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Can newborn infants safely be discharged at lower weights from hospital care

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CAN NEWBORN INFANTS SAFELY BE DISCHARGED AT LOWER WEIGHTS FROM HOSPITAL CARE?

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A Research Report submitted to the Faculty of Medicine of the University of Witwatersrand, Johannesburg, in partial fulfilment of the requirement of Master of Medicine in Paediatrics.

Johannesburg 1999.

ABSTRACT

INTRODUCTION

At the neonatal unit at Baragwanath Hospital, 22% of all admissions weighed less than 1500g at birth at the time of the study. This group of babies are responsible for a formidable part of both the workload and expenditure of any neonatal unit. The earlier discharge of these babies offers significant advantages to both parents and the health service.

OBJECTIVES:

To establish the outcome of premature infants discharged earlier, i.e. at a weight of 1650g as compared to the conventional practice (1800g in summer and 1900g in winter). In this study the control group was discharged at 1800g in summer and winter.

METHOD

Design

Prospective, observational, case-control study.

Setting and participants

Chris Hani Baragwanath Hospital, is a tertiary care, academic hospital serving Soweto. All premature infants awaiting weight gain before discharge in ward 40, - a low level care area within the hospital - were eligible for

study. Infants weighing less than 1600g on arrival in ward 40 from other "higher care" wards were randomized into one of two groups - Group 1 (discharge at 1650g) and Group 2 (discharge at 1800g). The researcher was blinded as to which group any infant belonged to until the infant reached 1650g and was ready for discharge. One hundred and twenty infants were included in the study. Enrollment was done over 9 months and participants were followed up for 3 months after discharge from hospital.

Outcome measures

Comparisons were made between the two groups using the following outcomes:

1. Weight gain at one and three months post-discharge.
2. Morbidity.
3. Mortality.

Data collection

Data was collected using a questionnaire which included demographic, clinical and psycho-social measures. Statistical analysis was made using the STATISTICA statistical programme. Standard statistical tests were used, when appropriate.

RESULTS

Outcome of babies discharged at a lower weight (1650g) was no different compared to those sent home at a higher weight (1800g). Weight gain at 3 months were similar in both groups (30g/day vs 33g/day, p= 0.22). Mortality of babies discharged at 1800g was worse than the early discharge group but this was not statistically significant (1.6% vs 5.1%, p = 0.27). Morbidity was the same in both groups.

CONCLUSION

It is safe to discharge premature babies home at a lower weight if the home circumstances are appropriate. This will be of advantage not only to the health service but also to the individual baby and it's family.

DECLARATION

I declare that this research report is my own, unaided work. It is being submitted for the degree of Master of Medicine in Paediatrics in the University of Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at any other university.

29th day of March 1999.

ACKNOWLEDGEMENTS

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My grateful thanks to Mrs Harriet Khuzwayo for her dedication and support. Without her support I would not have been able to follow up these patients. I would also like to thank the Gauteng Health Department for sponsoring the study.

I am also grateful to my family particularly, my mother, Mampho, for their emotional support during this period.

DEDICATION

This is dedicated to my sister, Ntsoaki Ikaneng Mokhachane and brother, Lejoetsamang Mokhachane.

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LIST OF ABBREVIATIONS

AGA - appropriate for gestational age.

CHBH - Chris Hani Baragwanath Hospital.

ELBW - extremely low birth weight.

Hb - haemoglobin.

HIV - human immuno-deficiency virus.

HMD - hyaline membrane disease.

IPPV - intermittent positive pressure ventilation.

IVH - intraventricular haemorrhage.

KMC - Kangaroo Mother Care.

LBW - low birth weight.

NICU - neonatal intensive care unit.

NNJ - neonatal jaundice.

RDS - respiratory distress syndrome.

SGA - small for gestational age.

SIDS - sudden infant death syndrome.

TICU - transitional intensive care unit.

URTI - upper respiratory tract infection.

VLBW - very low birth weight.

CHAPTER ONE

LITERATURE REVIEW

INTRODUCTION

In developing countries and communities, including many parts of Africa, more than 15% of all babies are classified as being of LBW [weighing less than 2500g at birth] (1). At the neonatal unit at Chris Hani Baragwanath Hospital 22% of all admissions were classified as being VLBW (less than 1500g) at the time of the study in 1995-96 (unpublished data). The incidence of LBW in black infants in the USA is double that of white infants[12.6% vs 5.6 %](1).

This group of VLBW babies are responsible for a large part of both the workload and budget of any neonatal unit. Low birth weight deliveries are more prevalent in women from poorer socio-economic classes (1), which is the predominant population CHBH serves. Caring for LBW babies is expensive. Longer stays in hospital expose the infant to nosocomial infections. It also delays the beginning of a healthy relationship between the mother and the baby and their integration within the family. In addition, in developing countries, there are often inadequate resources to take care of all LBW infants in hospital. This overcrowding increases the risks for LBW babies.

EARLY DISCHARGE - A GLOBAL VIEW

There are numerous advantages in discharging babies earlier, be they premature or born at term. Literature on discharge policies focus on two main issues:

a) weight at discharge for pre-term babies and

b) discharging term babies within the first 48 hours after birth.

Lowest discharge weights in the developed world are as low as 2200g for pre-terms (2-4). For developing countries, where more than15% of births are of low birth-weight (1), discharging at 2200g, could result in serious overcrowding and overburdening of limited resources, when compared to the developed world. Most of the LBW babies in developing countries are SGA (1) and as a result adapt better and quicker to environmental challenges as compared to a baby of a similar weight who is AGA. It needs to be recognised that the discharge of premature and term babies involve different considerations and they need to be discussed separately. The complications of earlier discharge that need to be considered in the two groups are also different.

CRITERIA FOR EARLY DISCHARGE

The following criteria for early discharge of term babies were suggested in 1980 by the Committee of Fetus and the Newborn of the American Academy of Pediatrics(5):

1. Attendance at prenatal childbirth education and infant care classes where

problems of the first five days are included.

2. Identification of a supporting person to assist with care at home in the neonatal period.

3. Identification of physician directed source of continuous medical care.

4. Uncomplicated antepartum, intrapartum and postpartum course of both mother and infant.

5. Term infant weighing between 2500 and 4500g.

6. A minimum of 6 hours of hospitalization during which time the infant has achieved thermal homeostasis and fed successfully.

7. Laboratory data: a) syphillis results; b) Coombs in the baby or cord blood if the mother is Rh negative or group O.

8. Maternal skill and demonstrated ability with: a) feeding; b) skin care, including cord care; c) temperature assessment and assessment of infant well-being and recognition of illness.

In pre-term babies or LBW babies, similar guidelines were suggested by the same academy except that these babies stay for much longer before they are able to maintain temperature, etc. The discharge should occur when the infant is gaining weight after the initial weight loss.

TERM BABIES

Age at discharge of term babies has changed over the years from about 72 hours to less than 24 hours (6). This may have potential advantages and disadvantages for psychosocial processes, morbidity, breastfeeding and

health care costs (1,6).

Medical advantages of earlier discharge, would be a decrease in the rate of nosocomial infections and costs. An increase in the rate of re-admissions would nullify this. Diseases that present after 24 hours would be missed, for example neonatal jaundice, cardiac abnormalities and some gastrointestinal atresias.

As expected there are psychosocial benefits to the family as a whole, e.g bonding(6). Recommendations for early discharge and postnatal follow-up made by the American Academy of Pediatrics suggest, that babies discharged early should be followed up (5,6). To minimize problems one author suggests that education and preparation for the postpartum period should occur during the antepartum period(6).

Early discharge works if patients are carefully selected (6). However, if there are fiscal constraints, medical personnel's judgement may be clouded, e.g discharging patients prematurely to reduce hospital costs.

PREMATURE OR LOW BIRTH WEIGHT BABIES.

Many studies recommend the use of Kangaroo Mother Care when discharging these babies. Derbyshire et al in Leicester (3) discharged babies at a weight as low as 1300g from hospital without using KMC. Of the103 patients in Derbyshire's study, 88 were discharged weighing under 2200g and 13 weighed 1500g or less. Of note is that 50% of these babies

were SGA. Only 11(11%) of babies were re-admitted. Casiro et al in Canada (7) and Dillard with Korones in Tennessee (8), also looked at discharging babies without KMC. Casiro (7) randomized babies into either an intervention or control group. The intervention group received public nursing and homemaker services for 8 weeks. Discharge weight in the intervention group was 2200g vs 2275g in the controls. Discharge of babies less than 1500g at birth was hampered by persistent apnoeic spells in Casiro's study (7). Dillard (8) also randomized babies into two groups (groups A and B) and their mean discharge weights were 2075g and 2295g respectively. Earlier discharge in these two studies reduced hospital stay by 3 days in Dillard's (8) study and 8.5 days in Casiro's (7) study. The problem with these two studies is that mean weight at discharge was still high (≥ 2000g). This would not be implementable in a Third World setting. Hospitals in the developing world are overcrowded and would benefit from discharging babies at a weight below 2000g.

In Zimbabwe, Singer et al (9) compared 3 groups of infants- Group 1 discharged at 1801 to 1900g, Group 2 at 1901 to 2000g and Group 3 at 2001 to 2500g. Re-admissions were significantly higher in the lighter groups(i.e 9.5%, 1% and 0.8%) respectively . Mortality rate was also significantly greater for group 1 compared to the other two groups (5.7% vs 1% and 0.8% in groups 2 and 3 respectively, p-value<0.01). They suggested that babies could be safely discharged home at a weight of 1900g and above.

KANGAROO MOTHER CARE

In 1978, Rey and Martinez developed the Kangaroo Mother Care Programme at the Instituto Materno Infantil in Bogota, Colombia (1). Since then various institutions have tried it, not only in well low birth weight babies, but in neonatal intensive care units as well, some with resounding success (1, 2,10-12). The hospitals in Bogota were overcrowded and they were out of essential medical equipments in a population which had a high rate of LBW babies. VLBW babies require a long stay in hospital which has multiple disadvantages coupled with a few advantages. It is in this area where KMC was found to be of use in a number of studies (1, 2,11,12). KMC allows VLBW infants to have close skin contact with their mothers. This was unusual before Rey-Martinez started it 20 years ago.

KMC has three components to it:

1) Kangaroo position

2) Kangaroo Nutrition

3) Kangaroo discharge.

1) Kangaroo Position

Position of the baby

The baby is placed naked, except for a nappy, with or without a cap or boots, in an upright position. It is placed skin to skin between the mother's breasts.

Position of the mother

The mother is upright most of the time and sleeps in a semi-Fowler's position. The baby is cared for in this position till it does not tolerate it (usually around 40 weeks gestation). The mother covers the baby with her clothes with or without a blanket.

2. Kangaroo Nutrition

Babies are exclusively breastfed. They are fed in a football position, i.e one hand under the baby's head and the other hand squeezing the breast. The mothers are trained and helped to feed their babies. The baby's suck is assessed. If inadequate, tube feeding is commenced first.

3. Discharge

Babies less than 2000g are discharged much earlier under KMC, as long as they have adapted to extra-uterine life (1). They could be discharged as low as 1400 - 1600g (13). They are initially followed up frequently, decreasing the number of visits as the baby grows, i.e daily, weekly etc.

APPLICATION

There are three distinct applications of the KMC as pointed out by Charpak (12):

1) In places without appropriate neonatal care facilities (where KMC is the only alternative to the lack of incubators.)

2) In places with easy access to all levels of neonatal care, where early mother to infant skin-to-skin contact may enhance the quality of the mother-

to-infant bonding and encourage successful breastfeeding.

3) In places where technical and human resources are of good standards but insufficient to cope with all the demands, KMC is an alternative for a neonatal minimal care unit (low care) once infants have overcome major extrauterine life adaptations.

ADVANTAGES

KMC has multiple important benefits particularly in LBW babies.

Psychosocial

Prolonged hospital stay is emotionally and psychologically devastating (6). KMC has been shown to work very well even in places such as Hammersmith Hospital, London, where mothers visit daily without problems [e.g transport problems] (11). Keeping mother and baby for too long in hospital may affect the family adversely (6,10,11). Mothers providing kangaroo care tend to respond emotionally to their babies better than control mothers (10).

Kangaroo care has been shown to give mothers increased confidence in handling their babies (10). In areas where traditional care has been used as a control, control mothers more frequently wanted to know how long their babies were going to stay, a question which kangaroo mothers tended not to worry about (10). A short report from UK, reported that prolonged separation of pre-term babies from their parents contributes to non-

accidental injury (3). This was confirmed in a study where families of pre-term babies were compared with those of term babies - child abuse and 'vulnerable baby syndrome' (over protective anxious parents) was more common in the former group (14).

Lactation

Reviews have concluded that separation does have some deleterious effects on infant-maternal relationship, the frequency and duration of lactation and the mothers confidence in being able to cope better with raising a LBW(10) infant. Kangaroo care has been shown to increase the rate and length of breastfeeding (1). This is a real benefit for LBW babies, given the overwhelming evidence of the importance of the role of maternal milk (1). Charpak (1)raises an important question though about exclusive breastfeeding- is it enough for a low birth weight baby when the literature suggests that it may not be sufficient to guarantee optimal physical growth? In Africa, in particular, breast milk may not necessarily always be safe with the increasing incidence of HIV.

Growth

Growth assessment of neonates includes assessing weight, length and head growth. Sloan (2) showed no significant differences in growth between KMC and a control group of infants. In another study done two years later in Colombia, the KMC group grew less in the first three months (1). This could have been because these infants were more ill and were also from a very

poor socio-economic background (1). The KMC group and the controls were also not from the same hospital which could also have been a confounding variable. The authors (1) also argue that although the KMC group grew less well, they still gained weight adequately - an average of 20 g/day. In addition, they found that mean head circumference was similar in the two groups, which they regarded as the most important feature of a growth pattern in LBW.

Temperature control

In KMC, mothers are employed as incubator proxies, especially where there is a shortage of incubators. Charpak (9), believes that temperature regulation in the KMC group is as good as that obtained inside an incubator or even better.

In serial recordings of skin temperature in three infants, weighing 1000 g, 1100g and 1250g, before, during and after skin-to-skin contact with their respective mothers, it was shown that skin temperature was well maintained as long as infants wore a hat and had a blanket over the back (10).

Morbidity

As survival rates for VLBW babies improved from 35% to 48% between 1968 and 1978 in USA, re-hospitalization rates before two years of age increased from 22% to 27% (15). In a survey done by McCormick of 4 989 infants, re-hospitalization rates in the first year of life for high risk patients

was 9.1% and it increased with decreasing birth weight (16). They also found that the percentage of infants re-hospitalized increased in non-whites, infants of young mothers, infants of mothers with lower educational attainment and in infants from low-income households (16).

Sepsis

The rate of sepsis should decline if KMC is used, particularly in overcrowded units where sepsis rates are high. Only one study has examined neonatal sepsis specifically when KMC is used. Sloan (2) studied infection rates following discharge, comparing traditional care and KMC and found that the rate of infections, i.e respiratory infections and diarrhoea were much higher in the KMC group. It was postulated that this was because the KMC group used health clinics more readily.

Mortality

Only two studies using KMC have evaluated its effects on mortality. In one, relative risk of death was higher in the KMC group compared to controls, but this group was more ill to start with(1). In the second study mortality was the same in both the KMC group and controls but this occurred before babies were randomized into early discharge or control groups(2).

CHAPTER TWO

THE STUDY

OBJECTIVE

To establish the outcome of premature babies discharged earlier, i.e at a weight of 1650g, as compared to the conventional practice (1800g in summer and 1900g in winter).

STUDY DESIGN

This was a prospective, observational, case-control study.

The neonatal unit at CHBH has four levels of special care,

i.e 1) Neonatal intensive care unit (NICU),

2) High care "transitional" ICU (TICU),

3) Wards 66/67- low care areas,

4) Ward 40- area for growing low birth weight infants.

Most infants graduate from the higher levels of care to levels with less intensive monitoring. The study sample was enrolled from babies arriving in ward 40. One hundred and twenty babies weighing less than 1600g were randomly assigned to two groups: Group 1(early discharge- weight of 1650g) and Group 2 (babies weighing 1800g- the existing conventional summer discharge weight and discharged at the same weight during winter months). In this unit babies are weighed on monday and thursday, hence some study patients, without problems, were discharged at a higher weight (>1650g). Babies were randomized by a research assistant on admission to

ward 40. The primary researcher was blind to the group allocation while the babies were in the ward. Their status was only revealed when the child weighed 1650g and was potentially ready for discharge.

Babies who were randomized to Group 1, but for medical reasons were judged not to be ready for discharge, were only discharged once the doctor caring for the baby felt that the baby could be discharged. The cause of the delay was noted, e.g poor sucking of the breast, and these babies were left in the study and also followed up after discharge. Their group allocation was not altered.

It was estimated that with one hundred and twenty babies, it was possible to detect a 10% difference in weight gain at three months of age, with a power of 80% at a significance level of 5%.

INFORMED CONSENT

Written consent was obtained from the mother before randomization.

INCLUSION CRITERIA.

1) Maternal consent at the time of randomization.

2) Adequate weight gain prior to enrollment (babies following their particular growth curve).

3) No serious ongoing medical problems in the infant.

EXCLUSION CRITERIA.

1) Refusal of consent by mother.

2) Multiple pregnancy, e.g twins.

3) Unfavourable home circumstances, e.g. mother residing in an area that was not serviced by a clinic within the Soweto area.

DATA COLLECTION.

On entry into the study, babies were examined by the investigator and a study entry data sheet was completed. Demographic data were also collected. Suitability for discharge was made using the usual unit criteria by the clinician caring for the baby. These included adequate weight gain, an acceptable blood haemoglobin value, lack of serious medical problems, established oral feeding, etc. at the time of discharge.

On discharge, a patient record card (outpatient file) was issued to the mother. She was requested to present it each time she visited a clinic or a general practitioner so that problems could be noted down together with the management of that particular problem. All the Soweto clinics were notified of the study before it was commenced. The problems noted in this record card were reviewed and critically evaluated at follow-up. Where mothers were very young, the grandmother was requested to come into hospital on discharge of the baby. The grandmothers were educated about the care of the baby and the complications to look out for. All babies were given 2mg/kg/day of iron on discharge.

Follow-up examinations were made at 1 and 3 months after discharge. At these visits babies were examined and anthropometric measurements and other haematological and psychosocial evaluations were made.

OUTCOME MEASURES

Comparisons were made between the two groups of the following outcomes:

1) Weight gain - at 1 and 3 months after discharge.

2) Morbidity - the frequency of illness reported by the mother and those recorded in the health record card were noted.

3) Mortality - an intensive effort was made to trace all babies "lost" to follow-up to ensure that this vital statistic was accurately determined.

4) Breastfeeding practices at follow-up.

DATA ANALYSIS

All information was entered into a computer database and analysed using the STATISTICA 5.0 (StatSoft, USA) statistical package. Standard statistical tests were used. The Student t-test was used to compare differences in means between the two groups. A significant difference was taken as p-value less than 0.05.

STUDY TIMETABLE

Enrollment - 01.10.95 to 31.07.96 (9 months).

Follow-up - 01.11.95 to 31.10.96 (12 month period from commencement of the study).

Data entry - 01.09.96 to 31.10.96.

Data analysis- 01.11.96 to 31.05.97.

Writing - 01.06.97 to 26.03.99.

BUDGET

1. Electronic weighing scale	R 6 000,00
2. Research associate (part-time nursing sister)	
Salary of R1 500,00 per month for 10 months	R15 000,00
3. Transport money - subsidy to patients for extra visits.	
120 patients x 2 visits x R15 per visit	R 3 600,00
4. Printing and stationery costs	R 400,00
	R25 000,00

The study was funded by the Gauteng Health Department.

ETHICS

Permission to perform the study was obtained from the University of the Witwatersrand Committee for Research on Human Subjects.

FOLLOW-UP

The infants were followed up at 1 and 3 months after discharge. The mothers were verbally asked to answer a questionnaire. This questionnaire sought to establish the following:

a) The person who was primarily taking care of the baby during the day and at night.

b) Who was supporting the both mother emotionally and financially.

c) Whether there were was any regrets about having the baby.

d) Whether the family moved house since discharge.

e) Feeding practices.

At follow-up the researcher reviewed mother's history over the preceeding period, with emphasis on clinic or hospital visits and admissions. The babies were examined and a data sheet completed. Weight, skull circumference and a problem list was noted. A haemoglobin level was checked at each visit. Weighing was done by the research assistant using an electronic scale. For those who demised, parents came to inform the researcher about the death and also brought post-mortem findings where it was performed. In one patient the post-mortem was not done but a history was taken from the family. Those infants who did not turn up for follow-up were traced by the research assistant who either visited them at home or wrote the parents a letter.

CHAPTER 3

RESULTS

One hundred and twenty patients were enrolled- 62 cases and 58 controls. One hundred and three (86%) of these patients were followed up successfully. The remaining (14%) had moved to other provinces.

Table 1 below shows mother's booking status, educational achievements and marital status. More than two thirds of the mothers were single and had received a high school education. The majority were booked. There was no significant difference between the two groups.

TABLE 1. Mother's booking status, education, marital status and place of residence.

	Total n =120 (%)	Cases n = 62 (%)	Controls n = 58 (%)
Booked	88 (73)	42 (67)	46 (79)
Unbooked	32 (27)	20 (32)	12 (21)
Married	21 (18)	11 (18)	10 (17)
Single	97 (82)	50 (82)	47 (81)
Education - nil	1 (1)	1 (2)	0
primary school	32 (27)	15 (24)	17 (29)
high school	84 (70)	44 (70)	40 (69)
tertiary	2 (2)	1 (2)	1 (2)

Ninety two families lived in brick houses, 26 in shacks and 2 in flats, with no significant difference between the two groups. Table 2 below, shows mean number of rooms in these residences, the number of occupants and the

distance from the nearest clinic. It also shows the number of children in each household with the mean age of the youngest child.

TABLE 2. Household- rooms, occupants and distance from the clinic.

	cases (mean)	controls (mean)	p-value
Rooms (no.)	3.6	3.3	0.42
Occupants (no.)	5.2	4.9	0.48
Distance from clinic (km.)	2.7	2.6	0.27
Children (no.)	2	1.8	0.45
Age of youngest sibling (years)	5.3	5.8	0.58

BABY'S DEMOGRAPHICS

Two thirds of the babies were appropriate for gestational age. Less than a quarter of the babies were ventilated. Some of the babies were born either at home or before arrival to hospital. There was no significant difference between the two groups. See Table 3.

TABLE 3. Gestational age, need for ventilation and mode of delivery of infants.

	Total n=120 (%)	Cases (n=62) (%)	Controls (n=58) (%)
Ventilated	26 (22)	16 (26)	10 (17)
Gestational age:			
a) AGA	79 (66)	38 (61)	41 (71)
b) SGA	41 (34)	24 (39)	17 (29)
c) LGA	0	0	0
Delivery:			
a) Normal vaginal delivery	60 (50)	30 (48)	30 (52)
b) Caesarian section	36 (30)	21 (34)	15 (26)
c) Breech	6 (5)	2 (3)	4 (7)
d) Born before arrival at CHBH	18 (15)	9 (15)	9 (16)

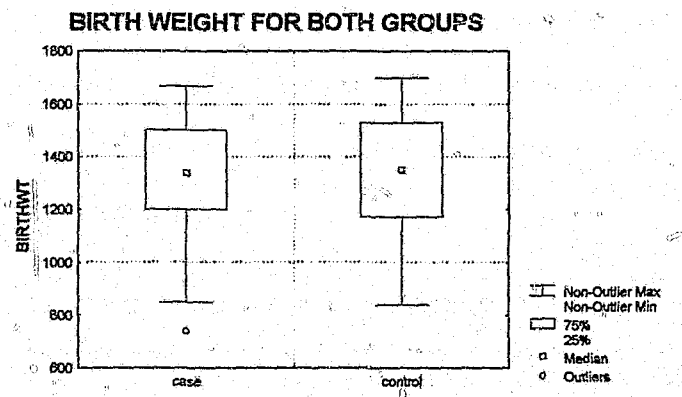
DEMOGRAPHICS ON ENTRY

There was no difference between the two groups comparing birth weight, gestational age, maternal age and family income. The difference in parity was significant. See Table 4 and Figure 1.

TABLE 4. Birth-weight, gestational age family income, maternal age and parity on entry.

	Cases(n=62) mean(± sd)	Controls(n=58) mean(± sd)	p - value
Birth weight (grams)	1333 (± 200)	1324 (± 229)	0.82
Gestational age (weeks)	31.2 (± 1.7)	31.2 (± 2.2)	0.92
Maternal age (years)	26.8 (± 7.0)	26.4 (± 5.9)	0.75
Parity (no)	1.52 (± 1.5)	0.95 (± 0.9)	**0.01**
Family income (rands)	17812	15413	0.61

Figure 1. Weight at birth.



DISCHARGE DATA

Pre-discharge weight gain was better in the control group. There was no difference between the chronological ages of the two groups on discharge. The early discharge group was discharged five days earlier than the control group, on average.

TABLE 5. Weight, gestational age and duration of hospital stay at discharge as well as pre-discharge weight gain.

	Cases (n=62) mean (± sd)	Control (n=58) mean (± sd)	p-value
Weight (grams)	1704(± 72)	1846(± 67)	**< 0.001**
Gestational age (weeks)	35.9(± 1.7)	36.8(± 2.5)	0.06
Duration of stay (days)	33.9(± 12.8)	38.8(± 16.8)	0.08
Pre-discharge weight gain (grams / day)	10.5(± 4.3)	14.2(± 6.5)	**< 0.001**

WEIGHT GAIN AT FOLLOW-UP.

One hundred and three (86%) babies were followed up. Table 6 shows weight at follow-up (first and second) as well as the mean number of days from discharge to attending follow-up. At first the follow-up visit, the control group showed better growth than the early discharge group. Table 6, Figures 2 and 3 show those results.

TABLE 6. Weights at follow-up and days taken to come to these follow-ups.

	cases (n=62) *mean (±sd)*	**controls (n=58) *mean (±sd)***	**p-value**
Days taken to first follow-up (days)	34 (±18.5)	39.7 (±36)	0.31
Weight at first follow-up (grams)	2636 (±530)	3082 (±1068)	**< 0.01**
Days taken to second follow-up (days)	88 (±20)	93 (±29)	0.36
Weight at second follow-up (grams)	4368 (±744)	4915 (±812)	**< 0.01**

Figure 2 shows weight gain per day to first follow-up. The difference between the two groups was significant.

Figure 2.

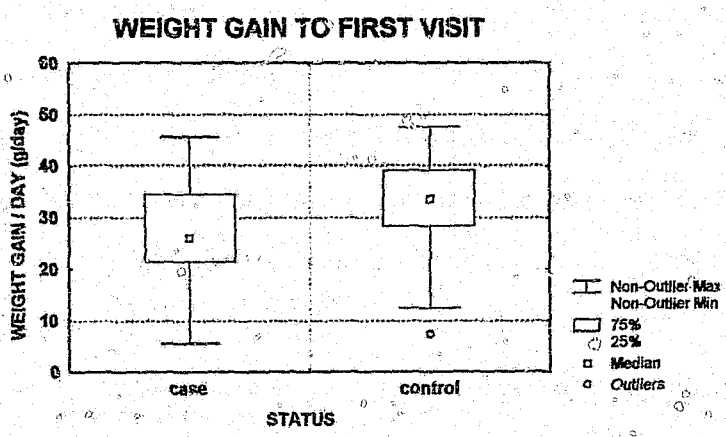
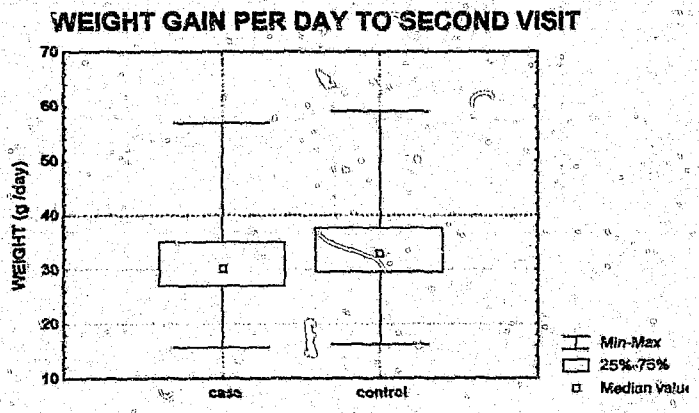


Figure 3 shows weight gain to second follow-up. The difference between the two groups was still significant but less so.

Figure 3.



ADJUSTMENT FOR AGE AT FOLLOW-UP VISITS

Some babies came at [illegible] months of age, more so in the controls. This was outside the age defined follow-up. The weights of these babies affected weight gain in controls giving an exaggerated better result. Other babies came much earlier than their scheduled follow-up date. For these reasons babies that came 3 weeks before and more than 3 weeks after their scheduled follow-up date were excluded from the next analysis for weight gain. Seventy nine (66%) patients were therefore analysed. Table 7, figures 3 and 4 show these results.

TABLE 7. Mean weight at follow-up of infants who attended follow-up at scheduled times.

	cases (n= 43) mean (±sd)	controls (n=36) mean (±sd)	p-value
Weight at first follow-up (grams)	2533 (±371)	2888 (±323)	**< 0.01**
Weight gain per day at 1 month (g / day)	26.6 (±9.8)	32.7 (±8.8)	**< 0.01**
Weight at second follow-up (grams)	4376 (±700)	4867 (±716)	**0.02**
Weight gain per day at 3 months (g /day)	30 (±5.5)	33 (±6.5)	0.2

Figure 4 shows weight at first follow-up.

Figure 4.

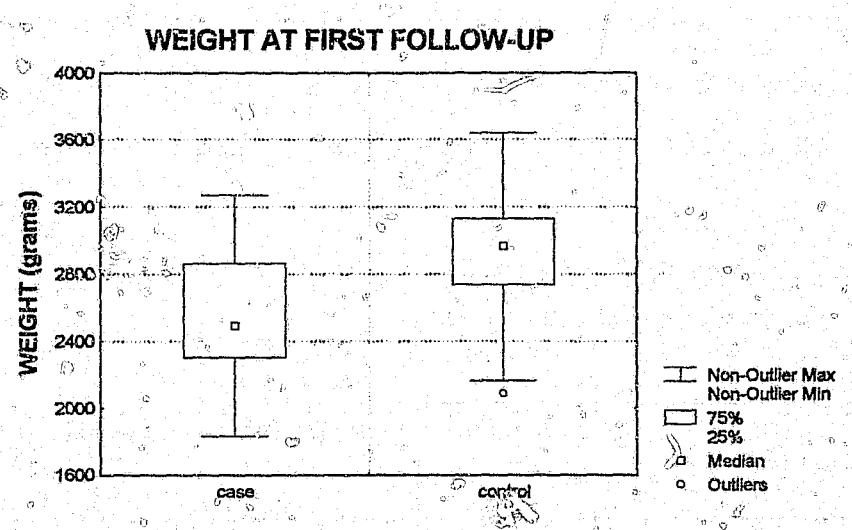
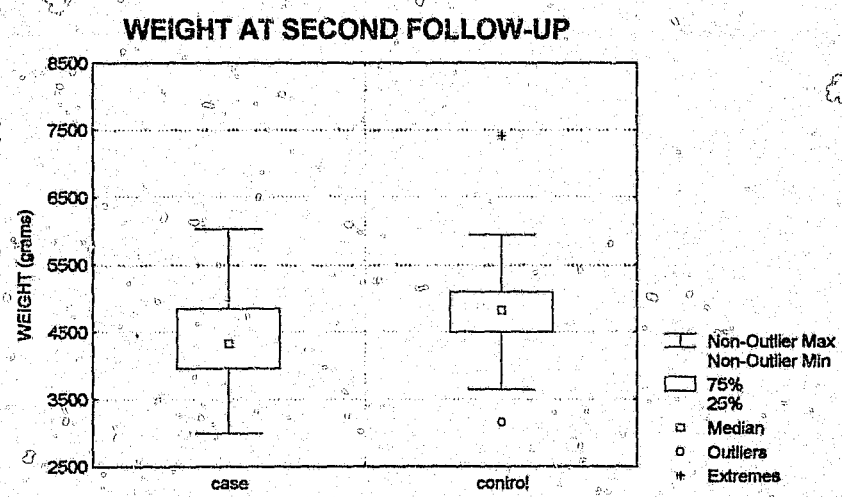


Figure 5 shows weight at second follow-up.

Figure 5.



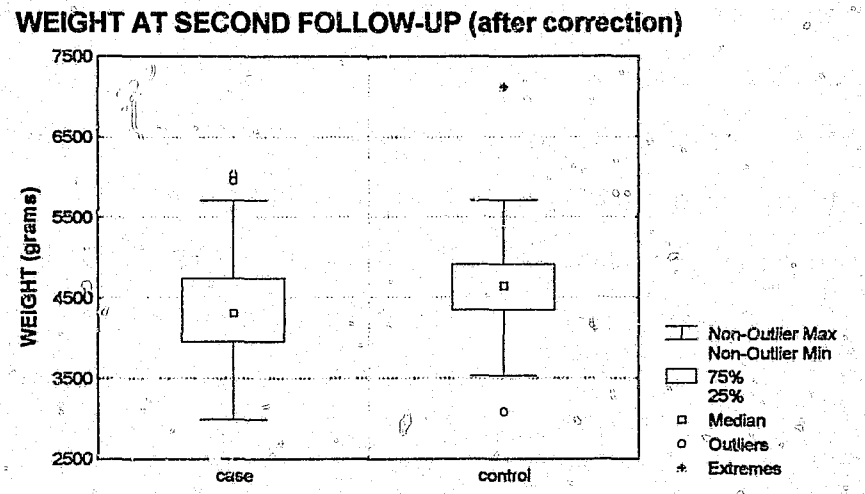
CORRECTION FOR EARLIER DISCHARGE

The early discharge group were discharged a week earlier than the control group, but at follow-up this was not corrected for, as they were followed up simultaneously, without considering a week's difference. The difference was still statistically significant, despite the correction. Table 8 and figure 6 shows these results.

Table 8. Weight at follow-up after adjusting for a week's difference.

	cases (n=43) mean (±sd)	controls (n=36) mean (±sd)	p-value
Pre-discharge weight gain (g / day)	10.4 (4.4)	14.2 (6.7)	**< 0.01**
Weight at first follow-up (grams)	2538 (±371)	2750 (±296)	**<0.01**
Weight at second follow-up	4360 (±701)	4701 (±676)	**0.03**

Figure 6. Weight at second follow-up after adjusting for a week's difference.



HEAD GROWTH

Table 9 shows head circumference at birth and both follow-up visits.

Table 9. Head circumference at birth, first and second visits.

	Cases head circumference (±sd)	Controls head circumference (±sd)	p-value
Birth (cm)	30(± 0.9)	30 (±0.9)	0.7
First visit (cm)	34.8 (±1.2)	35.7 (±1.7)	< 0.01*
Second visit(cm)	38.9 (±1.4)	39.5 (±1.7)	0.1

FEEDING PRACTICES

Figures 7 and 8 below demonstrate that the total number of solely breastfed infants did not change at first and second follow-up. The number of babies that were both breastfed and given formula decreased by 20%. As expected, more infants were fed solids at second follow-up. Solids given included cereals and vegetables in addition to milk. There was no difference between the two groups for solids and milk feeds. See figures 7 and 8.

Figure 7

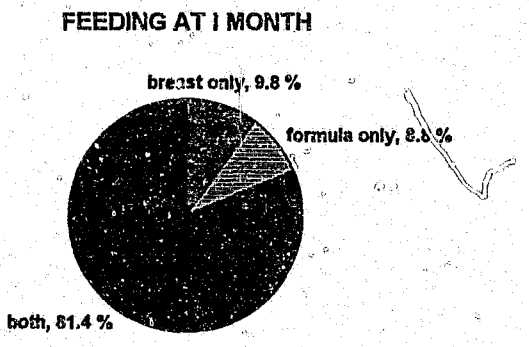
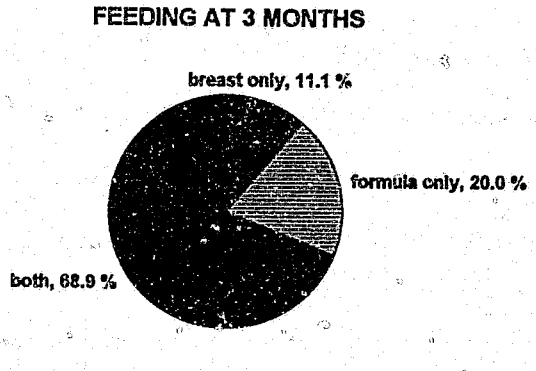


Figure 8


FEEDING AT 3 MONTHS
breast only, 11.1 %
formula only, 20.0 %
both, 68.9 %

ANAEMIA

Haemoglobins levels were monitored after discharge at the first and second follow-up visits, to establish if weight or morbidity were influenced by the Hb level. Table 10 shows mean Hb and ranges for all the patients. The lowest Hb of 6.7g/dl was recorded in a child who was thriving.

TABLE 10. Haemoglobin at discharge and follow-up for all babies.

	Mean	Range
Discharge Hb	11.2	7.2 - 18
First follow-up Hb	9.1	6.7 - 16.8
Second follow-up Hb	10.5	7.8 - 12.7

Table 11 demonstrate levels of Hb comparing the two groups. There was a significant difference of Hb level at the second follow-up visit.

TABLE 11. Mean Hb for the two groups, on discharge and follow-up.

	cases (n=62) mean (±sd)	controls (n=58) mean (±sd)	p-value
haemoglobin on discharge (g/dl)	11.5 (±2.6)	11.1 (±2.9)	0.42
Haemoglobin at first follow-up (g/dl)	9.2 (±1.3)	9.0 (±1.5)	0.57
Haemoglobin at second follow-up (g/dl)	10.2 (±1.2)	10.8 (±1)	0.03

MORBIDITY AND MORTALITY

Morbidity was due to gastroenteritis, bronchiolitis and upper respiratory tract infections. More than 90% of these patients were seen at the Soweto clinics. See Table 12.

TABLE 12. Morbidity related to outpatient visits.

Illness	Total	Cases	Controls
URTI	32	19	13
Gastroenteritis	1	1	0
Bronchiolitis	4	2	2
Otitis media	1	1	0
Blocked nose	2	1	1

Table 13 shows number of hospital admissions, outpatients visits and deaths comparing the two groups.

TABLE 13. Outpatients visits, hospital admissions and death.

	cases(n=62)	controls(n=58) mean(± sd)	p-value
Outpatients visits (no.)	24	16	0.3
Hospital admissions (no.)	12	3	0.1
Deaths	1	3	0.27

RE-ADMISSIONS.

Ten patients were admitted before the first follow-up visit, 7 of these being from the early discharge group. Only four patients were admitted after the first follow-up. One patient was admitted twice with HIV related problems. Tables 14 and 15 show length of stay in hospital, diagnoses and age on admission for the early discharge group and controls respectively. The commonest indication for admission was bronchopneumonia.

TABLE 14. Reasons for admission, approximate age on admission and length of stay in the early discharge group.

Age on admission (months)	Diagnosis	Length of hospital stay (days)
Two	bronchopneumonia-IPPV, Staph Aureus septicaemia	7-14
One and a half	stricture post NEC	7-14
Two and a half	gastroenteritis	< 7
Two and four and a half	gastroenteritis, HIV, bronchopneumonia	7-14, both times
One and a half	bronchopneumonia	7-14
Two	bronchopneumonia	< 7
Two	HIV, septicaemia and gastroenteritis	7-14, both times
Three	bronchopneumonia	< 7
Three and a half	bronchopneumonia and gastroenteritis	7-14
Four	bronchopneumonia	< 7

TABLE 15. Reasons for admission, approximate age on admission and length of stay in controls.

Age on admission (months)	Diagnosis	Approximate length of stay (days)
Four	inguinal hernia repair	<7
Two	viral pneumonia	< 7
Two and a half	bronchopneumonia, IPPV for 1 day	< 7

Four babies (3.8%) died from bronchopneumonia. Post-mortems were done on three patients and the diagnosis of bronchopneumonia was confirmed in all. The parents of the fourth infant were questioned about the condition of the child before death. The history was also suggestive of a bronchopneumonia. The first and the second patients as shown in table 16, died 4 and 3 days after discharge respectively. The third patient died 3 months after discharge and the last one, about 2 months after discharge. None of the deaths occurred in the winter months. None of the patients were admitted to hospital prior to their death, 3 were home deaths one infant died on its way to hospital.

TABLE 16. Causes of death, age at death and discharge haemoglobin.

Case or control	Diagnosis	Discharge weight (g)	Age at death (days)	Discharge Hb (g/l)
Case	broncho-pneumonia	1688	25	11.3
Control	broncho-pneumonia	1801	36	10
Control	broncho-pneumonia	1866	134	9
Control	broncho-pneumonia	1940	±120	13.7

CHAPTER 4

DISCUSSION

The study sought to address several issues. No research has been undertaken examining the effects of discharging babies earlier, at a weight of 1650g or less without using KMC. Many First World countries are currently using a cut-off weight of at least 2000g with close follow-up in the form of home visits (17). In South Africa it is difficult to justify keeping LBW babies till they reach a weight of 2000g because of financial constraints, overcrowding and a high incidence of nosocomial sepsis. We also wanted to evaluate how mothers would cope with their small babies at home without extended support from the health system.

In the unit where this study was done mothers of premature babies stay in hospital for the entire period that the child is admitted. Mothers often leave other siblings at home with family. This disrupts the family structure and dynamics which may create problems. Discharging babies 5-10 days earlier could be very valuable to these mothers and their families. Early discharge would combat overcrowding at the hospital with its complications and would also ease the fiscal burden on the public health sector.

Our study differs from published studies in that:

a) KMC was not used even though the early discharge group of babies weighed less than 1700g.

b) The nature of follow-up was less intensive than other studies.

c) The discharge weight for both controls and cases was much lower than previous studies.

Limitations

a) The findings in this study cannot be generalized to centres without adequate primary health care services or hospitals as in some rural areas. We relied on the ability of clinics and private practitioners to care for these babies in between follow-up visits.

b) Morbidity data was dependent on diagnoses made by these practitioners which could be wrong or exaggerated.

c) Gestational age data may be inaccurate because the Ballard score was done mainly by [illegible] or doctors at birth.

d) A post-mortem was not done in one patient. The diagnosis was made from the history given by parents.

Safety

Early discharge has been shown to be safe in several studies using KMC (1,2,10-12). It was also found to be safe in studies where KMC was not used (3, 7- 9,16), but home visits were done in most of these studies. In studies where KMC was not used, babies were discharged at a higher weight (> 2000g). Singer et al (9) in Zimbabwe discharged babies at a weight less than 2000g, the lowest weight at which an infant was discharged was 1800g. They concluded that it was safe to discharge babies at a weight of 1900 g. In our study both the early discharge and the controls did well, although there were more deaths in the control group which was not statistically significant.

We conclude that early discharge is safe even where KMC is not used particularly where clinics and hospitals are accessible. Death and re-admissions rates in this study were comparable to studies where KMC was used. Nevertheless, the benefits of KMC are impressive. The issue of whether only certain infants are eligible for early discharge must be considered when discharging babies early.

We believe that prior to discharge the infant must be able to suck, maintain its temperature and breathe without additional support, e.g an incubator and respiratory centre stimulants (theophylline).

Discharge weights did not vary between winter and summer in this study and none of the patients presented with hypothermia. Mothers in this study tended to carry babies on their backs, covered with blankets, during the day and sleep with their infants at night. This probably protects these infants from any cold spells.

Advantages of early discharge.

a) Financial savings

Discharging early reduces the costs to health care and also reduces the work load to health workers. Babies in the early discharge group left 5 days earlier with an estimated saving to the hospital of R528 per patient. This was calculated using Malan's (18)calculations made in Cape Town in 1992- this included the cost of personnel, consumable supplies, equipment and building. This would amount to a total saving of R32736 for the whole study group(17).

The cost incurred in keeping the mothers in hospital is not included - i.e cost of a hospital bed, three meals a day, water, electricity and payment of personnel used to support these mothers (social workers, nurses, etc).

b) Psychological

Early discharge improves mothers' confidence in handling their low birth-weight babies. Mothers in the study were happy with the idea of leaving hospital earlier than usual. Half of the mothers in the control group were unhappy about staying longer in hospital before discharge, i.e staying generally 5 days longer than the early discharge group.

There was a significant difference between the two groups in the parity of the mothers, favouring the early discharge group. This may imply that the early discharge group mothers were more experienced and therefore better able to cope with taking their baby home early.

Disadvantages.

The benefit of discharging early might be lost if the LBW babies are re-admitted with diseases that could have been prevented by later discharge. In this study more babies in the early discharge group were re-hospitalised as compared to controls but this was not significant. However, the diseases these babies presented with were not predictable or preventable.

Weight gain.

At first follow-up the controls were better grown as compared to the early discharge group (early discharge group gaining 26.6g/day compared to

32.7g/day in controls, p<0.01). Weight gain at the second visit was better, (30g/day in the early discharge vs 33g/day in the controls p = 0.05). This weight gain was better to the one observed in Charpak's study which was 20g/day (1). Weight gain in our group seem to be better than in studies where KMC was used (1, 2, 12). This is probably due to the use of formula as a supplementary feed.

Hospital weight gain and weight gain at first follow-up were probably better in the controls because the early discharge group was more sick as evidenced by the numbers ventilated, outpatient visits and hospital admissions. The way hospital weight gain was calculated could also explain the difference in weight gain. Birth weight was subtracted from discharge weight and divide by hospital days. It would have been a true reflection if birth weight was subtracted from the discharge weight, then divided by the number of days from when the infant regained the birth weight. The days from when both groups regained the birth weight were not recorded.

Long-term growth and development.

Head size at 8 months corrected age has been shown to be predictive of cognitive function, academic achievement and behaviour at 8 years of age (21). The early discharge group had a smaller mean head size initially but caught up at second follow-up which was at 7 weeks corrected age. This implies that this group could do as well as the controls. Strauss et al (22) showed that intrauterine growth retardation had little impact on long-term mental and motor development except when associated with large deficits in

head circumference. The early discharge group still has a lot of time to catch up as this occurs in the first year of life as shown by Hack et al (21).

Should we be using weight or gestational age when discharging babies early?

We recommend that weight and clinical judgement be used rather than gestational age, as it is easier to implement consistently. Most of the babies in this study were plotted as appropriate for gestational but this could be inaccurate as Ballard scores were done by junior staff. The Ballard scores were also done immediately after birth which might also result in inaccurate findings. If it was not for these shortcomings, gestational age may be a better parameter to use.

Feeding practice.

Breastfeeding rates were poor in both groups. This study was done before a breastfeeding campaign was started in the wards and babies were fed both formula and breast till discharge. The majority of mothers (80%) in the study were giving both formula and breast at discharge. This practise was continued after discharge. Not surprisingly at the 1 month follow-up 80% of the mothers were still giving both and only 60% at the last follow-up carried on with the practice.

Anaemia.

The majority of babies were not anaemic. Hb levels at 2-4 months were more than 7g/dl which was comparable to other studies (19, 20). Anaemia was not

a problem mainly because iron was given on discharge. Only one child had a Hb below 7g/dl, a level regarded by some experts (19, 20) as an indication for transfusion. This infant was thriving despite this. Hb level in patients who were re-admitted only one patient was transfused (Hb of 7.5 g/dl) because the child required ventilation.

Predictors of outcome at discharge.

There were no predictors of morbidity or mortality outcome. Babies who required acute care outpatients visits or hospital admissions often had a stormier course at birth but this was not significant. Babies who were known to be HIV positive tended to have more recurrent outpatients visits or admissions. The early discharge group had more admissions but this was not statistically significant.

Deaths could also not be predicted. Only one child among those that died was ventilated. The other three were not particularly ill in hospital before discharge.

Re-admissions and deaths - were they preventable?

All the re-admissions were not preventable because these babies were admitted more than three weeks to a month after discharge. Keeping these babies for 5 days more would not have made a difference.

Only one death was probably preventable. The baby was taken to a hospital a few hours before death but was diagnosed as having an URTI by the attending doctor and sent home.

The role of KMC in our setting.

The use of KMC in this group of patients would have improved our breastfeeding rates. Breastfeeding was poorly practised in our group because mothers continued with what was practised in hospital (breastfeeding and formula as opposed to breastfeeding only in KMC). Although weight gain using KMC may be better, none of the studies showed an overwhelming success (1,2). It is questionable if the application in our group of patients would have an important difference.

CHAPTER 5

CONCLUSION

This study has established the safety of earlier discharge of LBW babies. Infants weighing 1650g at discharge achieved post-discharge weight gains comparable to those of babies who were allowed home only at a weight of 1800g. There were similar rates of post-discharge illnesses, clinic or outpatient visits and hospitalization in the two groups. Mortality rates were also comparable. Considering the benefits to the health service and the individual infant and its family, we would recommend the application of this discharge weight criteria (1650g) to all South African settings with similar characteristics to our study site.

CHAPTER 6

RECOMMENDATIONS

1. Discharge LBW babies once they have attained a weight of 1650mg if the following conditions are fulfilled; maintaining temperature in a crib and feeding well from bottle or breast.

2. Encourage mothers to handle their babies earlier. If the VLBW baby does not require oxygen or photo-therapy, encourage the use of KMC in these babies.

Role of clinics.

In future we should send infants to their local clinics after early discharge. These babies could be seen every 2 weeks for the first month and monthly for the next 3 months. They should then be followed up like all babies in a well baby clinic.

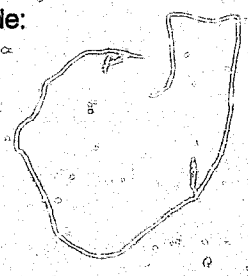
Specific tasks at the clinic for the VLBW will include:

a) weighing and plotting

b) feeding advice

c) immunization

d) emotional support



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APPENDIX

QUESTIONNAIRE

(1 and 3 month visit)

Who is mainly looking after the child?
During the day:
At night:

Who is supporting you?
Financially
Emotionally

Any regrets about having had this child?

Are you still living in the same house?

Number of occupants:

Number of children:

Would you have liked your child to have stayed longer in hospital at birth?

Feeding history from birth:

Type of feed presently:

Breast:how many times/day?

Formula:-name:
How many times/day?
mixing(correct/dilute/concentrated):
Volume:

Solids(y/n)
If yes,why?

Contraception(Y/N):

PROBLEMS(open-ended):

Author Mokhachane M
Name of thesis Can Newborn Baby Infants Safely Be Discharged At Lower Weights From Hospital Care? Mokhachane M 1999

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