 (80%)

Table 3. Prediction of the share of DD in declining CDR from 1992 to year 2000 based on optimistic, pessimistic and fair scenarios

	1992	Prediction in the year 2000 scenario		
		optimistic	fair	pessimistic
1-4 yr death rate	10.0	7	8	9
Decrease of death rate	2.4	3	2	1
DD death rate	0.17	1.6	1.9	2.2
Share of DD		0.8 (27%)	0.5 (25%)	0.2 (20%)
DD death rate due to:				
dehydration	0.31	0.11	0.13	0.15
share		0.06 (7%)	0.04 (8%)	0.02 (10%)
dysentery	0.48	0:32	0.38	0.44
share		-0.01 (-1%)	-0.07 (-14%)	-0.13 (-65%)
complicating diseases	1.44	0.24	0.29	0.33
share		0.24 (30%)	0.19 (38%)	0.15 (75%)
persistent diarrhea		0.93	1.10	1.28
share		0.51 (64%)	0.34 (68%)	0.16 (80%)

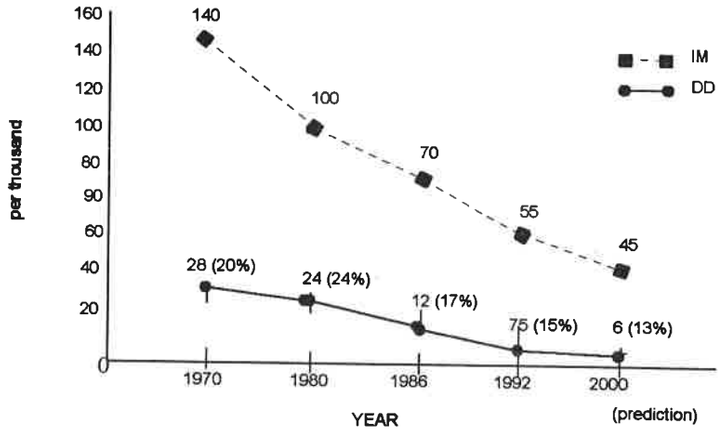

Figure 1. The share of DD death in infants

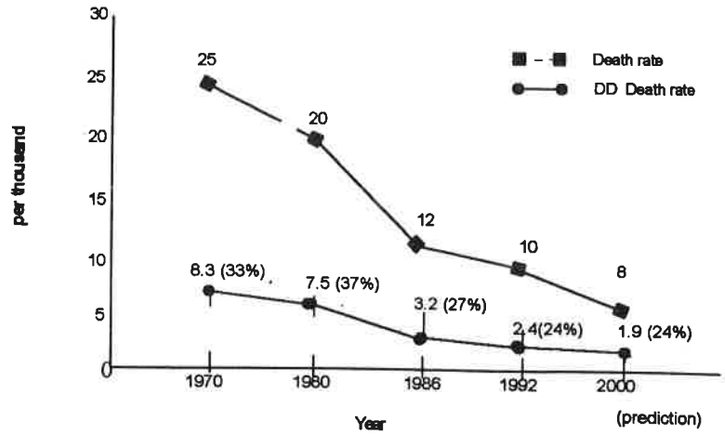

Figure 2. The share of DD death in 1-4 years of age children

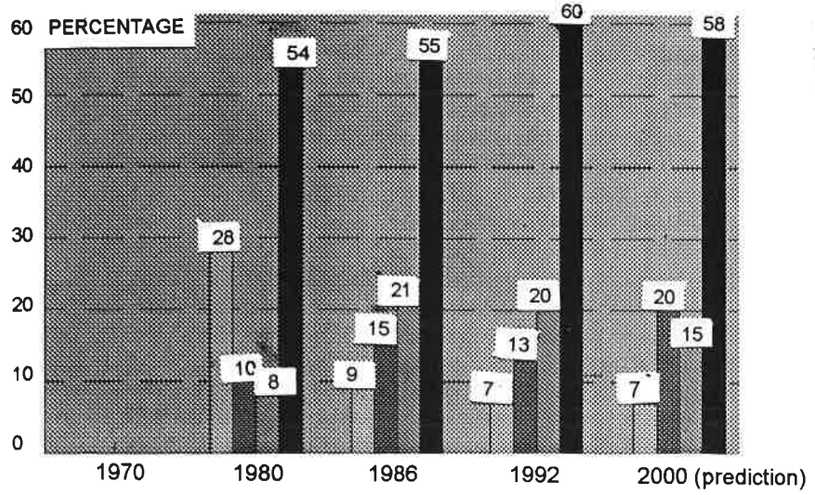

Figure 3. The mechanisms of DD death in infants

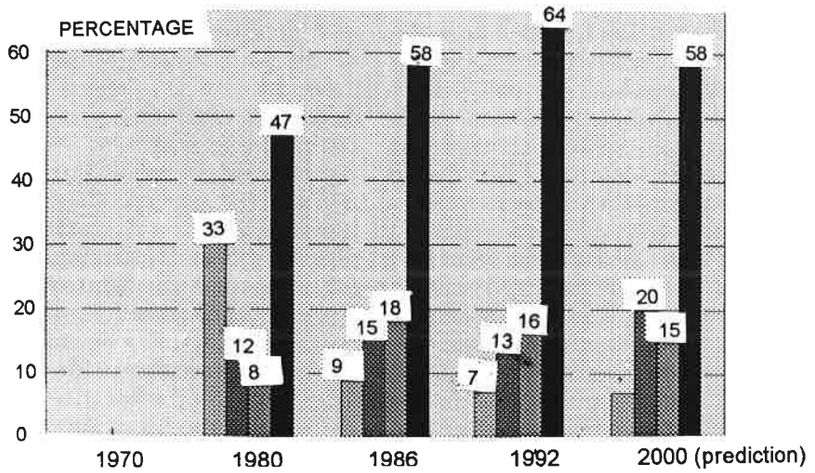

Figure 4. The mechanisms of DD death in 1-4 years of age children

rates yielded from HHHS. It is fair to assume under reporting in HHHS. However, in most reports, the rate based on the census data was calculated for a range of years. For example, based on the 1980 Census and the 1985 intercensal data, crude death rate for 1980 to 1985 was 10/1000, whilst crude death rate based on 1986 HHHS was 7/1000. Based on the available estimates, in this paper the figure 8/1000 was used. This kind of estimation was used to present other figures of death rates.

Based on these age specific death rates, using the figures of proportion of DD death in HHHS, DDDR was calculated. There were changes of methods in defining causes of death, between the 1971/1980 HHHS and the 1986/1992 HHHS. If there were more than one cause of death, in 1971/1980, the direct cause of death was recorded as the cause of death, whilst in the 1986/1992 HHHS, the underlying cause of death was recorded.[7] This change makes the 1971/1980 and the 1986/1992 figures not exactly comparable. However, in this paper, those figures were used as it is.

It is understandable that the proportion of DD death that occurred due to dehydration, dysentery, complicating diseases and persistent diarrhea in Palembang General Hospital could not be generalized to the condition in the community and the whole situation in Indonesia. However, up until now there is no more valid data available for this purpose in Indonesia. In 1992 Victoria et al. reported the differences in clinical patterns of diarrheal death in Brazil, Senegal, Bangladesh, and India. The author has compared these findings with the data calculated based on proportion at Palembang General Hospital, and found that the figures arisen complied to the level of health and economic status in Indonesia compared to these four countries.[17]

The optimistic prediction of IMR in the year 2000 (40 per 1000 live births) actually is realistic to be achieved. If the target for zero death due to neonatal tetanus in the year 2000 can be materialized, we can save 6 lives per 1000 live births.[8] In 1992 36% of infant deaths were due to ARI, and if we can decrease these deaths by 25%, it means another 5 infants per 1000 live births are saved. Another 4 (to achieve reduction of IMR 15/1000) can be yielded from CDD Program and the decrease of the incidence of low birth weight.

Infectious diseases still cause 70% childhood deaths in 1992,[8] which means 7 per 1000 of 1-4 years of age children. Assuming that the rate of childhood death due to non infectious diseases is constant, declining CDR from 10 in 1992 to 7 in the year 2000 (optimistic scenario) means we must decrease death due to infectious disease at least 40% by the year 2000. Through effective coverage of measles immunization, vitamin A supplementation and fruitful ARI and DD control programs, this target can be achieved. The predictions of DDDR reduction for the fair scenario are in line with the predictions made by the National CDD Program.[10]

The role of dehydration in causing death in infants and 1-4 years of age children is quite low. Death due to dehydration had decreased from 6.7 per 1000 live births in 1980 to 0.52 in 1992, and from 2.5 per 1000 1-4 years of age children in 1980 to 0.11 in 1992. Therefore, it can be assumed that the share of promoting appropriate rehydration will be minimal in declining IMR and CDR between the year 1992 and 2000. However, it should be stressed, that is does not mean that we can loose ORT promotion, for maintaining the current achievements, but also for controlling the incidence of persistent diarrhea and complicated DD.

Based on the epidemy of dysentery in South Asia in the late eighties, which is anticipated to reach Indonesia in the near future, the share of appropriate dysentery case management will also be minimal. In means that the share of CDD in declining further IMR and CDR by the year 2000 must depend on better control and management of persistent diarrhea and DD which are complicated by other diseases.

Tables 2 and 3 show their share. By the fair prediction, in infants, out of 1.5 lives saved in 1000 live births through successful CDD Program, 88% is the share of persistent diarrhea control, and 20% is the share of better control and management of DD complicated with other diseases. In the optimistic scenario, out of 2.5 infants lives saved, 81% is the share of persistent diarrhea control and 14% is the share of better management of DD complicated with other diseases. The figures for the pessimistic scenario are 0.5, 80% and 40% respectively.

The share of persistent diarrhea control in infants depends on the success of breast feeding promotion, appropriate feeding during diarrhea, appropriate ORT and selective drug therapy. The share of better management of DD complicated with other diseases, based on experiences at Palembang General Hospital, depends on the appropriate management of DD in neonates and young infants.

By fair prediction, in 1-4 years of age children, out of 0.5 lives saved per 1000 1-4 years of age children through successful CDD Program, 68% is the share of persistent diarrhea control, and 38% is the share of better management of DD complicated with other diseases. In the optimistic scenario, out of 0.8 1-4 years age children's lives saved, 64% is the share of persistent diarrhea control and 30% is the share of better management of DD complicated with other diseases. The figures for the pessimistic scenario are 0.2, 80% and 75% respectively.

The share of persistent diarrhea control in 1-4 years of age children mainly depends on the success of nutrition promotion in children, appropriate feeding during diarrhea, appropriate ORT, measles immunization, vitamin A supplementation and selective drug therapy. The share of better control and management of DD complicated with other diseases, based on the spectrum of the complicating diseases at Palembang General Hospital, mainly depends on the appropriate management of DD complicated with LRI, severe malignant convulsion or severe PEM.

It can be concluded that after the success of diarrheal diseases control program, maintaining and intensifying promotion of CDD Program will still contribute a substantial proportion in declining further the IMR and CDR. By the

fair prediction, IMR will decrease from 55 in 1992 to 45 in the year 2000, and CDD Program contributes 15% to this reduction; CDR will decrease from 10 to 8, where CDD Program will contribute 25% to this reduction. From this share of the CDD Program in declining IMR, 88% will be achieved through controlling and better management of persistent diarrhea; whilst in declining CDR, 68% will be achieved through controlling and better management of persistent diarrhea.

References

1. BPS. Statistical yearbook of Indonesia: 1982. Jakarta: Biro Pusat Statistik, 1983.
2. BPS. A brief note on the results of the 1985 intercensal population survey. Jakarta: Biro Pusat Statistik, 1987.
3. BPS. Proyeksi penduduk Indonesia 1985-2005 berdasarkan hasil SUPAS 1985. Jakarta: Biro Pusat Statistik, 1987.
4. BPS. Population of Indonesia. Results of 1990 census. Series: S2. Jakarta: Biro Pusat Statistik, 1992.
5. Budiarso LRP. Laporan sementara Survei Kesehatan Rumah Tangga 1970. Working paper for National Health Workshop, Jakarta, 1973.
6. Depkes RI. Survei Kesehatan Rumah Tangga 1980: Data statistik. Jakarta: Balitbangkes, 1981
7. Budiarso RL, Bakri Z, Soesanto SS, et al. Survei Kesehatan Rumah Tangga 1986. Jakarta: Balitbangkes, 1987
8. Soemantri S, Gotama IBI, Prapti IV. Proceeding Lokakarya Survei Kesehatan Rumah Tangga 1992. Jakarta: Balitbangkes, 1992.
9. Brotowasisto. Epidemiologi penyakit diare. In Proceeding, Seminar Rehidrasi I, Jakarta 1974. Jakarta: Ditjen PPM-PLP Depkes RI, 1974.
10. Depkes RI. Buku pegangan pemberantasan penyakit diare dalam Repelita V. Jakarta: Ditjen PPM-PLP Depkes RI, 1993.
11. Joe LK, Rukmono B, Oemijati S, et al. Diarrhoea among infants in a crowded area of Djakarta, Indonesia. A longitudinal study from birth to two years. Bull WHO 1966; 34: 197-210.
12. Ismail R, Nasir M. Kejadian Diare dan Pengelolaannya di Kecamatan Rambutan, Kabupaten Musi Banyuasin, Sumatera Selatan. Pertemuan Tahunan JEN II, Semarang 20-25 November 1989.
13. Sutoto, Mochtar MA, Karyadi, Brotowasisto. Morbidity and Mortality Study on Diarrhoeal Diseases in North Jakarta- an Urban Area. South East Asean J Trop Med Pub Health 1982; 13:3.
14. Situmorang K, Moeharianto, Ismail R. Hasil pengelolaan penyakit diare yang dirawat di Bagian Ilmu Kesehatan Anak FK UNSRI/ RSUP Palembang dalam tahun 1979-1980. Proceeding, PIB BKGAI VII, Manado 1981. Manado: BKGAI, 1981.
15. Rachman, KN. Mekanisme kematian penderita penyakit diare yang dirawat di UPF Penyakit Anak RSUP Palembang selama tahun 1989. Thesis. Palembang: Bagian IKA RSUP/FK UNSRI, 1993.
16. Victoria GC, Huttly SRA, Fuchs SC, et al. International differences in clinical patterns of diarrhoeal death: A comparison of children from Brazil, Senegal, Bangladesh and India. J Diarrhoeal Dis Res 1993; 11:25.
17. Ismail R. Penilaian permasalahan kesehatan akibat penyakit diare berdasarkan penyebab kematian yang berkaitan dengan penyakit diare. Berita Pusat Informasi Diare 1992; 3:77-80.