Measures of Malnutrition in England

by

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A thesis submitted for the degree

of

Doctor of Philosophy

March 1998

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Abstract

Obesity is a focus of public health, however, undernutrition should be regarded as a focus of public health. This study was initiated to assess the usefulness of routinely collected data to assess the extent of malnutrition in the 0 - 4 year old population, so that appropriate nutritional advice and health care be given to parents and carers.

Children were identified retrospectively by one of two methods: (1) a review of medical records assigned The International Classification of Diseases (ICD) for disease codes; protein-energy malnutrition (PEM), obesity and non-disease codes inferring the likelihood of malnutrition, and (2) a review of a State Registered Dietician’s medical records from a paediatric out-patient clinic inferring the likelihood of undernutrition. Children with a diagnosis of prematurity were excluded.

The ICD disease codes for protein-energy malnutrition and obesity revealed that coding for these conditions is rare. Hospital treatment of obesity for young children was uncommon. However, undernutrition was identified in the non-disease ICD codes. Malnutrition was found in 50% of paediatric hospital admissions. More undernutrition was found in children ≤ 0.25 year age range. A woman’s prepregnancy weight (BMI < 20) or poor nutrition during pregnancy could contribute to the malnutrition in young infants. Malnutrition was more common in children ≥ 1 year of age, as seen, in a paediatric out-patient clinic.

The study highlighted that malnutrition is not being recognised nor acknowledged in young children. Malnutrition can have long-term consequences to growth and development. Public health needs to focus on malnutrition as a health problem in the 0 - 4 year old population rather than obesity.
Acknowledgements

Firstly, I would like to thank Dr. Jacqueline Stordy for her supervision, encouragement and patience throughout the duration of this study and preparation of this thesis.

I am indebted to the Medical Record Department who assembled and handled all the medical records required to complete the study.

My thanks go to Dr. John Cornell from the University of Florida, Department of Agriculture, Gainesville, Florida, for his invaluable guidance on statistics. I also thank Tricia Langley for her time and patience in proof reading this thesis.

Finally, I would like to thank my friends, Bonita Miller and Sandi Phillippi, for all their continued support and encouragement. Most of all, I thank my Mom for all her love, support and encouragement throughout the duration of this thesis. I also thank my Dad for teaching me how to meet the challenges of my dreams to their completion.
Glossary of Terms and Abbreviations

BMI Body mass index
CHD Coronary heart disease
CSO Central Statistical Office
DoH Department of Health
FTT Failure to thrive
HES Hospital Episode Statistics
HIPE Hospital In-patient Enquiry
HMSO Her Majesty Stationery Office
ICD International Classification of Diseases
ICD9 version of ICD coding
ICD10 version of ICD coding
in-patient defined as a person who has gone through full hospital admission procedure and who have subsequently been discharged or have died in hospital
MAFF Ministry of Agriculture, Fisheries and Food
medical coder individual responsible for ICD assignment
MHE Mental Health Enquiry
MR Medical Record
NDNS National Diet and Nutrition Survey
NOS not originally stated
NSPCC National Society for the Protection of Cruelty to Children
ONS Office for National Statistics
OPCS Office of Population Censuses and Survey
<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>out-patient</td>
<td>defined as a person attending an out-patient department for treatment or advice</td>
</tr>
<tr>
<td>PAS</td>
<td>Patient Administration System</td>
</tr>
<tr>
<td>PEM</td>
<td>Protein-energy malnutrition</td>
</tr>
<tr>
<td>PID</td>
<td>Patient Information Data</td>
</tr>
<tr>
<td>pop.</td>
<td>population</td>
</tr>
<tr>
<td>RHA</td>
<td>Regional Health Authority</td>
</tr>
<tr>
<td>SD</td>
<td>Standard deviation</td>
</tr>
<tr>
<td>SPSS</td>
<td>Statistical Package of the Social Sciences</td>
</tr>
<tr>
<td>SRD</td>
<td>State Registered Dietician</td>
</tr>
<tr>
<td>UK</td>
<td>United Kingdom</td>
</tr>
<tr>
<td>WIC</td>
<td>Women Infant and Children Supplemental Food Program</td>
</tr>
<tr>
<td>WHO</td>
<td>World Health Organisation</td>
</tr>
<tr>
<td>Y</td>
<td>years</td>
</tr>
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</table>
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Publications
Infancy is a period of rapid growth requiring adequate calories, protein and essential nutrients. Nutrient requirements are higher for the infant than for the adult.

Undernutrition can have a negative impact on a child’s growth and development. Undernutrition is characterised by delays in growth, which can be accompanied by illness, cognitive delay, decreased activity, behavioural and social problems. If undernutrition is not recognised, children will suffer the consequences of poor growth.
Chapter One
Introduction

Obesity in the United Kingdom (UK) is increasing in adults (Davies, 1997; Glenny et al., 1997). It increases the risk of coronary heart disease (CHD) and stroke, through its association with an increased prevalence of hypertension and a raised plasma cholesterol level (DoH, 1992c), and can also lead to social disabilities and unhappiness which can cause stress. It is accepted that obesity is a hazard to health. Davies (1997) states that obesity is now prevalent enough to be considered as one of the most important public health and medical problems of recent years.

The Health of the Nation (1992c) addressed health issues affecting the health of the UK population. The UK Government identified areas of health to target reforms. The key policy objectives of the government were:

1. to assess the state of health of the people
2. to obtain the services to take effective action to maintain good health
3. to ensure the quality and effectiveness of the services

The UK Government has recognised obesity as a significant risk factor to disease, including CHD and stroke. In 1987, 12% of women and 8% of men were obese between 16-64Y of age (DoH, 1992c). The target set for obesity by The Health of the Nation (DoH, 1992c) was:

To reduce the percentage of men and women aged 16 - 64Y who are obese by at least 25% for men and at least 33% for women by 2005 to no more than 6% and 8%, respectively.
Obesity in adults has been defined as a body mass index (BMI) > 30 (weight in kilograms divided by height squared in metres) and overweight defined as a BMI > 25 - 30 (Davies, 1997; Glenny et al, 1997; DoH, 1997). Glenny et al (1997) states that in England, men and women with a BMI > 25 is increasing. Between 1991 and 1994, the prevalence of obesity in men rose from 39% to 43% and for women from 26% to 29%. The most recent publication of The Health of the Nation (1997) indicates that the prevalence of obesity has continued to increase since 1993. The report summarised that among the 16-64Y age range, 15% of men and 16.5% of women were obese (BMI > 30) in 1995. The prevalence of obesity in the adult population is increasing with age. Table 1 shows of the DoH (1997) population surveyed (8720), the percentage increase in BMI for age and gender. Overall, about 59% of men and 50% of women were overweight (BMI >25). However, more women are obese (BMI >30) than men; 17.5% and 15.3%, respectively (DoH, 1997). Similar trends in adult obesity are reported in North America (Whitaker et al, 1997; Flegal, 1996; Rippe, 1996).

<table>
<thead>
<tr>
<th>Table 1</th>
<th>BMI for Men/Women, England, by Age</th>
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<tr>
<td></td>
<td>16 - 24</td>
</tr>
<tr>
<td>BMI</td>
<td>M</td>
</tr>
<tr>
<td>≤ 20</td>
<td>16.2</td>
</tr>
<tr>
<td>20-25</td>
<td>54.0</td>
</tr>
<tr>
<td>25-30</td>
<td>24.1</td>
</tr>
<tr>
<td>&gt; 30</td>
<td>5.8</td>
</tr>
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</table>

Obesity is the focus of public health advice in relation to nutrition but careful examination of the DoH (1997) data indicates more undernutrition among women in the 16-34Y age range. Between this age range of 16-34Y, 12% (337) of the population (2790) have a BMI ≤ 20: 17.2%, 16-24Y (1046); and 9.0%, 25-34Y (1744), respectively. Within the 16-34Y age range, only 314 women have a BMI > 30; 83, 16-24Y and 231, 24-34Y, respectively. Obesity is a health concern, however, this age range covers the childbearing years where a low BMI can indicate a compromised nutritional status in the mother. Low BMI can have a negative impact on foetal development and infant birthweight. Undernutrition in the 16-34Y age range is more of a health concern than obesity. Thinness in the childbearing years should be a focus of public health but was not recognised in the Health of the Nation.

Studies (Glenny et al, 1997; Power et al, 1997; Robinson, 1993; Stordy, 1988) define obesity as an excess in body fat which can lead to adverse health outcomes. In defining obesity, a suitable measure and a suitable cut-off is required. In adults, BMI has been used to assess the body fatness of the individual and the cut-offs are based on mortality risk associated with the increased BMI (Power et al, 1997). Other types of measurements, such as skinfold measurements or waist-hip ratio, can be used, but BMI is widely accepted as a measure of assessing body fatness. Robinson (1993) states that BMI in adults is significantly associated with morbidity and mortality.

Obesity is not just an adult problem. Childhood obesity can increase the risk of obesity in adulthood and has possible long-term associations with adult diseases, such as, CHD or diabetes or stroke (Power et al, 1997). Obesity can also have emotional effects on children lasting into adulthood (DoH, 1997). The psychological and social consequences, such as, being teased, bullied or even ostracised, can seriously affect a child (Taitz, 1983). Taitz (1983) suggests that a child does not want to be fat, but it is difficult for children to lose weight and frustrating for the parents and physicians.
In childhood, obesity is often determined by plotting the child's weight on a standard reference growth chart. The child's placement on the growth chart is a relative measure in relationship to the population. If the child is 1 or 2 standard deviations (SD) above what is regarded as normal body fatness, then the child is considered obese. Weight by itself is a poor indicator of fatness or obesity. Weight alone does not relate the risk of body fat to a health risk.

Figs. 1 and 2 show the centiles of BMI (boys and girls 1990) for British children covering childhood from birth to 23 years based on nationally representative data. An individual BMI serves as an anthropometric measurement. This single measurement can be used to identify children unusually fat. During childhood, changes in body fat occur because of normal physiological development. Body fat increases during infancy more than height, falling off during the pre-school period and rising again in adolescence through adulthood. Power et al (1997) states that if cut-offs are required, it should be based on a specified age and gender related BMI reference centile. Using the centiles for BMI, health risks could be associated with values of the 91st and the 97th centiles on the British BMI reference charts (Power et al, 1997; Cole et al, 1995). The role of BMI centiles in clinical practice has not yet been determined because they have not been readily available (Cole et al, 1995; Hall, 1995). However, BMI charts could more accurately monitor childhood obesity. Robinson (1993) discusses that 'over diagnosing' obesity in childhood can have psychological effects. He states that the obsession with weight can lead to children restricting their energy intakes resulting in undernutrition. These charts can also show the changes in size and shape of the UK child population. The National Diet and Nutrition Survey ((NDNS) DoH, 1995b) summarised that there were variations between BMI and regions of England and social class. The Northern region of England had a BMI above the average (16.8) for boys.
Girls from homes, in which the occupation of the head of household was non-manual or those with mothers with no formal qualifications, had a lower than average BMI.

Fig. 1 Centiles for BMI in British Boys

(Data from Cole, TJ, Freeman, JV, Preece, MA, Body mass index reference curve for the United Kingdom, 1990. Archives of Disease in Childhood, 73, 25-29, 1995.)
Fig. 2 Centiles for BMI in British Girls

(Data from Cole, TJ, Freeman, JV, Preece, MA, Body mass index reference curve for the United Kingdom, 1990. Archives of Disease in Childhood, 73, 25-29, 1995.)
If used in the same way as BMI for adults, the centiles for BMI could be used to identify children who are thin or obese based on a single measurement. However, the clinical consequences of centile BMI values in childhood are not yet known. Robinson (1993) suggests that in childhood a cut-off for obesity at the 95th centile is acceptable in the clinical setting. He suggests that the 85th centile should define overweight and the 95th centile define obesity. However, using centiles to assess health risk is innately unsatisfactory. Centiles are a statistical definition of obesity. What is needed is an ‘operational’ definition of obesity (Stordy, 1988) where it is known that a certain body fatness (BMI) is associated with ill-health either at present or in the future. For adults, BMI > 30 is known to be associated with increased ill-health. There is no equivalent cut-off for childhood obesity. If one chooses to use percentiles alone as a measure of satisfactory or unsatisfactory body fatness, any population by definition will always have some obese and some malnourished. It is essential that we move to an absolute or operational definition of obesity and malnutrition.

I have located 4 definitions of childhood obesity:

1. weight-for-height greater than 120%, controlled for age and sex on a standard reference growth chart (Suskind et al, 1993; Rolfes et al, 1990; Dietz, 1983)
2. triceps skinfold thickness in excess of the 85th percentile (Dietz, 1983)
3. an excess adipose tissue, considered to be undesirable, or reaching levels above those set arbitrarily, and based on a suitable anthropometric measurement (Robinson, 1993)
4. centile for BMI value 85th centile for overweight and centile for BMI value 95th centile for obesity (Robinson, 1993)
These definitions are a statistical definition of obesity. They are not an operational definition of obesity associated with ill-health. The best means to diagnose obesity is by visual assessment (Robinson, 1993; Dietz, 1983). There is a high likelihood that the children who look fat will be classified as obese by other criterion. Studies (Power et al, 1997; Cole et al, 1995; Robinson, 1993; Taitz, 1983) have shown that in the assessment of obesity in children, criteria such as weight-for-height or skinfold thickness, can be an assessment tool. Thomas (1994) recommends that the overweight child should be given an opportunity to grow into their weight. Factors contributing to childhood obesity are: hormonal causes (rare); hereditary tendency; feeding habits in infancy; emotional factors; and lack of exercise (Thomas, 1994; McLaren et al, 1991; Agras et al, 1990; Baranowski et al, 1990).

As the prevalence of obesity is a health focus, undernutrition should also be regarded as a health focus. Under diagnosing children who are undernourished is a missed opportunity to provide nutrition intervention. Studies (Power et al, 1997; Cole et al, 1995; Robinson, 1993) discuss that the application of adult guidelines to younger individuals may not be appropriate. Looking at Figs. 1 and 2, and using the age range of birth to four years of age and drawing a straight line across from BMI value 20, the majority of the children in this age range are located below this centile for BMI. It is clearly common for children in this age range to be slender. However, it can not be ignored that some children may be experiencing undernutrition.

Dietary practices appropriate for adults do not always meet the needs of the growing child (Stordy, 1995). Parental misconceptions may limit the child's nutrition by placing them on diets because of certain health practices and beliefs recommended for adults (Skinner et al, 1997; Glinnsman et al, 1996). Low fat and low cholesterol diets appropriate for adults are not suitable for children < 2Y of age. This action may be motivated from beliefs that CHD begins before 2Y (Lauer, 1994) or attitudes towards
body shape and image (Robinson, 1993). Limiting fat to children < 2Y can compromise growth and development during a time of rapid growth. Parents offering children vegetarian (Maggioni et al, 1995) or 'cult' diets (Sanders et al, 1995; Roberts et al, 1979) may lead to undernutrition. Inappropriate nutrient intake can not only lead to poor growth but also vitamin and mineral deficiencies (Sanders et al, 1995).

Early studies looking at children suffering from malnutrition have shown suppressed growth (Widdowson, 1968). The adverse effects of malnutrition may depend on the time of life when the child is malnourished (Widdowson, 1968). It is recognised that malnutrition with all of its consequences could affect a child with lasting outcomes (Peterson, 1993). There can be both physical and psychological effects from malnutrition. Various terms are used to describe malnutrition such as: undernutrition, failure to thrive or protein-energy malnutrition. There are different methods used to assess the signs and symptoms of malnutrition (Karp, 1994; Batchelor et al, 1990; Listernick et al, 1985) such as dietary surveys, clinical assessments or anthropometry. Whatever method is used to assess malnutrition, children can be robbed of their vitality if malnutrition goes untreated.

Failure to thrive (FTT) is a paediatric condition describing the growth and nutritional status of young children. The growth delays that are characterised by FTT are associated with significant risk for developmental and psychosocial problems (Wright et al, 1996; Skuse et al, 1995; Bithoney et al, 1992). FTT is often accompanied by illness, decreased activity, cognitive delay, poor school performance, and behavioural and social problems (Peterson, 1993).

There are many different definitions of FTT (Wilensky et al, 1996; Maggioni et al, 1995; Reif et al, 1995; Boddy et al, 1994; Bithoney et al, 1992). Skuse (1985) commented that FTT does not fulfil the criteria for a satisfactory medical diagnosis, but is “merely an arbitrary description of a pattern of growth”. The lack of a standardised anthropometric
criteria and cut-off points further weakens FTT as a diagnosis. For all of its' short comings as a term, FTT is commonly used to describe a child's growth pattern. FTT is found in 1 to 5% of paediatric hospital admissions and it is also being seen in out-patient clinics (Maggioni et al, 1995; Reif et al, 1995; Frank et al, 1994; Batchelor et al, 1990). FTT is not one disorder, but rather a spectrum of disorders with different aetiologies (Hathaway, 1989).

1.1 Definitions of Failure to Thrive

I have located six different definitions of FTT:

1. a drop below the 3rd centile for weight (Batchelor, 1996)
2. a height less than the 5th centile and weight less than 3rd centile (Peterson, 1993; Bithoney et al, 1992)
3. a weight decrement of more than 2 major centiles (50th centile to 30th centile) from a previously established growth channel over a period of 3 to 6 months (Hall, 1996; Peterson, 1993)
4. a decrease in weight-for-age of approximately 1 or more SD from a previously established growth channel (Peterson, 1993)
5. a sudden decrease in rate of weight gain (Peterson, 1993; Bithoney et al, 1992)
6. behavioural and developmental delays in passing appropriate milestones (Black et al, 1995; Drotar et al, 1985)

1.1.2 Definitions of Protein-energy malnutrition

The energy requirement of an individual is the energy intake from food that will balance energy expenditure. Malnutrition results when an individual's nutrient intake falls below metabolic requirements (Butte, 1996; Lennard-Jones, 1992) unless obese at the outset. Kretchmer et al (1996) further defines malnutrition as an issue of a shortage of meganutrients that is also associated with a deficiency of specific nutrients. These general
definitions are not helpful when trying to assess the prevalence of protein-energy malnutrition (PEM). In trying to measure the number of malnourished individuals, various methods of assessment can be used.

A method used to classify a degree of malnutrition is to compare a child’s weight-for-age or weight-for-height for age against a reference standard. The Gomez classification for malnutrition, used by the World Health Organisation (WHO), has been widely used and recommended for the assessment of the prevalence and severity of malnutrition in populations (Fidanza, 1991). The Gomez criteria expresses weight as a percentage of the 50th centile weight-for-age on a standard growth chart for gender. The degrees of malnutrition are (WHO, 1979):

Malnutrition of mild degree
- malnutrition of first degree according to Gomez classification
  (weight-for-age 75% to less than 90% standard)

Malnutrition of moderate degree
- malnutrition of second degree according to Gomez classification
  (weight-for-age 60% to less than 75% standard)

Other severe protein-calorie malnutrition
- malnutrition of third degree according to Gomez classification
  (weight-for-age less than 60% standard)

Weight-for-age as a measure of nutritional status has two disadvantages (Fidanza, 1991). In severely malnourished children oedema may mask the weight loss associated with malnutrition. The second disadvantage is that malnutrition over time produces a deficit in
height as well as weight (Fidanza, 1991). Early stages of malnutrition may have little effect on height.

Because of the disadvantages, Waterlow (1972) established new criteria based on weight-for-height. These criteria examine the relationship of weight-for-height for age to a degree of wasting (acute malnutrition) and height-for-age to a degree of stunting (chronic malnutrition) (Wright et al, 1994). The disadvantage of weight-for-height is the difficulty in measuring body length in infants and obtaining the correct information (Frisancho, 1993). Measuring height does not necessarily identify the duration of malnutrition. Also, genetic differences can influence height. Table 2 shows the different methods used by Gomez and Waterlow to categorise undernutrition. Both classifications identify a degree of malnutrition, however, Waterlow’s classification has a smaller percentage range in each degree of malnutrition.

<table>
<thead>
<tr>
<th>Degree of Undernutrition</th>
<th>Gomez Classification</th>
<th>Waterlow Classification</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>% median weight-for-age for age</td>
<td>% median weight-for-height for age</td>
</tr>
<tr>
<td>None</td>
<td>&gt; 90</td>
<td>&gt; 90</td>
</tr>
<tr>
<td>Mild</td>
<td>75 - 90</td>
<td>80 - 90</td>
</tr>
<tr>
<td>Moderate</td>
<td>60 - 74</td>
<td>70 - 79</td>
</tr>
<tr>
<td>Severe</td>
<td>&lt; 60</td>
<td>&lt; 70</td>
</tr>
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</table>

1.1.3 Factors Contributing to Failure to Thrive and Protein-energy malnutrition

The most common cause of FIT is inadequate food intake, however, a distorted social situation can contribute to poor weight gain, delayed development and abnormal behaviour (Wright et al, 1996; Maggioni et al, 1995; Peterson, 1993). Parental misconceptions about nutrition can lead to inadequate intake for age (Fomon, 1994). Parents attempting to develop healthy eating patterns for children later in life may be restricting necessary nutrients for growth (Lauer, 1994). Restricting foods by placing children on diets more appropriate for adults can impede growth (Sanders, 1995). Offering an unbalanced diet such as foods high in sugar can result in a reduced food consumption which is low in dietary protein, fat and micronutrients (Smith et al, 1994).

Feeding problems are seen in children (ONS, 1997b; OPCS, 1992). FIT from feeding issues usually occurs between 6 months to 3 years of age (Losch et al, 1995; Satter, 1986). These authors discuss how behaviour such as apathy or fist-clenching towards the caregiver can result in a negative feeding experience.

Specific nutrient deficiencies may influence an infant’s eating behaviour. Low iron or zinc intakes may be associated with poor appetite and lack of interest in their surroundings (Lozoff et al, 1991; McLaren et al, 1991; Milner, 1990). Food refusal or extreme food selectivity or undereating despite parental efforts leads to FIT (Rudolph, 1994). Lack of communication between caregiver and infant has been observed in children with feeding problems. In these circumstances, infant feeding becomes controlled by emotions rather than physiological needs.

Infant social development is dependent on the interaction between parent and child. The effect maternal attachment has on infant development and behaviour has consistently been demonstrated (Black et al, 1995; Boddy et al, 1994; Kelleher et al, 1993). The quality and quantity of emotional stimulation between mother and child is imperative for infant
development (Heffer et al, 1994). The nurturing needs of the infant may be decreased due to maternal depression, low socioeconomics or multiple stresses.

Gardner (1993) reported that the National Society for the Prevention of Cruelty to Children (NSPCC) in 1984 began producing a general estimate of the level of child abuse in England. Between October 1986 and September 1987, 223 (1.0%) of all referrals to the NSPCC were registered under the category of FTT. She continues to state that FTT can be a form of psychological maltreatment resulting in undernutrition or delayed development. If undetected, the severity of undernutrition resulting from child abuse will hamper normal growth and development in children. Currently, the NSPCC registration of FTT is under the category of neglect.

Maggioni et al (1995) explains that children affected with FTT show signs of mild to moderate malnutrition. The poor growth seen in children with FTT and PEM is associated with poor emotional and/or cognitive development.

### 1.2 The International Classification of Diseases

The International Classification of Diseases (ICD) is designed to allow the systematic recording, analysis, interpretation and comparison of mortality and morbidity data. A diagnosis is translated into a alphanumeric code permitting easy storage, retrieval and analysis of data (WHO, 1994). ICD9 codes were the version used at the time of this study. Since completing the study, ICD10 has been introduced as of January 1996.

The ICD code has become the international standard diagnostic classification for all general epidemiological and many health management purposes. It can also serve to classify diseases or other health problems recorded on many types of health and vital records. The codes' original role was to classify causes of mortality as recorded at the registration of death. As time has progressed, the scope of the ICD has been extended to included
diagnoses of morbidity. Peterson (1990) suggested that ICD code analysis could be used to monitor the health and prevalence of diseases of populations.

1.2.1 Description of International Classification of Diseases

The codes classify diseases, however, there are codes for a wide variety of signs, symptoms, abnormal findings and social circumstances that might stand in place of a formal diagnosis in a health record.

There are two main classes of codes. The first class covers a diagnosis or health status. This represents a formal diagnosis and allows for more specific classification of a disease including its morphology. The second class covers health problems outside a formal diagnosis. This class includes medical or surgical procedures, disablement or reasons for contact with health care providers.

The 'core' classification is a three-character code which is the mandatory level of coding for international reporting. The database for the international coding and comparison is located at WHO, Geneva. The subcategories are defined by using a four-character code. Even though this code is not mandatory for international coding it is an integral part of the ICD coding structure. This established framework of coding allows an ongoing surveillance system compiling data at an international level. Table 3 gives examples of core codes and subcategory codes.
Table 3 Examples of ICD9 Core and Subcategory Codes

<table>
<thead>
<tr>
<th>Core Code</th>
<th>Subcategory Code</th>
<th>Description of Code</th>
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<td>260</td>
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<td>Kwashiorkor</td>
</tr>
<tr>
<td>261</td>
<td></td>
<td>Nutritional marasmus</td>
</tr>
<tr>
<td>263</td>
<td></td>
<td>Other and unspecifiedprotein-calorie malnutrition</td>
</tr>
<tr>
<td></td>
<td>263.8</td>
<td>Other protein-calorie malnutrition</td>
</tr>
</tbody>
</table>

1.2.2 Using the International Classification of Diseases

The ICD code is assigned to the Medical Record (MR) for the purpose of sorting and counting for statistical purposes. To assist in providing the most accurate information on a disease state, the three or four character rubrics will usually list a number of other diagnostic terms located under the core code. These are known as 'inclusion terms'. These terms are examples of other diagnostic statements that can be included within that rubric. They are not sub classifications of the rubric, but are synonyms or conditions allowed coding under that rubric. Inclusion terms are guides to the contents of the rubric.

The 'exclusion terms' located in the rubrics suggests that the disease or condition is classified elsewhere. Similar diseases or conditions may suggest their location under a code, but the exclusion will verify the accurate location of the required disease or condition. Following some exclusion terms, the category or subcategory will list the correct location of the needed code. Table 4 gives examples of inclusion and exclusion terms (WHO, 1979).
Table 4 Inclusion and Exclusion Terms for Protein-energy malnutrition, Obesity and Symptoms, Signs and Ill-defined Conditions

**Malnutrition and Obesity**

260 **Kwashiorkor**
Nutritional oedema with dyspigmentation of skin and hair

261 **Nutritional marasmus**
Nutritional atrophy
Severe calorie deficiency
Severe malnutrition NOS

262 **Other severe protein-calorie malnutrition**
Malnutrition of third degree according to Gomez classification (weight-for-age less than 60% of standard)
Nutritional oedema without mention of dyspigmentation of skin and hair

263 **Other and unspecified protein-calorie malnutrition**

263.0 **Malnutrition of moderate degree**
Malnutrition of second degree according to Gomez classification (weight-for-age 60% to less than 75% standard)

263.1 **Malnutrition of mild degree**
Malnutrition of first degree according to Gomez classification (weight-for-age 75% to less than 90% standard)

263.2 **Arrested development following protein-calorie malnutrition**
Nutritional dwarfism
Physical retardation due to malnutrition

263.8 **Other protein-calorie malnutrition**

263.9 **Unspecified**
Dystrophy due to malnutrition
Malnutrition (calorie) NOS

*Excludes:* nutritional deficiency NOS (269.9)

278.0 Obesity

*Excludes:* adiposogenital dystrophy (253.8)
  obesity of endocrine origin (259.9)

**Symptoms, Signs, Ill-Defined Conditions**

783.2 *Abnormal weight loss*

783.3 *Feeding difficulties and mismanagement*

Feeding problem (infant) (elderly)

*Excludes:* feeding problems in newborn (779.3)
  infantile feeding disturbance of nonorganic origin (307.5)

783.4 *Lack of expected normal physiological development*

Delayed milestone  Physical retardation
Failure to thrive  Short stature
Lack of growth

*Excludes:* delay in sexual development and puberty (259.0)
  specific delays in mental development (315.)

V61.2 *Parent-child relations*

Child abuse or neglect or battering
Concern about behaviour of child
Parent-child conflict
Problem concerning adopted or foster child.
1.2.3 Data Origin

The ICD9 code is assigned to the patient’s MR after discharge from the hospital. The hospital’s Medical Coding Department will assign a code to a diagnosis or operation or treatment as described by the physician. A total of 30 different ICD9 codes are allowed to be assigned to a patient’s MR. The ICD9 codes assigned are divided into 15 allowable diagnoses and 15 allowable operations and treatments. This information is often located in the discharge summary as described by the physician.

At the time of the study, the Patient Administration System (PAS) was the computer program used by hospitals in England to transmit collected data from hospital to Regional Health Authority (RHA). The purpose of the PAS system was to ensure compatibility of data collection from district to region.

The RHAs received and assembled the transmitted data into a computer compatible form to match the system used by the Department of Health (DoH). This system was called the Patient Information Data (PID). The system provided the basis for analysis in determining prevalence of disease in England. The figures are then sent to WHO for collection of international statistics. Fig. 3 illustrates the data flow from hospital MR to the DoH.
Fig. 3  Flow Chart of the Medical Coding Process from Patient’s Hospitalised Medical Record to the Department of Health

1.2.4  Basic Coding Guidelines

The accuracy of coding for mortality or morbidity is essential and the coding process requires the medical coder to be familiar with the guidelines suggested by the WHO. These guidelines are outlined in a simple format intended to assist the coder (WHO, 1979). The steps in coding are:

1. Identify the statement to be coded.

2. Locate the lead term. For diseases and injuries this is usually a noun for the pathological condition.

3. Read and follow any notes under the lead term.
4. Read all words in the diagnostic expression and account for all words.
5. Follow any cross-references.
6. Read any inclusion and/or exclusion terms under the selected code and be guided appropriately.
7. Assign the code.

1.2.5 Medical Record

The MR is the means of communicating the episodes of care as documented during a patient’s hospitalisation (DoH, 1994a). The information about clinical care provided during the hospitalisation is translated into an assigned ICD code. It is imperative that good record keeping of patient care be maintained during the hospital stay. The concise documentation by the health professional will assist in defining the disease or operation or treatment associated with illness. The medical coder will scan the MR for diagnosis, findings or treatment history. The clarity of terms described in the MR determines the ICD code assignment. As the ICD coding system is designed to collate data that can be used to assess prevalence of certain conditions, it was decided to look for evidence of malnutrition from this source.

1.3 The International Classification of Diseases 10

The development of ICD10 began in September 1983 and in 1989 all revisions were accepted by the Expert Committee of the WHO. The 43rd World Health Assembly approved the ICD10 and it was effective as of January 1993. In January of 1996, England replaced ICD9 with the new version ICD10.

The revisions to ICD10 encompassed more information other than diagnostic information. A broader information base of medical and surgical procedures and disablement were included in this version. The traditional ICD coding guidelines were retained but an alphanumeric coding scheme replaced the previous numeric code scheme. This coding
structure provides a larger coding frame and allows room for future revisions without disruption to the numbering system (WHO, 1994). Table 5 lists the ICD10 alphanumeric coding and descriptions for protein-energy malnutrition, obesity and symptoms, signs and abnormal clinical and laboratory findings (WHO, 1994).

Table 5  ICD10 Alphanumeric Coding for Protein-energy malnutrition, Obesity and Symptoms, Signs and Abnormal Clinical and Laboratory Findings

**Protein-energy Malnutrition (E40-E46) and Obesity (E66)**

*Note:* The degree of malnutrition is usually measured in terms of weight, expressed in standard deviations from the mean of the relevant reference population. When one or more previous measurements are available, lack of weight gain in children, or evidence of weight loss in children or adults, is usually indicative of malnutrition. When only one measurement is available, the diagnosis is based on probabilities and is not definitive without other clinical or laboratory tests. In the exceptional circumstances that no measurement of weight is available, reliance should be placed on clinical evidence.

If an observed weight is below the mean value of the reference population, there is high probability of severe malnutrition if there is an observed value situated 3 or more standard deviations below the mean value of the reference population; a high probability of moderate malnutrition for an observed value located between 2 and less than 3 standard deviations below this mean; and a high probability of mild malnutrition for an observed value located between 1 and less than 2 standard deviations below this mean.

*Excludes:* intestinal malabsorption (K90.)

- nutritional anaemia (D50-D53)
- sequelae of protein-energy malnutrition (E64.0)
- slim disease (B22.2)
- starvation (T73.0)
E40  Kwashiorkor
Severe malnutrition with nutritional oedema with dyspigmentation of skin and hair

Excludes: marasmic kwashiorkor (E42)

E41  Nutritional marasmus
Severe malnutrition with marasmus

Excludes: marasmic kwashiorkor (E42)

E42  Marasmic kwashiorkor
Severe protein-energy malnutrition (as in E43)

- intermediate form
- with signs of both kwashiorkor and marasmus

E43  Unspecified severe protein-energy malnutrition
Severe loss of weight (wasting) in children or adults, or lack of weight gain in children leading to an observed weight that is at least 3 standard deviations below the mean value for the reference population (or a similar loss expressed through other statistical approaches). When only one measurement is available, there is a high probability of severe wasting when the observed weight is 3 or more standard deviations below the mean of the reference population.

E44  Protein-energy malnutrition of moderate and mild degree

E44.0  Moderate protein-energy malnutrition
Weight loss in children or adults, or lack of weight gain in children leading to an observed weight that is 2 or more but less than 3 standard deviations below the mean value for the reference population (or a similar loss expressed through other statistical approaches). When only one measurement is available, there is a high probability of moderate protein-energy malnutrition when the observed weight is 2 or more but less than 3 standard deviations below the mean of the reference population.
**E44.1 Mild protein-energy malnutrition**

Weight loss in children or adults, or lack of weight gain in children leading to an observed weight that is 1 or more but less than 2 standard deviations below the mean value for the reference population (or a similar loss expressed through other statistical approaches). When only one measurement is available, there is a high probability of mild protein-energy malnutrition when the observed weight is 1 or more but less than 2 standard deviations below the mean of the reference population.

**E45 Retarded development following protein-energy malnutrition**

Nutritional:
- short stature
- stunting

Physical retardation due to malnutrition

**E46 Unspecified protein-energy malnutrition**

Malnutrition NOS

Protein-energy imbalance NOS

ICD10 has added marasmic kwashiorkor. From ICD9, Other protein-calorie malnutrition (263.8) has been absorbed into code E46.

**E66 Obesity**

*Excludes:* adiposogenital dystrophy (E23.6)

Lipomatosis:
- NOS (E88.2)
- dolorosa (Dercum) (E88.2)

Prader-Willi syndrome (Q87.1)

**E66.0 Obesity due to excess calories**
E66.1 Drug-induced obesity
Use additional external cause code (Chapter XX), if desired, to identify drug.

E66.2 Extreme obesity with alveolar hypoventilation
Pickwickian syndrome

E66.8 Other obesity
Morbid obesity

E66.9 Obesity, unspecified
Simple obesity NOS

ICD10 has expanded the categories of obesity. As in ICD9, no established criterion or cut-off point is included to define obesity.

Symptoms, Signs and Abnormal Clinical and Laboratory Findings

R62 Lack of expected normal physiological development

Excludes: delayed puberty (E30.0)

R62.0 Delayed milestone
Delayed attainment of expected physiological development state

Late:
• talker
• walker

R62.8 Other lack of expected normal physiological development
Failure to:
• gain weight
• thrive

Infantilism NOS
Lack of growth
Physical retardation
Excludes: HIV disease resulting in failure to thrive (B22.2)
physical retardation due to malnutrition (E45)

*R62.9 Lack of expected normal physiological development, unspecified*

ICD10 has separately listed out some of the inclusions found in ICD9 783.4, such as, delayed milestone and growth failure.

**T74 Maltreatment syndromes**

*T74.0 Neglect or abandonment*

*T74. Physical abuse*

Battered:

- baby or child syndrome NOS
- spouse syndrome NOS

*T74.2 Sexual abuse*

*T74.3 Psychological abuse*

*T74.8 Other maltreatment syndromes*

*T74.9 Maltreatment syndrome, unspecified*

Effects of:

- abuse of adult NOS
- child abuse NOS

**Z61.0 Loss of love relationship in childhood**

Loss of an emotionally close relationship, such as of a parent, a sibling, a very special friend or a loved pet, by death or permanent departure or rejection.

**Z61.1 Removal from home in childhood**

Admission to a foster home, hospital or other institution causing psychosocial stress, or forced conscription into an activity away from home for a prolonged period.
Under ICD10, ICD9 V61.2 has been divided into two defined areas of abuse. The inclusions under ICD9 V61.2 for abuse are now defined separately by the type of abuse whilst other inclusions are listed as a negative event in childhood, Z61.0 and Z61.1.
Aims of the Study

This study was initiated to assess the usefulness of routinely collected data to assess the extent of malnutrition in the 0 - 4Y year old population, so that appropriate nutritional advice and health care can be given in the United Kingdom.
Chapter Two

Measure of Malnutrition Derived From International Classification of Diseases in Young Children in England

2.1 Introduction

Malnutrition in young children is of particular importance because of the impact it has on development and possibly of future health (Torres-Gil, 1996). The age range investigated was restricted to 0 - 4 years of age. The routine data set reveals that the most severe malnutrition is likely to be recorded in data relating to hospital admission. The ICD coding should reveal the extent of malnutrition in hospital patients.
2.2 Methods

Contact was made with the DoH to assess ICD9 data relating to the prevalence of malnutrition in England. Consent was given by the DoH to use data from 1991 - 1993. Data collection begins April ending March 31 of the financial year. The DoH felt that the overall quality of data after 1990 was more pertinent for the study. Data prior to 1990 was not available due to changes in processing. In 1987, the Hospital Episode Statistics (HES) system was introduced to replace the Hospital In-patient Enquiry (HIPE) and the Mental Health Enquiry (MHE). HIPE discontinued in 1985 and MHE in 1986. Since both programs ceased, there was a break in the continuity of hospital data due to the introduction of a new system. The first publication of HES was for the financial year 1990. Data for 1993 was given prior to publication in HES.

A written request was made for specific ICD9 codes. Table 6 lists the requested ICD9 codes:

<table>
<thead>
<tr>
<th>Core Codes</th>
<th>Subcategory Codes</th>
<th>Description of Codes</th>
</tr>
</thead>
<tbody>
<tr>
<td>260</td>
<td></td>
<td>Kwashiorkor</td>
</tr>
<tr>
<td>261</td>
<td></td>
<td>Nutritional marasmus</td>
</tr>
<tr>
<td>262</td>
<td></td>
<td>Other severe protein-calorie malnutrition</td>
</tr>
<tr>
<td>263</td>
<td></td>
<td>Other and unspecified protein-calorie malnutrition</td>
</tr>
<tr>
<td>263.0</td>
<td></td>
<td>Malnutrition of moderate degree</td>
</tr>
<tr>
<td>263.1</td>
<td></td>
<td>Malnutrition of mild degree</td>
</tr>
<tr>
<td>263.2</td>
<td></td>
<td>Arrested development following protein-calorie malnutrition</td>
</tr>
<tr>
<td>Code</td>
<td>Description</td>
<td></td>
</tr>
<tr>
<td>-------</td>
<td>--------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>263.8</td>
<td>Other protein-calorie malnutrition</td>
<td></td>
</tr>
<tr>
<td>263.9</td>
<td>Unspecified</td>
<td></td>
</tr>
<tr>
<td>278.0</td>
<td>Obesity</td>
<td></td>
</tr>
<tr>
<td>783.2</td>
<td>Abnormal loss of weight</td>
<td></td>
</tr>
<tr>
<td>783.3</td>
<td>Feeding difficulties and mismanagement</td>
<td></td>
</tr>
<tr>
<td>783.4</td>
<td>Lack of normal physiological development</td>
<td></td>
</tr>
<tr>
<td>V61.2</td>
<td>Parent-child relations</td>
<td></td>
</tr>
</tbody>
</table>

Data was placed onto a computer disc as well as a 5 page computer print out being provided for each year.

### 2.2.1 Data Source

Data was collected for children age 0 - 4Y discharged from hospital under specific ICD9 codes. The on-going collection of ICD9 codes represents a MR assigned a code after hospital discharge. It is not possible to ascertain from the data:

1. gender, race or ethnic background
2. multiple admissions for a patient within the same year

(because of this, the percentage population (0 - 4Y) may not be accurate.)

For the purpose of the analysis, the data represents a MR coded a specific ICD9 code for a patient's hospitalisation.

The requested ICD9 codes denote both diagnosis-related classifications and non-diagnostic classifications. Code selection was based on the codes offering the greatest likelihood of an inferred PEM or FTT incidence. The disease diagnoses selected were the classifications of malnutrition and obesity. Obesity was included as it represents the extreme of the other end of malnutrition which is a health concern (DoH, 1992c; Hall, 1989).
Unless PEM is specifically stated in the patient’s MR by the physician, the medical record department can not assign a code for malnutrition. There are other ICD9 codes that could be descriptive of malnutrition. These codes are not diseases but could infer a degree of malnutrition. The assigning of other codes would be based on the physician’s terminology describing the condition. These codes are:

<table>
<thead>
<tr>
<th>Subcategory Codes</th>
<th>Description of Codes</th>
</tr>
</thead>
<tbody>
<tr>
<td>783.2</td>
<td>Abnormal weight loss</td>
</tr>
<tr>
<td>783.3</td>
<td>Feeding difficulties and mismanagement</td>
</tr>
<tr>
<td>783.4</td>
<td>Lack of normal physiological development</td>
</tr>
<tr>
<td>V61.2</td>
<td>Parent-child relations</td>
</tr>
</tbody>
</table>

### 2.2.2 Statistical Analysis

All analyses were performed using Microsoft Excel (version 5.0, 1995) and Statview II (1991). Descriptive statistics (eg, means and percentages) summarised the data. Significance testing for the difference between means (Z-critical (-1.645, 1.645)) was used to test hypotheses. A value for a simple regression correlation coefficient at a $p<0.05$ was used to measure linear association between two variables. The data is presented by age: $<1Y; 1Y; 2Y; 3Y; 4Y$.

The Standard Regions do not correspond exactly with the RHAs. For example, RHA of Oxford and Wessex, covers two different standard regions. An arbitrary decision was made to divide the number of MRs equally between the East Midland and South East regions. Table 7 lists the standard regions and the RHAs within that region.
Table 7 Standard Regions and Regional Health Authorities within England

<table>
<thead>
<tr>
<th>Standard Region</th>
<th>Regional Health Authority</th>
</tr>
</thead>
<tbody>
<tr>
<td>North</td>
<td>Northern</td>
</tr>
<tr>
<td>Yorkshire &amp; Humberside</td>
<td>Yorkshire</td>
</tr>
<tr>
<td>East Midland</td>
<td>Trent</td>
</tr>
<tr>
<td></td>
<td>1/2 Oxford</td>
</tr>
<tr>
<td></td>
<td>1/2 Wessex</td>
</tr>
<tr>
<td>East Anglia</td>
<td>East Anglian</td>
</tr>
<tr>
<td>South East</td>
<td>1/2 Oxford</td>
</tr>
<tr>
<td></td>
<td>1/2 Wessex</td>
</tr>
<tr>
<td></td>
<td>NW Thames</td>
</tr>
<tr>
<td></td>
<td>NE Thames</td>
</tr>
<tr>
<td></td>
<td>SE Thames</td>
</tr>
<tr>
<td></td>
<td>SW Thames</td>
</tr>
<tr>
<td>South West</td>
<td>South Western</td>
</tr>
<tr>
<td>West Midlands</td>
<td>West Midlands</td>
</tr>
<tr>
<td>North West</td>
<td>Mersey</td>
</tr>
<tr>
<td></td>
<td>North Western</td>
</tr>
</tbody>
</table>
2.3 Results

2.3.1 Measure of Malnutrition (262, 263.0 and 263.1) and Obesity (278.0)

The number of MRs assigned PEM (262, 263.0 and 263.1) were grouped together because of small numbers. The number of MRs assigned obesity (278.0) were also small. No trend was shown over time. Fig. 4 shows the number of MRs assigned PEM and obesity by year.

![Fig. 4 Number of Medical Records, ICD 262, 263.0, 263.1 and 278.0, by Year, England](image_url)
Figs. 5 through 9 further illustrate the small number of MRs assigned PEM (262, 263.0 and 263.1) and obesity (278.0) by age and year.

**Fig. 5** Number of Medical Records, ICD 262, 263.0, 263.1 and 278.0, 1991-1993, England, Less Than One Year of Age

**Fig. 6** Number of Medical Records, ICD 262, 263.0, 263.1 and 278.0, 1991-1993, England, One Year of Age
Fig. 7 Number of Medical Records, ICD 262, 263.0, 263.1 and 278.0, 1991-1993, England, Two Years of Age

Fig. 8 Number of Medical Records, ICD 262, 263.0, 263.1 and 278.0, 1991-1993, England, Three Years of Age
2.3.2 Measure of Malnutrition in Non-disease ICD9 Codes

PEM and obesity had small numbers of MRs assigned, however, there are thousands of children assigned codes for feeding difficulties and mismanagement (783.3) and lack of normal physiological development (783.4). Fig. 10 shows the high numbers of MRs assigned these codes by year. Abnormal weight loss (783.2) and parent-child relations (V61.2) have a small number of MRs assigned these codes by year.
Fig. 10  Number of Medical Records, ICD 783.2, 783.3, 783.4 and V61.2, by Year, England
Figs. 11 through 15 show the marked difference between the number of MRs allocated different codes at different ages.
Fig. 13 Number of Medical Records, ICD 783.2, 783.3, 783.4 and V61.2, 1991-1993, England, Two Years of Age

Fig. 14 Number of Medical Records, ICD 783.2, 783.3, 783.4 and V61.2, 1991-1993, England, Three Years of Age
Figs. 16 through 18 clearly illustrate by age that 783.3 has the largest number of MRs < 1Y. In contrast, 783.3 declines significantly > 1Y whilst 783.4 shows a gradual decrease with age.
Fig. 17 Number of Medical Records, ICD 783.3 and 783.4, by Age, 1992, England

Fig. 18 Number of Medical Records, ICD 783.3 and 783.4, by Age, 1993, England
2.3.3 Age

There were more MRs assigned the specific ICD9 codes < 1Y. PEM and obesity show small numbers, however, malnutrition and obesity could be coded under other ICD9 codes for this age. The ICD9 codes 783.3 and 783.4 had high numbers of MRs assigned all 3 years in the < 1Y age range. PEM and obesity may be hidden within these non-disease ICD9 codes.

Using government data for England, 1991-1993, the following hypothesis was tested: the percentage of hospital MRs coded (i.e., 262, 263.3, 263.1, 278.0, 783.2, 783.3, 783.4, and V61.2) < 1Y of age is equal to the percentage of hospital MRs coded (i.e., 262, 263.3, 263.1, 278.0, 783.2, 783.3, 783.4, and V61.2) 1Y of age. This age range was selected because of the high numbers of MRs assigned ≤1Y. Tables 8 through 10 show the summary of the results.
Table 8  Frequency and Number of Assigned ICD9 Codes to Medical Records, 1991, England

<table>
<thead>
<tr>
<th>ICD9</th>
<th>&lt; 1Y</th>
<th>1Y</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>262, 263.0 and 263.1</td>
<td>25%</td>
<td>63%</td>
<td>% &lt; 1Y lower than % 1Y (z=1.64)</td>
</tr>
<tr>
<td></td>
<td>(8)</td>
<td>(20)</td>
<td></td>
</tr>
<tr>
<td>278.0</td>
<td>0</td>
<td>100%</td>
<td>% 1Y significantly higher than % &lt; 1Y (z=1.59)</td>
</tr>
<tr>
<td></td>
<td>(16)</td>
<td>(40)</td>
<td></td>
</tr>
<tr>
<td>783.2</td>
<td>69%</td>
<td>19%</td>
<td>% &lt; 1Y significantly higher than % 1Y (z=2.9)</td>
</tr>
<tr>
<td></td>
<td>(144)</td>
<td>(40)</td>
<td></td>
</tr>
<tr>
<td>783.3</td>
<td>91%</td>
<td>6%</td>
<td>% &lt; 1Y significantly higher than % 1Y (z=8.8)</td>
</tr>
<tr>
<td></td>
<td>(3360)</td>
<td>(224)</td>
<td></td>
</tr>
<tr>
<td>783.4</td>
<td>48%</td>
<td>27%</td>
<td>% &lt; 1Y significantly higher than % 1Y (z=8.8)</td>
</tr>
<tr>
<td></td>
<td>(2352)</td>
<td>(1336)</td>
<td></td>
</tr>
<tr>
<td>V61.2</td>
<td>46%</td>
<td>20%</td>
<td>% &lt; 1Y higher than % 1Y (z=1.9)</td>
</tr>
<tr>
<td></td>
<td>(156)</td>
<td>(68)</td>
<td></td>
</tr>
</tbody>
</table>

* Numbers in parentheses represent specific ICD9 coded medical records.  
** Percentages do not sum to 100%, as there are children over 1 Y with these particular ICD9 codes.
Table 9  Frequency and Number of Assigned ICD9 Codes to Medical Records, 1992, England

<table>
<thead>
<tr>
<th>ICD9</th>
<th>&lt; 1Y</th>
<th>1Y</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>262, 263.0 and 263.2</td>
<td>100%</td>
<td>0%</td>
<td>% &lt; 1Y higher than 1Y (z=.63)</td>
</tr>
<tr>
<td>278.0</td>
<td>6%</td>
<td>22%</td>
<td>% &lt; 1Y is lower than 1Y (z=.84)</td>
</tr>
<tr>
<td>783.2</td>
<td>27%</td>
<td>20%</td>
<td>no difference</td>
</tr>
<tr>
<td>783.3</td>
<td>88%</td>
<td>6.8%</td>
<td>% &lt; 1Y significantly higher than % 1Y (z=7.6)</td>
</tr>
<tr>
<td>783.4</td>
<td>49%</td>
<td>27%</td>
<td>% &lt; 1Y significantly higher than % 1Y (z=2.9)</td>
</tr>
<tr>
<td>V61.2</td>
<td>32%</td>
<td>37%</td>
<td>no difference</td>
</tr>
</tbody>
</table>

* Numbers in parentheses represents specific ICD9 coded medical records.
** Percentages do not sum to 100%, as there are children over 1Y with these particular ICD9 codes.
Table 10 Frequency and Number of Assigned ICD9 Codes to Medical Records, 1993, England

<table>
<thead>
<tr>
<th>ICD9</th>
<th>&lt; 1Y</th>
<th>1Y</th>
<th>Significance</th>
<th>p&lt;0.05</th>
</tr>
</thead>
<tbody>
<tr>
<td>262, 263.0 and 263.1</td>
<td>57%</td>
<td>14%</td>
<td>% &lt; 1Y higher than % 1Y (z=1.3)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(16)</td>
<td>(4)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>278.0</td>
<td>11%</td>
<td>22%</td>
<td>% &lt; 1Y lower than % 1Y (z=1.14)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(4)</td>
<td>(8)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>783.2</td>
<td>60%</td>
<td>22%</td>
<td>% &lt; 1Y significantly higher than % 1Y (z=2.3)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(108)</td>
<td>(40)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>783.3</td>
<td>89%</td>
<td>6.2%</td>
<td>% &lt; 1Y significantly higher than % 1Y (z=7.4)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(2880)</td>
<td>(200)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>783.4</td>
<td>48%</td>
<td>27%</td>
<td>% &lt; 1Y significantly higher than % 1Y (z=3.7)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(2140)</td>
<td>(1208)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>V61.2</td>
<td>55%</td>
<td>13%</td>
<td>% &lt; 1Y higher than % 1Y (z=1.9)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(84)</td>
<td>(20)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Numbers in parentheses represents specific ICD9 coded medical records.
** Percentages do not sum to 100%, as there are children over 1Y with these particular ICD9 codes.
2.3.4 Standard Regions of England

England is divided into 8 standard regions (Appendix 1). The standard regions of England can be geographically grouped (CSO, 1994). Table 11 shows the geographical groupings of the standard regions.

<table>
<thead>
<tr>
<th>Geographical Region</th>
<th>Grouping</th>
</tr>
</thead>
<tbody>
<tr>
<td>Northern</td>
<td>North</td>
</tr>
<tr>
<td></td>
<td>Yorkshire &amp;</td>
</tr>
<tr>
<td></td>
<td>Humbershire</td>
</tr>
<tr>
<td>Central SW</td>
<td>West Midlands</td>
</tr>
<tr>
<td></td>
<td>East Anglia</td>
</tr>
<tr>
<td></td>
<td>South West</td>
</tr>
<tr>
<td>South East</td>
<td>South East</td>
</tr>
</tbody>
</table>

Table 12 lists the standard regions of England, the 0 - 4Y population for each region in 1993 and the number of MRs assigned specific ICD9 codes.

The null hypothesis was tested: the prevalence of MRs assigned specific ICD9 codes is independent of geographical location. More malnutrition (262, 263.0 and 263.1) in the South East region. Obesity (278.0) was evenly found throughout the regions of England. More abnormal loss of weight (783.2), feeding difficulties and mismanagement (783.3) and lack of normal physiological development (783.4) was found in the Northern region. More parent-child relations (V61.2) in the South East region. Table 13 shows the summary of the results.
Table 12 Frequency and Number of ICD9 Codes Assigned to Medical Records Per Thousands, 0 - 4Y Population, 1993, Standard Regions of England

<table>
<thead>
<tr>
<th>Standard Regions</th>
<th>0-4 Y</th>
<th>262</th>
<th>278.0</th>
<th>783.2</th>
<th>783.3</th>
<th>783.4</th>
<th>V61.2</th>
</tr>
</thead>
<tbody>
<tr>
<td>pop.</td>
<td>263.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(thousands)</td>
<td>263.1</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td></td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
</tr>
</tbody>
</table>

| North            | 201.   | 0     | 4     | 24    | 236   | 232   | 12    |
|                  |        | (.01) | (.12) | (.12) | (.005)|       |       |
| Yorkshire &      | 253.   | 4     | 0     | 4     | 420   | 436   | 12    |
| Humbershire      |        | (.01) | (.17) | (.17) | (.004)|       |       |
| East             | 408.   | 4     | 0     | 18    | 332   | 478   | 8     |
| Midlands         |        | (.001)| (.08) | (.12) | (.001)|       |       |
| East Anglia      | 137.   | 2     | 0     | 4     | 132   | 228   | 0     |
|                  |        | (.01) | (.096)| (.17) |       |       |       |
| South East       | 1162.  | 18    | 8     | 84    | 1000  | 1394  | 78    |
|                  |        | (.001)| (.007)| (.09) | (.006)|       |       |
| South West       | 302.   | 0     | 0     | 10    | 288   | 340   | 6     |
|                  |        | (.03) | (.09) | (.11) | (.002)|       |       |
| West             | 365.   | 4     | 8     | 12    | 304   | 500   | 4     |
| Midlands         |        | (.01) | (.03) | (.08) | (.002)|       |       |
| North West       | 451.   | 0     | 4     | 24    | 512   | 832   | 32    |
|                  |        | (.008)| (.11) | (.18) | (.007)|       |       |
| Total            | 3279   | 32    | 24    | 180   | 3224  | 4440  | 152   |
|                  |        | (.009)| (.05) | (.09) | (.005)|       |       |

* Numbers in parentheses represents the percentage of MRs assigned of the 0 - 4Y population assigned specific ICD9 codes
Table 13  By Geographical Grouping for England, 1993, the Frequency and Number of ICD9 Codes Assigned to Medical Records in the 0 - 4Y Population

<table>
<thead>
<tr>
<th>ICD9 Code</th>
<th>Geographical Region</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>262, 263.0 and 263.1</td>
<td>South East (.0037%); Central South West (.0022%); Northern (.0011%)</td>
<td>significant at p=0.0075</td>
</tr>
<tr>
<td>278.0</td>
<td>Northern (.0039%); South East (.0026%); Central South West (.0028%)</td>
<td>not significant at p=0.2019</td>
</tr>
<tr>
<td>783.2</td>
<td>Northern (.0193%); Central South West (.0128%); South East (.0141%)</td>
<td>statistically significant at p=0.0003</td>
</tr>
<tr>
<td>783.3</td>
<td>Northern (.3667%); Central South West (.3371%); South East (.2794%)</td>
<td>statistically significant p&lt;0.00005</td>
</tr>
<tr>
<td>783.4</td>
<td>Northern (.4461%); Central South West (.0221%); South East (.0149%)</td>
<td>statistically significant p&lt;0.00005</td>
</tr>
<tr>
<td>V61.2</td>
<td>South East (.0301%); Central Northern (.0221%); South West (.0149%)</td>
<td>statistically significant p&lt;0.00005</td>
</tr>
</tbody>
</table>

* Numbers in parenthesis represents the percentage of MRs of the 0 - 4Y population assigned specific ICD9 codes
The association between the 0-4Y population of England in 1993 in the standard regions of England and MRs assigned specific ICD9 codes was graphed. The association between the 0-4Y population and MRs assigned specific ICD9 codes was statistically significant.

Figs. 19 through 24 show the summary of the results.

Fig. 19 Association between 0-4Y population in the standard regions of England and ICD9 code assignment 262, 263.0 and 263.1 was significant ($r=.85$)
Fig. 20 Association between 0 - 4Y population in the standard regions of England and ICD9 code assignment 278.0 was not significant ($r=.75$)

![Graph showing linear relationship between 0 - 4Y population and ICD278, with the equation $y = 0.026x + 2.258$, $r^2 = 0.753$.]

Fig. 21 Association between 0 - 4Y population in the standard regions of England and ICD9 code assignment 783.2 was significant ($r=.73$)

![Graph showing linear relationship between 0 - 4Y population and ICD783.2, with the equation $y = 0.141x + 5.006$, $r^2 = 0.728$.]
Fig. 22 Association between 0 - 4Y population in the standard regions of England and ICD9 code assignment 783.3 was statistically significant ($r=.97$)

\[ y = 2.572x + 277.7, \quad r^2 = .967 \]

Fig. 23 Association between 0 - 4Y population in the standard regions of England and ICD9 code assignment 783.4 was statistically significant ($r=.92$)

\[ y = 3.569x + 219.539, \quad r^2 = .921 \]
Fig. 24 Association between 0 - 4Y population in the standard regions of England and ICD9 code assignment V61.2 was statistically significant ($r=0.90$)

\[ y = 0.319x - 37.389, \quad r^2 = 0.898 \]
2.4 Discussion

Yip et al (1994) use the analogy of an iceberg to describe malnutrition. The tip of the iceberg represents the severely malnourished population. While the larger portion hidden by the water represents the mild to moderate malnourished population, a bigger problem. By using a variety of terms, as seen by the non-disease ICD9 codes which may infer the likelihood of PEM or FTT, malnutrition may be hidden from view. If malnutrition is identified in only severe cases, this implies that only severe malnutrition has an impact on well-being (Islam et al, 1994). However, poor cognition or motor skill development can also be affected by mild to moderate malnutrition. Malnutrition can be a contributing factor to childhood mortality or morbidity either directly or indirectly (Islam et al, 1994). Whatever the relationship between malnutrition and poor growth, identification of the condition is imperative to the child’s survival.

2.4.1 Protein-energy Malnutrition (262, 263.0 and 263.1)

A total of only 80 MRs were coded PEM over a 3 year period, which suggests that PEM is extremely rare in hospital paediatric patients. But this does not mean that malnutrition is as rare as implied. Unless the physician records the child has PEM, it can not be coded as such. Even if malnutrition is co-morbid with another disease diagnosis, unless stated, it will not be coded. PEM disease codes for mild malnutrition (263.1), moderate malnutrition (263.0) and severe malnutrition (262) were rarely assigned to MRs. Other PEM disease codes (260, 261, 263, 263.2, 263.8 and 263.9) were never assigned. If malnutrition is seen in hospital paediatric patients, it is not being recognised nor acknowledged in the MR.
2.4.2 Obesity (278.0)

A total of only 112 MRs were coded obesity over a three year period. The coding for obesity is as rare as PEM in children ≤ 4Y of age. Hall (1996) does not even discuss obesity in this age range because it is not a priority of health focus. Identification of obesity using a statistical definition would recognise only a small proportion of children (0 - 4Y) as obese. Using the centiles for BMI values (Figs. 1 and 2) show that infants increase in weight more than height during infancy, falling off during the pre-school period and rising again in adolescence. Children in this age range may be slender because of normal physiological development. This would account for the low numbers of MRs assigned ICD9 code 278.0. However, there may be other reasons for the low numbers of MRs assigned obesity.

Children may not be admitted to hospital for treatment of obesity. Nutritional advice may be provided on an out-patient basis with follow-up at a paediatric clinic. If this is the situation, then the national ICD data would not reflect obesity in this age range. For coding purposes, only hospital discharges are assigned an ICD code. It is possible that obesity could be hidden in the non-disease ICD9 code, feeding difficulties and mismanagement (783.3). Overeating or poor food selections is a feeding problem that can contribute to obesity. In this case, the MR would only reflect the feeding problem not the obesity.

The exclusion under 278.0 is 'obesity of endocrine origin'. Only obesity resulting from non-organic origin is coded under 278.0.
2.4.3 Abnormal Loss of Weight (783.2)

Abnormal loss of weight, of the requested ICD9 codes, was the code assigned least often to the MR. There is no inclusion to better define 783.2. The lack of MRs assigned this code seems odd in terms of the definition of FTT. As FTT is defined by loss of weight or poor growth for age as compared against standard reference growth chart, it would be assumed that PEM or FTT would have been identified. The MR would also have been assigned the code 783.2 -- abnormal loss of weight. This appears not to be the case.

It is possible that this code could be used to further explain the presenting symptoms of a disease. The ICD9 code 783.2 might be assigned when diagnosing diabetes or cancer.

2.4.4 Feeding Difficulties and Mismanagement (783.3)

Of the requested ICD9 codes, 783.3 was the most common code used for children < 1Y of age. There is no inclusion under this code to better define feeding problems. This term refers to a broad definition of some types of feeding problem. The feeding relationship is a series of interactions that take place between the parent and child (Satter, 1986). These interactions engage as the child begins the food selection process. Satter (1986) states that feeding also depends on the information coming from the child about timing, quantity, preference and eating capability shared back to the caregiver. The feeding relationship may reflect the overall parent-child relationship. Sanders et al (1993) further describe feeding problems as ranging from transient, relatively minor behavioural problems at mealtimes to total food refusal, resulting in a life-threatening malnutrition.
The exclusions under 783.3 are:

1. feeding problems in newborn (779.3)
   Feeding problems in newborn (779.3) inclusions are: regurgitation of feeds, vomiting or slow feeds in newborn. This code is used for the nursery.

2. infantile feeding disturbance of nonorganic origin (307.5)
   Other and unspecified disorders of eating (307.5) is used when a more precise medical or psychiatric diagnosis cannot be made. This ICD9 code is located under mental disorders and not appropriate for the study’s usage.

2.4.5 Lack of Normal Physiological Development (783.4)
   The ICD9 code 783.4 remained high in the number of MRs assigned all 3 years. Inclusions under this code are:

   1. failure to thrive
   2. lack of growth
   3. delayed milestones
   4. physical retardation
   5. short stature.

Because of the inclusions, it is likely that malnutrition is hidden under ICD9 code 783.4. Without more defined coding, for example coding subcategorises, malnutrition will remain unrecognised. Reviewing the definitions of FTT, 783.4 is the likely ICD9 code for PEM. The inclusion short stature does not mean poor growth in terms of PEM or FTT. Short stature refers to physiological growth delays (delayed bone age) with a normal height prognosis (Campbell et al, 1992).
Paediatric hospital discharges assigned ICD9 code 783.4 in 1993 (Table 12) had the likelihood of FTT. Studies (Maggioni et al, 1995; Frank et al, 1994; Peterson, 1993; Bithoney et al, 1992; Batchelor et al, 1990) have found that FTT accounts for 1 - 5% of paediatric admissions. ICD9 data from 1993 supports the findings that FTT could account for 1 to 5% of paediatric hospital admissions. Maggioni et al (1995) suggests that FTT is malnutrition in children. They continue to state that malnutrition results in poor growth, as well as, delayed development, abnormal behaviour and distorted caretaker infant interaction. PEM is coded under ICD9 code 783.4. It is possible that PEM could be coded under 783.2, 783.3 and V61.2 as FTT and PEM have the same consequences to growth and development.

2.4.6 Parent-child Relations (V61.2)

The inclusions under V61.2 are:

1. child abuse or neglect or battering
2. concern about behaviour of child
3. parent-child conflict
4. problem concerning adopted or foster child.

The interaction between parent and child often reflects the parents support for the child. The social dynamics of a family influence each participants responsiveness to the situation. Skuse (1995) discusses that abuse and neglect may have an adverse influence on a child’s physical growth. Families that are struggling with parenting difficulties contribute to a child’s poor growth (Boddy et al, 1994; Weston et al, 1993).
A lack of a positive parent-child relationship or emotional stimulation can be psychosocial issues contributing to poor growth.
FIT has been associated with poor family dynamics (Wright et al, 1996; Skuse, 1995). Read (1994) identified that 11% of hospitalised admissions before the age of 2 years in Western Australia were directly related to an inadequate home environment. It takes courage for physicians to document poor parent-child relations in the MR. The numbers of MRs documented with this code are small, but may infer the likelihood of PEM or FTT.

2.4.7 Age
Feeding difficulties and mismanagement (783.3) had the highest number of MRs assigned <1Y. It is during this age range that infants can experience feeding problems. O'Brien et al (1991) reports that of 379 newborns discharged from the hospital and with follow-up four months later, 33% of the mothers reported mealtime problems with the infant. The weaning period can be a difficult experience if infants are reluctant to wean onto solid foods (ONS, 1997b; O'Connell et al, 1989). ONS (1997b) reported that 11% of mothers surveyed (5160), found it difficult weaning the baby onto solid foods. The reasons varied from disinterested in foods, preferring drinks to food or refused to take solids. The number of MRs assigned ICD9 code 783.3 declined <1Y of age.

Lack of normal physiological development (783.4) had a high number of MRs assigned <1Y and maintained a high number of MRs assigned 1Y of age. Feeding problems during <1Y can contribute to poor growth. Budd et al (1992) discusses how feeding problems that persist over time in children can result in abnormal growth and development. Studies (Frank et al, 1994; Karp, 1994; Marcovitch, 1994; Bithoney et al, 1992; Batchelor et al, 1990) discuss that FTT is often seen in children around 18 months of age. This may also account for the high number of MRs assigned ICD9 code 783.4 >1Y.

Canter et al (1990) reports in The Faces of Homelessness in London: Interim Report to the Salvation Army, that nearly 31% of homeless are children <16Y. Young children (0 - 4Y) living in a negative environment can experience poor growth. Inadequate energy intake for
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age or poor food selection or poor hygiene can influence poor growth. Moore et al (1991) suggests that this negative living environment of the homeless often results in children experiencing poor growth, poor social skills, decreased IQ and frequent illness. The ICD9 code 783.4 may be hiding PEM as a result of a poor living environment.

2.4.8 Standard Regions of England

As the 0 - 4Y population increases, the number of MRs coded for non-disease ICD9 codes for England will increase. However, there are regional variations in the number of MRs assigned specific ICD9 codes.

The South East geographical region had more MRs assigned ICD9 codes for PEM (262, 263.0 and 263.1). Are physicians in the South East region recognising and acknowledging PEM in the MR more than other regions? Is PEM being recognised as a secondary condition to a disease? Studies (Edington et al, 1997; Pennington, 1997; Brown et al, 1996; Ruel et al, 1996; Lennard-Jones, 1992) have shown that malnutrition can result from a disease state. A poor nutritional status can be identified with a variety of diseases. Physicians may be recognising malnutrition as a contributory factor to the patients ill-health. Documenting malnutrition in the MR allows the appropriate ICD coding and the measure of malnutrition amongst a population.

More heads of household in the South East are in social class I and II (non-manual) (CSO, 1994). Parents in this social grouping have a higher educational level. Their overall understanding of the ill-health of the child may assist the physician acknowledging the malnutrition. The actual numbers of MRs assigned ICD9 codes for PEM were small, however, this does not indicate that malnutrition is not a health focus in young children. Other geographical regions may not be acknowledging PEM thus greatly reducing its’ prevalence.
The Northern geographical grouping had more MRs assigned ICD9 codes 783.2, 783.3 and 783.4. Are more young children (0 - 4Y) in the Northern region experiencing more health issues with feeding problems and poor growth? Studies (Frank et al, 1994; Batchelor et al, 1990; Rathbun et al, 1987) suggest that a lower social economic status and low literacy levels are risk factors to FTT. In the Northern grouping, more heads of households are in manual social classes IIIM, IV and V (CSO, 1994). Within the manual (IIIM, IV and V) grouping, only 41% of mothers completed education 18Y or over. More mothers in total manual grouping left education at 16Y or under (ONS, 1997b).

Because of possible risk factors to FTT, the physician may choose to admit the child to hospital for health problems of 783.3 and 783.4. Studies (Karp, 1994; Bithoney et al, 1992; Bithoney et al, 1991; Frank et al, 1988; Peterson et al, 1984) have shown that children admitted to hospital respond favourably to nutritional intervention. Admission to hospital may allow more time for professionals to work with the parents and child. Children often begin to gain weight and the results of the hospitalisation assist in confirming the diagnosis of FTT. Documentation in the MR may clearly state the condition and symptom thus allowing the appropriate ICD9 code to be assigned to the MR.

Obesity in young children (0 - 4Y) was not a health problem in the geographical groupings of England. This health problem is not a priority amongst this population. National ICD9 data shows a small number of children hospitalised for obesity. Nutritional intervention for childhood obesity, if needed, may be provided on an out-patient basis. If this is the case, ICD9 data would not reflect the measure of obesity in young children.

More MRs were assigned parent-child relations (V61.2) in the South East geographical regions. Physicians may be more willing to document in the MR cases of maltreatment. Childhood maltreatment is not isolated to only the South East region (Corby, 1994),
however, physicians in this region may be more willing to document poor parent-child
relations in the MR.
2.5 Conclusion

Malnutrition was documented in small numbers under the ICD9 codes for PEM. However, this does not mean that it does not exist. As the long-term consequences of FTT to a child’s well-being are the same as PEM (Peterson, 1993), the likelihood is that PEM is hidden in lack of normal physiological development (783.4). Malnutrition must be recognised and acknowledge so appropriate ICD coding can reveal its’ prevalence. Further research is needed to investigate ‘why’ malnutrition is not being recognised nor acknowledged in the MR.

A low number of MRs were assigned the ICD9 code 278.0 for obesity. From the ICD9 data, obesity is not a health problem in young children (0 - 4Y). However, if young children were overweight or obese, intervention may be handled without a hospitalisation. Children may be referred to a paediatric out-patient clinic for nutritional intervention. Further research is needed to investigate whether this is the case.

Feeding difficulties and mismanagement (783.3) and lack of normal physiological development (783.4) had high numbers of MRs assigned these ICD9 codes. With such high numbers of MRs assigned these codes, public health needs to focus on the issues surrounding the feeding problems and poor growth. The challenge to public health is to identify the cause and reduce the number of MRs assigned 783.3 and 783.4. Further research is needed to investigate the reasons for the feeding problems and poor growth.
Chapter Three
Measures of Malnutrition Derived From Medical Records In Hospital

3.1 Introduction

The analysis of ICD9 codes indicated that PEM is a rare condition. In order to find if malnutrition is coded elsewhere, it was decided to examine the MRs of children assigned specific ICD9 codes in one hospital and investigate their nutritional status with respect to PEM and obesity.
3.2 Methods

Consent for the study was sought and given by the hospital ethics committee. A list of MRs 0 - 4Y classified with certain ICD9 codes were requested from the Medical Records Department. Table 14 lists the requested ICD9 codes.

Table 14 List of Requested ICD9 Codes

<table>
<thead>
<tr>
<th>Core Codes</th>
<th>Subcategory Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>260</td>
<td></td>
<td>Kwashiorkor</td>
</tr>
<tr>
<td>261</td>
<td></td>
<td>Nutritional marasmus</td>
</tr>
<tr>
<td>262</td>
<td></td>
<td>Other severe protein-calorie malnutrition</td>
</tr>
<tr>
<td>263</td>
<td></td>
<td>Other and unspecified protein-calorie malnutrition</td>
</tr>
<tr>
<td>263.0</td>
<td></td>
<td>Malnutrition of moderate degree</td>
</tr>
<tr>
<td>263.1</td>
<td></td>
<td>Malnutrition of mild degree</td>
</tr>
<tr>
<td>263.2</td>
<td></td>
<td>Arrested development following protein-calorie malnutrition</td>
</tr>
<tr>
<td>263.8</td>
<td></td>
<td>Other protein-calorie malnutrition</td>
</tr>
<tr>
<td>263.9</td>
<td></td>
<td>Unspecified</td>
</tr>
<tr>
<td>278.0</td>
<td></td>
<td>Obesity</td>
</tr>
<tr>
<td>783.2</td>
<td></td>
<td>Abnormal loss of weight</td>
</tr>
<tr>
<td>783.3</td>
<td></td>
<td>Feeding difficulties and mismanagement</td>
</tr>
<tr>
<td>783.4</td>
<td></td>
<td>Lack of normal physiological development</td>
</tr>
<tr>
<td>V61.2</td>
<td></td>
<td>Parent-child relations</td>
</tr>
</tbody>
</table>
Ten MRs were retrieved for the pilot study. Based on the information on these MRs, the organisation of the questionnaire was correct. However, the MR provided neither the mother's anti-natal history, the mother's diet history during pregnancy, nor the child's birthweight.
The Medical Record Department retrieved the MRs of 0 - 4Y assigned the specific ICD9 codes from April 1989 to November 1994. A 6 page computer print-out by ICD9 code provided a listing of the patient’s medical number. The computer program was unable to group patients separately with multiple ICD9 codes assigned to the MR. It is assumed that patients did have multiple ICD9 codes assigned to the MR. The Medical Record Department was responsible for the handling of the MRs and all MRs were reviewed within their department to protect patient confidentiality. Review of the MRs was limited to the information relating to the hospital admission weight. No birth or dietary intake history was available.

A questionnaire was developed as the data collection tool for review of the MR (Appendix 2). A pilot questionnaire was tested prior to commencing the study. This helped to determine the sequence of questions and organisation of the questionnaire based on the MR layout. A reference number was assigned to each MR.

3.2.1 Data Source

The MR provides information including the presenting symptoms, the results of diagnostic investigations, the diagnosis itself and the record of treatment (DoH, 1994a). A child’s hospital admission weight may also be recorded in the MR. The concise documentation by the health provider will assist in defining the disease, operation or treatment associated with the illness. The information regarding clinical care provided during the hospitalisation is converted to an assigned ICD code. The clarity of terminology used within the MR enhances the correctness of assigned codes. Data was collected from the MR of hospital discharged paediatric patients with an age range of 0 to 4 years of age. Eight children with a diagnosis of prematurity were removed from the study since prematurity can affect growth (McLaren, 1991).
Weight-for-age is a tool used to assess a child’s nutrition and growth status. The child’s weight is plotted against age on the appropriate growth chart for gender. In this study, weight-for-age was used as the reference measurement. The hospital admission weight was compared with the 50th centile on the Growth and Development Record (Appendix 3 and 4) for gender and age. Determination of malnutrition was based on the percentage range as defined by Gomez classification (WHO, 1979):

Malnutrition of mild degree (263.1)
- malnutrition of first degree according to Gomez classification (weight-for-age 75% to less than 90% standard)

Malnutrition of moderate degree (263.0)
- malnutrition of second degree according to Gomez classification (weight-for-age 60% to less than 75% standard)

Other severe protein-calorie malnutrition (262)
- malnutrition of third degree according to Gomez classification (weight-for-age less than 60% standard)
3.2.2 Data Origin

After the MR leaves the hospital ward, it is forwarded to the Medical Coding Department. The medical coder reviews the MR for diagnosis, operation or treatment as noted within the MR. From the Medical Coding Department, the MR is then processed through the Medical Records Department. This department will examine the MR for completeness and advise any personnel of incomplete or inappropriate documentation. The MR is then filed in the Medical Records Department. Fig. 25 illustrates the MR flow from hospital ward to medical record filing.

Fig. 25 Flow Chart of the Medical Record from Hospital Ward to Medical Record Filing

3.2.3 Statistical Analysis

All analyses were performed using Microsoft Excel (version 5.0, 1995) and Statistical Package for the Social Sciences ((SPSS) version 6.1, 1996). Descriptive statistics (e.g., percentages) summarised the data. Significance testing for the difference between means (Z-critical (-1.645, 1.645)) was used to test hypotheses.
The children's ages were converted to years (Y) for analysis. Children younger ≤ 1Y of age were grouped into categories representing a three month grouping. The age range used in the study was: younger children; ≤ 1Y, whilst older children; >1Y (1Y-4Y). Table 15 lists the ages converted to years for analysis.

Table 15  Ages Converted to Years

<table>
<thead>
<tr>
<th>Ages By Month</th>
<th>Conversion (Y)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-3m</td>
<td>≤ 0.25Y</td>
</tr>
<tr>
<td>4-6m</td>
<td>&gt; 0.25 ≤ 0.5Y</td>
</tr>
<tr>
<td>7-9m</td>
<td>&gt; 0.5 ≤ 0.75Y</td>
</tr>
<tr>
<td>10-12m</td>
<td>&gt; 0.75 ≤ 1.0Y</td>
</tr>
</tbody>
</table>
A child’s hospital admission weight-for-age was allocated a degree of malnutrition using Gomez classification (WHO, 1979). Hospital admissions without a recorded weight-for-age nor a date of birth were recorded as such. The remaining hospital admissions appropriate for age and gender were allocated together (CDC, 1993). Table 16 lists the allocation of the hospital admission weight.

Table 16 Allocation of Hospital Admission Weights

1. Malnutrition of mild degree (263.1)
   • malnutrition of first degree according to Gomez classification (weight-for-age 75% to less than 90% standard)

2. Malnutrition of moderate degree (263.0)
   • malnutrition of second degree according to Gomez classification (weight-for-age 60% to less than 75% standard)

3. Other severe protein-calorie malnutrition (262)
   • malnutrition of third degree according to Gomez classification (weight-for-age less than 60% standard)

4. Appropriate Weight-for-Age
   • weight-for-age was appropriate for gender and age (weight-for-age ± 10% of standard)

5. No Recorded Weight
   • no recorded hospital admission weight

6. No Recorded Weight or Date of Birth
   • no recorded hospital admission weight or date of birth
3.3 Results

3.3.1 Admission Weights by Degree of Malnutrition

There were no MRs coded PEM (262, 263.0 and 263.1). There were no MRs coded obesity (278.0). The number of MRs assigned ICD9 codes were: 783.2, 2; 783.3, 104; 783.4, 72; V61.2, 24. Of the 202 MRs, 104 admission weights were allocated a degree of malnutrition. Weights were allocated mild malnutrition (263.1), moderate malnutrition (263.0) and severe malnutrition (262): 45% (47); 39% (41); and 15% (16), respectively. Fig 26 shows by ICD9 code the allocation of hospital admission weights. Table 17 shows allocation of hospital admission weight by ICD9 code and degree of malnutrition.
Table 17 Allocation of Hospital Admission Weights by ICD9 Code

<table>
<thead>
<tr>
<th>ICD9 Code</th>
<th>No Recorded Weight</th>
<th>Appropriate Weight for Age</th>
<th>Mild Malnutrition (263.1)</th>
<th>Moderate Malnutrition (263.0)</th>
<th>Severe Malnutrition (262)</th>
<th>Other weight or date of birth</th>
</tr>
</thead>
<tbody>
<tr>
<td>262, 263.0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>and 263.1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>278.0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>783.2</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>783.3</td>
<td>23</td>
<td>30</td>
<td>23</td>
<td>19</td>
<td>8</td>
<td>1</td>
</tr>
<tr>
<td>783.4</td>
<td>14</td>
<td>7</td>
<td>20</td>
<td>22</td>
<td>8</td>
<td>1</td>
</tr>
<tr>
<td>V61.2</td>
<td>9</td>
<td>9</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>48</td>
<td>46</td>
<td>47</td>
<td>41</td>
<td>16</td>
<td>4</td>
</tr>
</tbody>
</table>

3.3.2 Measure of Malnutrition and Age

83% (39) cases of mild malnutrition were $\leq 1$Y. More children $\leq 0.5$Y were allocated mild malnutrition than $> 0.5$Y; 62% (29) and 21% (10), respectively. Fig. 27 shows the number of children with a degree of malnutrition and age.

Feeding difficulties and mismanagement (783.3) and lack of normal physiological development (783.4) had the highest number of children allocated a degree of malnutrition $\leq 0.5$Y; 48 and 27, respectively. Table 18 shows the degree of malnutrition by age and ICD9 code.
Fig. 27 Number of Children with a Degree of Malnutrition by Age

Number of Children with a Degree of Malnutrition

- Mild Malnutrition
- Moderate Malnutrition
- Severe Malnutrition

Age Categories:
- ≤ 0.25 Y
- > 0.25 ≤ 0.5 Y
- > 0.5 ≤ 0.75 Y
- > 0.75 ≤ 1.0 Y
- > 1 Y
Using the number of cases allocated a degree of malnutrition for ICD9 codes 783.3 and 783.4, the following hypothesis was tested: the percentage of children allocated a degree of malnutrition \( \leq 0.5 \text{Y} \) of age is equal to the percentage of children allocated a degree of malnutrition \( > 0.5 \text{Y} \) of age. This age range was selected because of the high number of MRs assigned \( < 1 \text{Y} \). (Within the \( < 1 \text{Y} \), more cases of malnutrition were allocated \( \leq 0.5 \text{Y} \) of age). Table 19 shows the summary of the results.
Table 19  Hospital Admission Weights Allocated a Degree of Malnutrition by Age

<table>
<thead>
<tr>
<th>Degree of Malnutrition</th>
<th>≤ 0.5Y</th>
<th>&gt; 0.5Y</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mild</td>
<td>29%</td>
<td>15%</td>
<td>% ≤ 0.5Y</td>
</tr>
<tr>
<td>(263.1)</td>
<td>(29)</td>
<td>(18)</td>
<td>significantly higher than % of &gt;0.5Y (z=2.4)</td>
</tr>
<tr>
<td>Moderate</td>
<td>31%</td>
<td>10%</td>
<td>% ≤ 0.5Y</td>
</tr>
<tr>
<td>(263.0)</td>
<td>(31)</td>
<td>(10)</td>
<td>significantly higher than % of &gt;0.5Y (z=2.5)</td>
</tr>
<tr>
<td>Severe</td>
<td>13%</td>
<td>2.0%</td>
<td>% ≤ 0.5Y</td>
</tr>
<tr>
<td>(262)</td>
<td>(13)</td>
<td>(2)</td>
<td>significantly higher than % &gt;0.5Y (z=1.2)</td>
</tr>
</tbody>
</table>

* Numbers in parentheses represents the number of hospital admission weights
There was more mild to moderate malnutrition than severe malnutrition (p<0.05).

\[
\text{Mild Malnutrition} \quad > \quad \text{Severe Malnutrition} \quad (z=8.1)
\]

\[
\text{Moderate Malnutrition} \quad > \quad \text{Severe Malnutrition} \quad (z=6.7)
\]

\[
\text{Mild and Moderate Malnutrition} \quad > \quad \text{Severe Malnutrition} \quad (z=6.8)
\]

Figs. 28 through 31 further illustrates the different degrees of malnutrition by the various age ranges.
Fig. 29 Hospital Admission Weights Allocated a Degree of Malnutrition, Five to Eight Weeks of Age

Fig. 30 Hospital Admission Weights Allocated a Degree of Malnutrition, Nine to Twelve Weeks of Age
3.3.3 Measure of Malnutrition by Gender

Table 20 Number of Medical Records of Males/Females Allocated Degree of Malnutrition by ICD9 Codes

<table>
<thead>
<tr>
<th>ICD9 Code</th>
<th>Mild Malnutrition (263.1)</th>
<th>Moderate Malnutrition (263.0)</th>
<th>Severe Malnutrition (262)</th>
</tr>
</thead>
<tbody>
<tr>
<td>M F</td>
<td>M F</td>
<td>M F</td>
<td>M F</td>
</tr>
<tr>
<td>783.3</td>
<td>14 9</td>
<td>7 12</td>
<td>1 7</td>
</tr>
<tr>
<td>783.4</td>
<td>11 9</td>
<td>9 13</td>
<td>2 6</td>
</tr>
<tr>
<td>Total</td>
<td>25 18</td>
<td>16 25</td>
<td>3 13</td>
</tr>
</tbody>
</table>
Table 20 shows the gender distribution by ICD9 codes and degree of malnutrition. By the degree of malnutrition, there were no cases allocated to ICD9 783.2 and V61.2 (4) was too small for analysis. However, using ICD9 codes 783.3 and 783.4, the following hypothesis was tested: the percentage of females allocated a degree of malnutrition is equal to the percentage of males allocated a degree of malnutrition. The hypothesis was rejected with a $z=1.28$ at a $p<0.05$ level. The $z$ score indicates more females were malnourished.

The null hypothesis was tested: a degree of malnutrition is independent of gender. It was rejected with a Chi-square value of 7.3 which is significant at a $p<0.05$ level. The Chi-square value shows that more females were allocated a degree of malnutrition.

3.3.4 Suspected Malnutrition in Children with No Recorded Weights

Twenty-four percent (48) of the children had no recorded weights in the MR at hospital admission. The ICD9 code 783.2 had only 2 no recorded weights and is excluded from analysis. Of the no recorded weights for ICD9 codes 783.3 (23), 783.4 (14) and V61.2 (9), if the pattern of malnutrition in these children is similar to that of the children with recorded admission weights allocated a degree of malnutrition, there are 30 additional suspected cases of malnutrition. Table 21 shows by ICD9 code and degree of malnutrition, the additional suspected cases of malnutrition from the no recorded weights. There is more inferred mild to moderate malnutrition than severe malnutrition. Table 22 shows by ICD9 codes and age the no recorded weights. ≤ 0.25Y had the highest number of no recorded weights under ICD9 code 783.3.
Table 21  Number of Suspected Malnutrition from No Recorded Hospital Admission Weights by ICD9 Code

<table>
<thead>
<tr>
<th>Degree of Malnutrition</th>
<th>783.3</th>
<th>783.4</th>
<th>V61.2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mild</td>
<td>6.7</td>
<td>7</td>
<td>1.2</td>
</tr>
<tr>
<td>Moderate</td>
<td>4.6</td>
<td>8.6</td>
<td>0</td>
</tr>
<tr>
<td>Severe</td>
<td>0.8</td>
<td>1.1</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>12.1</td>
<td>16.7</td>
<td>1.2</td>
</tr>
</tbody>
</table>

Table 22  Number of No Recorded Weights by Age and ICD9 Codes

<table>
<thead>
<tr>
<th>Age</th>
<th>783.3</th>
<th>783.4</th>
<th>V61.2</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ 0.25Y</td>
<td>20</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>&gt; 0.25 ≤ 0.5Y</td>
<td>0</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>&gt; 0.5 ≤ 0.75Y</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>&gt; 0.75 ≤ 1.0Y</td>
<td>0</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>&gt; 1Y</td>
<td>2</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>
3.4 Discussion

No MRs were coded PEM (262, 263.0 and 263.1) or obesity (278.0). Without coding the disease codes for PEM or obesity, it would be assumed that these conditions are not found. As a consequence of the lack of data, PEM or obesity may not be recognised as an immediate health focus for this population. The assessment of severity of these conditions and their impact on a child's growth and development would not be considered a health target. Thus, this would not become a monitor for health appraisal. However, Allred (1996) states the prevalence of malnutrition is a critical health problem among all ages. Malnutrition does exist. Malnutrition was not identified in the disease ICD9 codes (262, 263.0 and 263.1) but in non-disease ICD9 codes (783.3, 783.4 and V61.2). Non-disease ICD9 codes are signs or symptoms that can be coded to support a disease. In this population, PEM is hidden in the symptom codes.

Seventy-two percent (75) of the admission weights allocated a degree of malnutrition were \( \leq 0.5 Y \). Fifty-seven percent (59) of the children allocated a degree of malnutrition were \( \leq 0.25 Y \). By a degree of malnutrition, more children in this age range were allocated mild, moderate and severe: 21, 26 and 12, respectively. As malnutrition was seen in the \( \leq 0.25 Y \), there may be contributory factors influencing the malnutrition.

Birthweight is an indicator of an infants nutritional status. Infants born with low birthweight (<2500g) have an increased risk of mortality and morbidity. The long-term growth potential in these infants has been shown to have weight and height deficits in early childhood (Strauss et al, 1997; Kellcher et al, 1993). In England in 1995, there were 44,851 infants born with low birthweight and of that total, 16,945 were in the South East (ONS, 1997c). Table 23 shows the break down of low birthweights (<2500g) and very low birthweights (<1500g) for England and the South East standard region (ONS, 1997c).
Malnutrition was seen in the $\leq 0.25Y$ and factors that can influence low birthweight are the mothers prepregnancy weight, her poor gestational nutrition and smoking habits.

Table 23 Number of 1995 Births, England and South East Region, Less Than 2500 grams

<table>
<thead>
<tr>
<th></th>
<th>Under 1500 g</th>
<th>1500g - 1999 g</th>
<th>2000g - 2499 g</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>% of total births</td>
<td>% of total births</td>
<td>% of total births</td>
</tr>
<tr>
<td>England</td>
<td>7,180</td>
<td>9,132</td>
<td>28,539</td>
</tr>
<tr>
<td></td>
<td>(1.2)</td>
<td>(1.5)</td>
<td>(4.7)</td>
</tr>
<tr>
<td>South East</td>
<td>2,823</td>
<td>3,392</td>
<td>10,730</td>
</tr>
<tr>
<td></td>
<td>(1.2)</td>
<td>(1.4)</td>
<td>(4.5)</td>
</tr>
</tbody>
</table>

Muscati (1988) states that babies born to underweight mothers have an increased incidence of lower birthweights and prematurity. A woman with a poor history of nutrition will already have low nutrient stores. Church et al (1991) comments that undernourished women are likely to have babies with low birthweights because of low body stores of nutrients. This poor nutritional status could affect the foetus's ability to sustain adequate access to needed nutrients. Growth failure can begin immediately after birth because of poor infant nutrient stores (Lindsey et al, 1993). Undernutrition prior to pregnancy can affect the infants birthweight and future growth (Barker, 1994; Frank et al, 1994; Lindsey et al, 1993). No antenatal history was obtained from the study, however, data from DoH (1997) summarises the BMI status of women aged 16Y - 54Y. Table 24 shows the BMI status of women.
DoH (1997) reported that of young women (16-24Y), 17.2% had a BMI ≤ 20. Infant Feeding 1990 (OPCS, 1992) reported that 7% of the mothers surveyed (5413) were aged 20Y or less. A low BMI indicates a compromised nutritional status in the mother.

Undernutrition prior to pregnancy can influence early development leading to low birthweight (Hackman et al, 1983). Early studies (Graham, 1968; Widdowson, 1968) looking at the impact poor nutritional status had on pregnancy outcomes during the Second World War, clearly showed that a nutritional insult to a woman prior to or during pregnancy adversely effects the infant. Strauss et al (1997) in a study of 818 preterm infants, concluded that mothers prepregnancy weight and prenatal care were instrumental factors to infant outcome. A low BMI (<20) during childbearing years becomes a health issue since prepregnancy weight influences infant outcome. A low prepregnancy weight may have contributed to the malnutrition in the children ≤ 0.25Y of age in this hospital.

If the woman’s diet during pregnancy is nutrient deficient, this further increases the risk of inadequate nutrition to the foetus. Mothers weight gain during pregnancy is associated with birthweight. It is not only the total weight gain that is important, but also the pattern of weight gain during pregnancy (Frisancho et al, 1983). A 3 pound weight gain is acceptable during the first trimester, whereas, later a 3 pound weight gain per month is appropriate during the second and third trimester (Thomas, 1994; Rolfes et al, 1990). A woman's

Table 24 1995 BMI Status of Women in England by Age

<table>
<thead>
<tr>
<th></th>
<th>16 - 24</th>
<th>25 - 34</th>
<th>35 - 44</th>
<th>45 - 54</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMI</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>20 or under</td>
<td>17.2</td>
<td>9.0</td>
<td>5.6</td>
<td>3.9</td>
</tr>
<tr>
<td>Over 20 - 25</td>
<td>56.4</td>
<td>53.1</td>
<td>46.8</td>
<td>38.2</td>
</tr>
<tr>
<td>Over 25 - 30</td>
<td>18.5</td>
<td>24.7</td>
<td>31.0</td>
<td>36.3</td>
</tr>
<tr>
<td>Over 30</td>
<td>8.0</td>
<td>13.3</td>
<td>16.6</td>
<td>21.5</td>
</tr>
</tbody>
</table>
nutrient need increases during pregnancy. The woman's need for calories (second and third trimester), protein, vitamins and minerals increase throughout the pregnancy (DoH, 1991). The National Academy of Sciences 1990 (United States) has developed guidelines for weight gain during pregnancy based on prepregnancy BMI. An increased gain in weight is suggested for women with a BMI < 20 because of possible inadequate nutrient stores. Table 25 shows the guidelines from The National Academy of Sciences for weight gain during pregnancy based on prepregnancy BMI. The woman beginning pregnancy with a low BMI (<20) and a low weight gain during pregnancy may have contributed to the malnutrition seen in this hospital. The focus on body shape and image even during pregnancy, can lead to a negative foetal outcome. Undernutrition in the childbearing years is more of a health problem than obesity in England.

Table 25 Recommended Weight Gain Based on Prepregnancy BMI

<table>
<thead>
<tr>
<th>Prepregnancy BMI</th>
<th>Weight Gain (kg)</th>
<th>Weight Gain (lb)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMI &lt; 19.8</td>
<td>12.5 - 18</td>
<td>28 - 40</td>
</tr>
<tr>
<td>BMI 19.8 - 26</td>
<td>11.5 - 16</td>
<td>25 - 35</td>
</tr>
<tr>
<td>BMI &gt; 26 - 29</td>
<td>7 - 11.5</td>
<td>15 - 25</td>
</tr>
<tr>
<td>BMI &gt; 29</td>
<td>6</td>
<td>at least 15</td>
</tr>
</tbody>
</table>
In the United States, the Women, Infants and Children (WIC) Supplemental Food Program provides nutrition education and monitoring throughout the pregnancy. Montgomery et al. (1997) comments that one of the goals of the WIC program was to decrease by 20% the low birthweight among participants with less than 12 years of education. She concludes that WIC has had a significant effect on reducing low birthweight, increasing head circumference growth, decreasing foetal mortality and perhaps neonatal mortality. This conclusion is also supported by Owen et al (1997).

Studies (Batten, 1996; Haste et al, 1990; Muscati et al, 1988; Kramer, 1987) have shown that smoking during pregnancy can decrease birthweight, decrease birth length and decrease head circumference (> 10 cigarettes per day). The study was unable to obtain data relating to maternal smoking habits, however, smoking can be a contributory factor to low birthweights. Haste et al (1990) suggests that smoking reduces food intake, thereby causing reduced weight gain, a factor known to affect birthweight. They continue to discuss that in Britain, women in the lower socio-economic groups (IV and V) smoke more than those in the higher social classes (I and II). It was found from their study that women in the higher social classes (I and II) who did not smoke had a higher nutrient intake than women who smoked in the lower social classes (IV and V).

Of the women surveyed (5118) who smoked before their pregnancy (ONS, 1997b), the lower social classes (IV and V) had a higher percentage of women who continued to smoke during their pregnancy; 40% to 28% and 52% to 37%, respectively. In the higher social classes (I and II), more women stopped smoking during the pregnancy; 14% to 7% and 22% to 12%, respectively. This is supported by the Infant Feeding 1995 (ONS, 1997b). Batten (1996) summarises that women who smoke during pregnancy are generally young (16 - 24Y), of lower social class, lower education levels and have a partner that smokes.
Fifty percent (104) of the MRs were assigned feeding difficulties and mismanagement (783.3). This was the highest number of MRs assigned a specific ICD9 code. Even though this hospital was an unlikely representative of all hospitals in the South East, it still provided a picture of hospital admissions for feeding problems. Because of the age range of the hospital admissions allocated a degree of malnutrition, a low birthweight could be a contributory factor to the malnutrition rather than the feeding problem. Providing adequate energy, protein and other nutrients needed by the malnourished infant would be the challenge for nutritional intervention. ICD coding reflects the feeding problem rather than the malnutrition. It is likely that ICD9 code 783.3 is hiding malnutrition.

A smaller number of children > 0.5Y were allocated a degree of malnutrition. However, the infants developmental readiness for solid foods is not until around 3 months (DoH, 1994c) and the too early introduction can result in feeding problems (Wilcock, 1995). Without a dietary history, the study was unable to review the reasons for difficulty in weaning. Kleinman (1994) suggests that feeding problems can be minimised if parents are aware of feeding readiness. He discusses that eating readiness depends on a variety of factors, such as, infant’s growth rate, nutritional needs and the rate of physiological and neurological maturation.

Thirty-six percent (72) of MRs were coded lack of normal physiological development (783.4). The study was unable to obtain the number of MRs assigned both ICD9 codes 783.3 and 783.4, however, it is possible to assume that some children experiencing feeding problems were also experiencing poor growth and were coded both 783.3 and 783.4. The challenge is in identifying the underlying cause of the malnutrition. Nutritional intervention will improve the outcome resulting from the malnutrition. Children suffering from FTT often respond favourably to nutritional intervention (Peterson, 1993). In theory, ICD9 code 783.4 is the most likely ICD9 code hiding malnutrition. If this is the case, ICD9 code 783.4 is hiding the prevalence of malnutrition because of a lack of anthropometry and by title.
There was no evidence of obesity found in the hospital data. From the admission weights, no children were admitted with a weight-for-age > 110% of standard (CDC, 1993). However, as this hospital was an unlikely representative of all hospitals in the South East, national ICD9 data showed obesity was not a health problem in young children. It is possible that obesity can occur from feeding problems, such as, overfeeding or food selections high in sweets but hospital data did not reveal obesity. ICD9 code 783.3 is not hiding obesity, however, it is likely that malnutrition is hidden in this ICD9 code.

Studies (MAFF, 1992; Black et al, 1983; McKillop et al, 1982) have shown that males have a greater energy intake than females. Seward et al (1984) states that weight gain in males is less than females during the first 2 months of life. They suggest that females weight gain will decrease after the first 3 months of life. Feeding problems in males could result in a decrease in weight gain sooner than in females. There were more females allocated a degree of malnutrition than males in this study. Are social attitudes concerning obesity influencing the feeding patterns of infants?

Stein et al (1989) conducted a study of the relationship between mothers experiencing bulimia nervosa and their children's eating habits. The authors identified 17 mothers who had children; 5 mothers with children (3 males; 3 females) ranging in age from 15 months to 6 years. Their findings showed that the mothers psychiatric disorder influenced the child's eating habits and growth. Of the younger children (15 months to 6 years), FTT resulted because of a lack of food in the house and the mothers undue concern about the child's shape and weight. They further identified an increase in physical harm to the children during the mothers period of overeating and vomiting.

McCann et al (1994) studied children (10 males; 16 females) suffering from FTT and their mother's attitude towards the child's weight and body shape. They found that despite the children suffering from FTT, 58% (15 mothers) believed that their child was at a normal
weight or just slightly underweight. The authors also found that 30% (8 mothers) admitted to restricting foods (sweets) because they considered the foods fattening. It appears that the obsession with weight and body shape is affecting feeding patterns of children both males and females.

Twenty-four percent (48) of MRs had no recorded admission weight. ICD9 code 783.3 had 20 children $\leq 0.25$Y with no recorded admission weight. Edwards et al (1990) suggest that weight during the first 4 to 8 weeks of age is a strong indicator of the infants nutritional status and growth. Tanner (1989) states that obtaining accurate measurements in infants can be difficult, but is essential for growth monitoring. Growth should be monitored from birth until at least 3 years of age (Bithoney et al, 1992; McLaren et al, 1991; Tanner, 1989) and accurately recorded for assessment (Bunting et al, 1997; Reilly, 1996; Hall, 1989). Davidson et al (1996) identified from a MR review of 180 nursing notes that only 31% documented a weight and 7% a height. Lennard-Jones et al (1995) conducted a survey of 450 nurses and 319 junior doctors in 70 UK hospitals to determine what they perceived as important as part of nutritional assessment. Their finding showed that 60% of the professionals survey considered weight to be unimportant as part of the nutritional assessment. By not identifying and recognising malnutrition, the prevalence of malnutrition is apparently low and the value of intervention and treatment can not be assessed.
3.5 Conclusion

Malnutrition does exist in the 0 - 4Y population. The amount of malnutrition is not recognised because it is hidden in the non-disease ICD9 codes. Unless the amount of malnutrition can be quantified as a disease, its’ prevalence will never be accurately assessed or acknowledged. Malnutrition will continue to go unrecognised and children suffering from malnutrition will go without appropriate nutritional intervention. Based on inaccurate health evidence, health education advice may be inappropriate.

Most of the malnutrition was found in the ≤ 0.25Y. The likelihood is that the malnutrition, as seen in this age range, could be avoided or less severe, if the foetus was not exposed to negative maternal influences. The issue of undernutrition, as it relates to body shape and image in the childbearing years, can impact on pregnancy outcome. Undernutrition is more of a health problem than obesity in the childbearing years. Health education needs to focus on the issue of undernutrition and its’ impact on health outcome.

No childhood obesity was found from the hospital admission weights. From the lack of MRs assigned ICD9 code 278.0, obesity is not a health problem in this age range. However, the physician may choose to handle obesity in young children (0 - 4Y) through the paediatric out-patient clinic rather than a hospitalisation. This requires further investigation.

The high number of MRs assigned feeding difficulties and mismanagement (783.3) in the ≤ 0.25Y of age is a health problem. Undernutrition, whether pre-pregnancy or during pregnancy, can lead to low birthweights. Malnutrition resulting from low birthweights can affect infant growth. Further research is needed to investigate the cause of feeding problems in young babies.
Medical record documentation was poor which leads to an inaccurate assessment of malnutrition and nutritional intervention. The lack of obtaining and recording anthropometric measurements could result in a deficiency of care. Accurately identifying children at nutritional risk is based on indicators of nutritional status, such as weight-for-age or BMI, relative to a standard reference. Cut-off points help to mark the boundaries of what is acceptable and the probability of what is impaired (Johnston, 1987). Malnourished children will not receive the appropriate nutritional intervention because of a lack of documentation in the MR. The effectiveness of the nutritional intervention can not be measured without monitoring change. Malnutrition could be hidden within the no recorded weights. Without all pertinent information to assess the health status of the child, malnutrition will continue to go undetected.
Chapter Four
Analysis of Data Derived From International Classification of Diseases and Medical Records

4.1 Introduction

In the previous chapter, it was found that children with malnutrition were allocated ICD9 symptom codes. National ICD9 figures for 1993 in England, showed a small number of MRs assigned PEM (262, 263.0 and 263.1), obesity (278.0) and parent-child relations (V61.2). However, feeding difficulties and mismanagement (783.3) and lack of normal physiological development (783.4) had a high number of MRs assigned these codes. The number of MRs assigned ICD9 codes 783.3 and 783.4 was: 3224; and 4440, respectively. It appears the national figures grossly underestimate the amount of malnutrition.

4.2 Methods

4.2.1 Data Source

In order to evaluate the numbers of malnourished children within the national ICD9 codes 783.3 and 783.4, the proportion of malnourished children identified by the hospital study was used. In the Surrey hospital, of the children coded ICD9 783.3 and allocated a degree of malnutrition: 29% mild malnutrition; 24% moderate malnutrition; and 10% severe malnutrition. Of those coded ICD9 783.4 and allocated a degree of malnutrition: 35% mild malnutrition; 39% moderate malnutrition; and 14% severe malnutrition.

However, the age pattern of hospital data differed from national figures. There was a higher proportion of young infants. An additional analysis was performed taking this into account.
4.2.2 Statistical Analysis

All analyses were performed using Microsoft Excel (version 5.0, 1995) and Statistical Package of the Social Sciences ((SPSS) version 6.1, 1996). Descriptive statistics (eg percentages) summarised the data. Mann Whitney U-test was used to compare two groups for ordinal variables. By default, for the Mann Whitney U-test, SPSS rounds up all p-values to 4 decimal places. So any resulting p-value between 0 and 0.00005 is displayed as 0.0000, and can only be accurately recorded as p<0.00005.

4.3 Results

Five thousand nine hundred and thirty-five (5935) additional cases of suspected malnutrition could be inferred from ICD9 codes 783.3 and 783.4. ICD9 code 783.3 showed a 63% (2029) increase in additional suspected cases of malnutrition. ICD9 code 783.4 showed a 88% (3906) increase in additional suspected cases of malnutrition. Table 26 shows the suspected numbers of a degree of malnutrition from ICD9 codes 783.3 and 783.4.
<table>
<thead>
<tr>
<th>Degree of Malnutrition</th>
<th>783.3</th>
<th>783.4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mild</td>
<td>934</td>
<td>1554</td>
</tr>
<tr>
<td>(263.1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moderate</td>
<td>773</td>
<td>1731</td>
</tr>
<tr>
<td>(263.0)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Severe</td>
<td>322</td>
<td>621</td>
</tr>
<tr>
<td>(262)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>2029</td>
<td>3906</td>
</tr>
</tbody>
</table>

Table 26 Additional Suspected Cases of Malnutrition from ICD9 Codes 1993, England
The Mann Whitney U-test was used to compare national data, ICD9 codes 783.3 and 783.4, for severity scale of malnutrition (p <0.05). This statistically significant p<0.00005 value indicates a comparative increase of severity in 783.4 Table 27 summaries the results.

Table 27 National Data, ICD9 Codes 783.3 and 783.4 by Degree of Malnutrition, 1993

<table>
<thead>
<tr>
<th>Degree of Malnutrition</th>
<th>783.3</th>
<th>783.4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appropriate Weight</td>
<td>1195</td>
<td>534</td>
</tr>
<tr>
<td></td>
<td>(37%)</td>
<td>(12%)</td>
</tr>
<tr>
<td>Mild</td>
<td>934</td>
<td>1554</td>
</tr>
<tr>
<td>(263.1)</td>
<td>(29%)</td>
<td>(35%)</td>
</tr>
<tr>
<td>Moderate</td>
<td>773</td>
<td>1731</td>
</tr>
<tr>
<td>(263.0)</td>
<td>(24%)</td>
<td>(39%)</td>
</tr>
<tr>
<td>Severe</td>
<td>322</td>
<td>621</td>
</tr>
<tr>
<td>(262)</td>
<td>(10%)</td>
<td>(14%)</td>
</tr>
<tr>
<td>Total</td>
<td>3224</td>
<td>4440</td>
</tr>
</tbody>
</table>
Fifty-six percent (1808) additional cases of suspected malnutrition by age could be inferred from ICD9 code 783.3. By degree of malnutrition, the additional cases of suspected malnutrition were: 25% mild malnutrition; 21% moderate malnutrition; and 10% severe malnutrition. The age range of < 1Y remained high for feeding difficulties and mismanagement (783.3). There were ages from hospital data that did not have ICD9 783.3 assigned, however, national figures show this ICD9 code assigned in the 0 - 4Y. Table 28 through 30 summarise the results.

Table 28 Additional Cases of Suspected Mild Malnutrition by Age and ICD9 Code, 783.3, 1993

<table>
<thead>
<tr>
<th></th>
<th>National Data</th>
<th>Hospital Data</th>
<th>Hospital Percentages</th>
<th>Suspected Malnutrition</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 1Y</td>
<td>2880</td>
<td>22</td>
<td>28%</td>
<td>792</td>
</tr>
<tr>
<td>1Y</td>
<td>200</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2Y</td>
<td>64</td>
<td>1</td>
<td>1.25%</td>
<td>8</td>
</tr>
<tr>
<td>3Y</td>
<td>56</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4Y</td>
<td>24</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>3224</td>
<td>23</td>
<td></td>
<td>800</td>
</tr>
</tbody>
</table>
Table 29  Additional Cases of Suspected Moderate Malnutrition by Age and ICD9 Code, 783.3, 1993

<table>
<thead>
<tr>
<th></th>
<th>National Data</th>
<th>Hospital Data</th>
<th>Hospital Percentages</th>
<th>Suspected Malnutrition</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 1Y</td>
<td>2880</td>
<td>19</td>
<td>24%</td>
<td>691</td>
</tr>
<tr>
<td>1Y</td>
<td>200</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2Y</td>
<td>64</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3Y</td>
<td>56</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4Y</td>
<td>24</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>3224</td>
<td>19</td>
<td></td>
<td>691</td>
</tr>
</tbody>
</table>

Table 30  Additional Cases of Suspected Severe Malnutrition by Age and ICD9 Code, 783.3, 1993

<table>
<thead>
<tr>
<th></th>
<th>National Data</th>
<th>Hospital Data</th>
<th>Hospital Percentages</th>
<th>Suspected Malnutrition</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 1Y</td>
<td>2880</td>
<td>9</td>
<td>11%</td>
<td>317</td>
</tr>
<tr>
<td>1Y</td>
<td>200</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2Y</td>
<td>64</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3Y</td>
<td>56</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4Y</td>
<td>24</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>3224</td>
<td>9</td>
<td></td>
<td>317</td>
</tr>
</tbody>
</table>
Forty-five percent (2018) additional cases of suspected malnutrition by age could be inferred from ICD9 code 783.4. By degree of malnutrition, the additional cases of suspected malnutrition were: 17% mild malnutrition; 18% moderate malnutrition; and 11% severe malnutrition. The age range of ≤ 1Y remained high for lack of normal physiological development (783.4). There were ages from hospital data that did not have ICD9 783.4 assigned, however, national figures show this ICD9 code assigned in the 0 - 4Y. Table 31 through 33 summarise the results.

<table>
<thead>
<tr>
<th>Age</th>
<th>National Data</th>
<th>Hospital Data</th>
<th>Hospital Percentages</th>
<th>Suspected Malnutrition</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 1Y</td>
<td>2140</td>
<td>13</td>
<td>23%</td>
<td>492</td>
</tr>
<tr>
<td>1Y</td>
<td>1208</td>
<td>1</td>
<td>1.75%</td>
<td>211</td>
</tr>
<tr>
<td>2Y</td>
<td>476</td>
<td>2</td>
<td>3.5%</td>
<td>17</td>
</tr>
<tr>
<td>3Y</td>
<td>368</td>
<td>2</td>
<td>3.5%</td>
<td>13</td>
</tr>
<tr>
<td>4Y</td>
<td>248</td>
<td>2</td>
<td>3.5%</td>
<td>9</td>
</tr>
<tr>
<td>Total</td>
<td>4440</td>
<td>20</td>
<td></td>
<td>742</td>
</tr>
</tbody>
</table>
Table 32 Additional Cases of Suspected Moderate Malnutrition by Age and ICD9 Code, 783.4, 1993

<table>
<thead>
<tr>
<th>Age</th>
<th>National Data</th>
<th>Hospital Data</th>
<th>Hospital Percentages</th>
<th>Suspected Malnutrition</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 1Y</td>
<td>2140</td>
<td>19</td>
<td>33%</td>
<td>706</td>
</tr>
<tr>
<td>1Y</td>
<td>1208</td>
<td>4</td>
<td>7%</td>
<td>85</td>
</tr>
<tr>
<td>2Y</td>
<td>476</td>
<td>2</td>
<td>3.5%</td>
<td>17</td>
</tr>
<tr>
<td>3Y</td>
<td>368</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4Y</td>
<td>248</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>4440</td>
<td>25</td>
<td></td>
<td>808</td>
</tr>
</tbody>
</table>

Table 33 Additional Cases of Suspected Severe Malnutrition by Age and ICD9 Code, 783.4, 1993

<table>
<thead>
<tr>
<th>Age</th>
<th>National Data</th>
<th>Hospital Data</th>
<th>Hospital Percentages</th>
<th>Suspected Malnutrition</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 1Y</td>
<td>2140</td>
<td>7</td>
<td>12%</td>
<td>257</td>
</tr>
<tr>
<td>1Y</td>
<td>1208</td>
<td>1</td>
<td>1.75%</td>
<td>211</td>
</tr>
<tr>
<td>2Y</td>
<td>476</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3Y</td>
<td>368</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4Y</td>
<td>248</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>4440</td>
<td>8</td>
<td></td>
<td>468</td>
</tr>
</tbody>
</table>
Fifty percent (3826) additional suspected cases of malnutrition could be inferred from ICD9 codes 783.3 and 783.4. Most of the additional cases of malnutrition were ≤ 1Y. No extra cases of ICD9 code 278.0 (obesity) was identified unless hospital chosen is an unlikely representative.
4.4 Discussion

The prevalence of malnutrition from this hospital data appears to be grossly underestimated. Potentially 63% of these MRs could be coded 783.3 and 88% of these coded 783.4. This represents .8% of paediatric hospital admissions ((738,477) DoH, 1995c) for 1993 in England that could infer additional suspected cases of malnutrition. The hospital data did not have children’s age with specific ICD codes, whereas, there were children in national figures, it is likely that the estimate is somewhere between the 63%/88% and 56%/45%.

Feeding difficulties and mismanagement (783.3) continues to show a high number of MRs assigned a degree of malnutrition < 1Y of age, mostly < 0.25Y. Lack of normal physiological development (783.4) maintains the same pattern of high numbers of MRs assigned ≤ 1Y, mostly < 0.25Y. If the infant was experiencing weight loss, why was the MR not assigned the appropriate ICD9 code or was the real cause low birthweight compounded by poor feeding practices. The hospital studied indicated much of the malnutrition was in young babies. The national data is not broken down under < 1Y and so it is not possible from national figures to separate problems with weaning and introduction of solid foods from problems with milk feeding and low birth weights.

Feeding difficulties and mismanagement (783.3) is a symptom code. It appears that malnutrition is hidden in the ICD9 code 783.3. The ICD9 code 783.3 can be a contributory factor to malnutrition. It appears that the contributory factor is being assigned the ICD code rather than the disease. Just coding the symptom does not provide a complete picture of the health status of a population. Children experiencing malnutrition must be identified and the malnutrition acknowledged in the MR.
Lack of normal physiological development (783.4) is the ICD9 code inferring the likelihood of malnutrition. As FTT is an inclusion under this ICD9 code, children suffering a degree of malnutrition may be described as having FTT. However, as ICD9 code 783.4 is only a signs and symptom code, the disease prevalence of malnutrition cannot be identified. Listerick et al (1985) comments that the term FTT is vague and often obscures malnutrition. These authors suggest that FTT, as a term, be discarded when describing a young child suffering from undernutrition and identified as experiencing a degree of malnutrition.

The terminology used to describe a condition may prevent the correct ICD code from being assigned to a MR. It is essential that the terminology used in the MR clearly identifies malnutrition. National data will not reflect hospital malnutrition without the appropriate ICD code. The number of MRs not properly coded PEM masks the actual number of children experiencing a degree of malnutrition.

National data is compiled from data received from the RHAs. The RHA's data source originates from the hospital level. ICD codes assigned to the MR, by the Medical Records Department, are based on the diagnosis, operation or treatment as described in the MR. If a diagnosis is not clearly stated in the MR, the appropriate ICD code will not be assigned. The weakness in inaccurate ICD coding prevents the identification of malnutrition as a health concern in young children (0 - 4Y).

ICD10 has a broader data base for coding purposes but unless children at risk of malnutrition are identified, ICD10 coding will not reflect disease prevalence. Medical staff must routinely perform a thorough nutritional assessment on children. Only through identification and documentation of malnutrition in the MR, will public health ascertain the prevalence of malnutrition in the 0 - 4Y UK population. Underrecognition of malnutrition prevents children receiving appropriate health care.
4.5 Conclusion

Malnutrition will not be acknowledged as a health concern in younger children (0 - 4Y) because of a weakness in the hospital ICD coding process. Until hospital coding can assign the correct ICD code, malnutrition will continue to go unrecognised. Hospital staff may not be aware of the problem of malnutrition in hospital patients. Routine nutritional assessments must be performed on all patients to assess the patient’s well-being. If malnutrition is recognised, it must be recorded in the MR. Only by recognising malnutrition and by documenting the malnutrition in the MR, will malnutrition be recognised as an issue which should influence public health policy on nutrition.

The lack of standardised terminology used to describe growth failure prevents the recognition of malnutrition. By not acknowledging undernutrition, children will go without appropriate nutritional intervention. Allowing malnutrition to be hidden in symptom codes hides the seriousness of growth failure. Signs and symptom codes can support the diagnosis, not hide a diagnosis. Public Health education can not focus its’ efforts to resolve this health problem of undernutrition in young children (0 - 4Y) until it is aware of the severity of malnutrition in this age range.
5.1 Introduction

In the previous chapters, malnutrition was found within certain ICD9 codes which are assigned at hospital discharge. It is possible that more malnutrition exists beyond the hospital.

Out-patient clinics are a means of conducting medical services without a hospitalisation. Paediatric out-patient clinics provide services by the physician, but also, through health care professional staff. The activities of the health care professional staff, including dietetic services, offers a more comprehensive approach to the treatment of a condition. The measure of disease, as seen on an out-patient basis, is imperative to assessing overall disease prevalence.

Disease prevention is compromised when all available data sources are not providing a more precise picture of the prevalence of illness. Britt (1993) states that by broadening the database to include out-patient clinics, a clearer picture of disease prevalence could be the outcome. In the light of this and because the State Registered Dietician (SRD) is the health care professional responsible for nutrition care, I decided to investigate the extent of malnutrition in out-patient referrals to the State Registered Dietician.
Hospital Two is a District General Hospital specialising in Oncology and Maxillo-facial surgery. It is a 500 bed facility. There were 6.5 full time SRDs providing clinical coverage. Hospital Two provided Paediatric SRD coverage for in-patient care (9 hours per week) and to 1 Paediatric out-patient clinic per week. At the time of the study, there was one community SRD affiliated with the hospital.
5.2 Methods

Consent for the study was sought and given by the two hospital ethics committees: Hospital One in West Central London; and Hospital Two in Guildford, England. Retrospective data was collected from Hospital One providing paediatric out-patient services.

Hospital Two had a very different records procedure. This procedure did not allow for data collection. A monthly activity record of patient services was maintained by the dietetic staff. The activity sheet is reviewed by the district dietician and discarded. A written referral from a physician is preferred but a verbal referral will allow counselling. No written information is required at the time of the referral.

A series of diet therapy codes describe the type of service rendered by the SRD. Activity codes likely to infer PEM, FTT and obesity were selected. Only one code is allowed to be assigned per patient activity. Activity codes selected:

- FP Feeding Problems
- HE High Energy
- R Weight Reducing

A review of monthly summaries of diet therapy codes was assembled. The data covered the period January 1994 to the end of March 1995. For 1994, only 8 summaries were available and 2 summaries for 1995. The summaries did not separate in-patient from out-patient referrals nor did it separate by gender or age. It was for these reasons data could not be used. The Management Information Systems Department of Hospital Two did not consider that prior to January 1994, out-patient data was accessible.
Hospital One is part of the University College London Hospitals specialising in Paediatrics. It is a 287 bed facility. There were 3 full time SRDs providing clinical coverage. Hospital One provided Paediatric SRD coverage for in-patient care and to 4 Paediatric out-patient clinics per week. At time of the study, the community SRD position was vacant.
5.2.1 Data Source

The SRD MRs from Hospital One provided information gathered as part of the collected Korner data. This minimum set of data is required by all district health authorities. The minimum data collected:

1. Patient’s age
2. Gender
3. Date of Birth
4. General Practitioner or consultant code
5. Insurance status

Hospital One’s administration created the Financial Information Project. This computerised system records patient activities including dietetic services. The SRD must receive a written referral from a physician to counsel a patient. The written referral must include: diagnosis, reason for referral, brief medical history, current medications and if paediatrics, anthropometric measurements including a copy of a growth chart and a basic dietary history.

A series of speciality and activity codes are used to explain services rendered by the SRD. Speciality code, 420, signifies Paediatrics whilst the activity codes describe the type of service rendered by the SRD. Activity codes likely to infer PEM, FTT and obesity were selected. Only one code is allowed to be assigned per patient activity. Activity codes selected:

- WR: Weight Reducing
- ONS: Oral Nutrition Support
- FPC: Feeding Problems - children
A computer list of speciality code 420 and activity codes was assembled. The 3 page computer print out stayed in the SRD’s office. The data covered the period January 1994 to the end of March 1995. The Information and Contact Department of Hospital One did not consider that prior to January 1994 the computer database was accessible. Data was collected from the SRD MRs of paediatric out-patients referred for nutrition counselling with specific activity codes with an age range of 0 - 7Y of age. The age range was expanded to provide a larger group for the study. Six children with a diagnosis of prematurity were removed from the study since prematurity can affect growth (McLaren, 1991).

5.2.2 Statistical Analysis

All analyses were performed using Microsoft Excel (version 5.0, 1995) and Statistical Package of the Social Sciences ((SPSS) version 6.1, 1996). Descriptive statistics (eg, means, standard deviations, percentages) summarised the data. An unmatched t-test was used to compare the mean age. By default, for the t-test, SPSS rounds up all p-values to 3 decimal places. So any resulting p-value between 0 and 0.00005 is displayed as 0.0000, and can only be accurately recorded as p<0.00005.

The children's ages were converted to years (Y) for analysis. Children younger ≤ 1Y of age were grouped into categories representing a three month grouping. Table 34 lists the ages converted to years for analysis.
<table>
<thead>
<tr>
<th>Ages By Month</th>
<th>Conversion (Y)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-3m</td>
<td>$\leq 0.25Y$</td>
</tr>
<tr>
<td>3-6m</td>
<td>$&gt; 0.25 \leq 0.5Y$</td>
</tr>
<tr>
<td>6-9m</td>
<td>$&gt; 0.5 \leq 0.75Y$</td>
</tr>
<tr>
<td>9-12m</td>
<td>$&gt; 0.75 \leq 1.0Y$</td>
</tr>
</tbody>
</table>
ICD9 codes were assigned to the reasons for referral to the SRD in a similar way to the normal coding procedures for in-patients. The terminology used by the physician was the basis for assigning the ICD9 code. Table 35 lists the ICD9 codes assigned to reasons for referral to the SRD.

Table 35  ICD9 Codes Assigned to Reasons for Referral to the State Registered Dietician

<table>
<thead>
<tr>
<th>ICD9 Code</th>
<th>Reasons for Referral</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protein-energy malnutrition (262, 263.0 and 263.1)</td>
<td></td>
</tr>
</tbody>
</table>
| Obesity (278.0)                                | • overweight  
|                                               | • obesity  |
| Feeding difficulties and mismanagement (783.3)  |                                                          |
| Feeding Problems                               | • feeding difficulties  
|                                               | • poor weaning practices  
|                                               | • food refusal  
|                                               | • poor appetite  
|                                               | • mealtime vomiting  |
| Nutritional Assessment                         |                                                          |
|                                               | • nutritional assessment  
|                                               | • feeding assessment  
|                                               | • assess eating  
|                                               | • special feeding  |
| Lack of Normal Physiological Development (783.4) |                                                          |
| Failure to Thrive                              | • failure to thrive  
|                                               | • measurements at or below the 3rd percentile for age  |
| Poor Growth                                    | • poor weight gain  
|                                               | • weight loss  |
| Parent-child Relations (V61.2)                 |                                                          |
|                                               | • marital problems  
|                                               | • social problems  |
Reasons for referral not assigned an ICD9 code

Medical Illness
- viral illness
- gastro-enteritis
- renal
- endocrine
- neurology
- dermatitis

Prematurity
- premature
- prematurity
- IUGR (Intrauterine Growth Retardation)
5.3 Results

5.3.1 ICD9 Code Assigned to Reasons for Referral to the State Registered Dietician

Fifty-one reasons for referral were assigned ICD9 code feeding difficulties and mismanagement (783.3). Thirty-six reasons for referral were assigned ICD9 code lack of normal physiological development (783.4). There were 5 reasons for referral assigned ICD9 code obesity (278.0) and 2 assigned parent-child relations (V61.2). PEM (262, 263.0 and 263.1) was not assigned to any reasons for referral. The ICD9 code 783.3 had the highest number of referrals to the SRD. Fig. 32 shows the ICD9 codes assigned to the reasons for referral to the SRD. Table 36 shows the ICD9 codes assigned to the reasons for referral to the SRD by age.
Table 36 ICD9 Codes Assigned to Reasons for Referral to the State Registered Dietician by Age

<table>
<thead>
<tr>
<th>Age</th>
<th>278.0</th>
<th>783.3</th>
<th>783.4</th>
<th>V61.2</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ 0.25Y</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt; 0.25≤ 0.5Y</td>
<td>7</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt; 0.5</td>
<td>6</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤ 0.75Y</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt; 0.75 ≤ 1.0Y</td>
<td>3</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 Y</td>
<td>1</td>
<td>11</td>
<td>17</td>
<td></td>
</tr>
<tr>
<td>2 Y</td>
<td>1</td>
<td>7</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>3 Y</td>
<td></td>
<td>4</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>4 Y</td>
<td>2</td>
<td>4</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>5 Y</td>
<td>1</td>
<td>5</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>6 Y</td>
<td></td>
<td>2</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>7 Y</td>
<td></td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>5</td>
<td>51</td>
<td>36</td>
<td>2</td>
</tr>
</tbody>
</table>

* Some children have multiple reasons for referral
<table>
<thead>
<tr>
<th>Reasons for Referral</th>
<th>Number of Cases</th>
<th>Mean Age in months</th>
<th>Standard Deviation</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Failure to Thrive</td>
<td>20</td>
<td>21.15</td>
<td>18.3</td>
<td>significant at P &lt; 0.05</td>
</tr>
<tr>
<td>Poor Growth</td>
<td>16</td>
<td>10.18</td>
<td>4.79</td>
<td>P = 0.01</td>
</tr>
<tr>
<td>Failure to Thrive</td>
<td>20</td>
<td>21.15</td>
<td>18.39</td>
<td>not significant</td>
</tr>
<tr>
<td>Feeding</td>
<td>34</td>
<td>29.82</td>
<td>22.63</td>
<td>P = 0.13</td>
</tr>
<tr>
<td>Po, Growth</td>
<td>16</td>
<td>10.18</td>
<td>4.79</td>
<td>statistically significant</td>
</tr>
<tr>
<td>Failure to Thrive</td>
<td>20</td>
<td>21.15</td>
<td>18.39</td>
<td>not significant</td>
</tr>
<tr>
<td>Nutritional Assessment</td>
<td>17</td>
<td>15.82</td>
<td>17.62</td>
<td>P = 0.37</td>
</tr>
<tr>
<td>Poor Growth</td>
<td>16</td>
<td>10.18</td>
<td>4.79</td>
<td>not significant</td>
</tr>
<tr>
<td>Feeding</td>
<td>34</td>
<td>29.82</td>
<td>22.63</td>
<td>statistically significant</td>
</tr>
<tr>
<td>Po, Growth</td>
<td>16</td>
<td>10.18</td>
<td>4.79</td>
<td>not significant</td>
</tr>
<tr>
<td>Nutritional Assessment</td>
<td>17</td>
<td>15.82</td>
<td>17.62</td>
<td>P = 0.22</td>
</tr>
<tr>
<td>Poor Growth</td>
<td>16</td>
<td>10.18</td>
<td>4.79</td>
<td>not significant</td>
</tr>
<tr>
<td>Nutritional Assessment</td>
<td>17</td>
<td>15.82</td>
<td>17.62</td>
<td>P = 0.02</td>
</tr>
<tr>
<td>Feeding</td>
<td>34</td>
<td>29.82</td>
<td>22.63</td>
<td>statistically significant</td>
</tr>
<tr>
<td>Problems</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nutritional Assessment</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The terminology used for reasons for referral most often associated with growth failure was FTT and poor growth. It appears that the term 'poor growth' is assigned to younger children (mean age 10.18 months). FTT was assigned to children of various age ranges (mean age 21.15 months). FTT is the term used to describe growth failure in a wider age range.

The terminology used for reasons for referral most often associated with feeding problems was feeding problems and nutritional assessment. It appears that the term 'feeding problem' is assigned to children of various age ranges (mean age 29.82 months). Nutritional assessment was assigned to younger children (mean age 15.82 months). Feeding problems is the term used to describe feeding problems in a wider age range. Table 37 summarises the results.

The null hypothesis was tested: ICD9 codes assigned to feeding difficulties and mismanagement (783.3) and lack of normal physiological development (783.4) are being picked up in the same ratio for the hospital and out-patient clinic. The difference was not significant with a Chi-square value $p<0.94$. The ICD9 codes 783.3 and 783.4 are being seen in the same ratio in in-patients and out-patients.
5.3.2 Frequency of Feeding Problems and Growth Failure in Paediatric Out-patient Referrals to the State Registered Dietician

Six children were referred for feeding problems and growth failure. Gender and age distribution was: 3 males; 2, 1Y; 1, 2Y; 1, 6Y; and 3 females; 1, ≤0.25Y; 1, >0.75 ≤1Y; 1, 5Y and therefore not gender specific.

5.3.3 Frequency of Obesity in Paediatric Referrals to the State Registered Dietician

Seven times more children were referred for growth failure than for obesity. The ratio of growth failure to obesity was 7.2:1.0. The number of referrals for obesity were 5. The gender distribution was: 2 males; 1, 2Y; 1, 4Y; and 3 females; 1, 1Y; 1, 4Y; 1, 5Y and therefore not gender specific. The mean age of the children was 3.16Y of age suggesting that the onset of obesity occurs at ≥2Y of age. The ratio of ≤2Y of age to ≥2Y of age was 1.0:4.0 meaning that 4 times as many children ≥2Y of age were referred for obesity.

5.3.4 Frequency of Premature Infants Referred to the State Registered Dietician

Six premature infants were referred for nutritional assessment. Gender and age distribution was: 3 males; 2, >0.25 ≤0.5Y; 1, >0.5 ≤0.75Y; and 3 females; 1, >0.25 ≤0.5Y; 1, >0.5 ≤0.75Y; 1, 1Y and therefore not gender specific. A specific nutritional recommendation accompanied the referral: 5 tube feeding assessments; and 1 fluid restriction.
5.3.5 Frequency of Medical Conditions Referred to the State Registered Dietician

Eighty-one percent of referrals to the dietician related to undernutrition. The remaining 19% (15) had a medical diagnosis which required nutritional intervention under activity codes WR, ONS and FPC. Gender and age distribution was: 6 males; 1, > 0.5 ≤ 1Y; 5, 1Y; and 9 females; 2, > 0.75 ≤ 1Y; 1, 1Y; 3, 2Y; 1, 5Y; 1, 6Y; and 1, 7Y and therefore not gender specific. Medical reasons for referral were: 7, viral illness; 3, endocrine; 3, gastro-enteritis; 1, dermatitis; and 1, renal.

5.3.6 Gender Distribution of Referrals to the State Registered Dietician for Growth Failure and Feeding Problems

Table 38 Ratio of Males/Females for Reasons for Referral to the State Registered Dietician, Growth Failure and Feeding Problems

<table>
<thead>
<tr>
<th>Reasons for Referral</th>
<th>Total</th>
<th>Male</th>
<th>Female</th>
<th>Ratio M/F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Failure to Thrive</td>
<td>20</td>
<td>8</td>
<td>12</td>
<td>.66:1.0</td>
</tr>
<tr>
<td>Poor Growth</td>
<td>16</td>
<td>10</td>
<td>6</td>
<td>1.6:1.0</td>
</tr>
<tr>
<td>Feeding Problem</td>
<td>34</td>
<td>19</td>
<td>15</td>
<td>1.2:1.0</td>
</tr>
<tr>
<td>Nutrition</td>
<td>17</td>
<td>9</td>
<td>8</td>
<td>1.0:1.0</td>
</tr>
<tr>
<td>Assessment</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The null hypothesis was tested: growth failure and feeding problems is independent of gender. It was not statistically significant with a Chi-square value of p<0.56. There was no significant difference in the ratio of males/females.
5.3.7 Suspected Malnutrition in Children with Referrals of Growth Failure and Feeding Problems

Sixty-four additional suspected cases of malnutrition could be inferred from the children referred for feeding problems and growth failure. If the pattern of malnutrition in out-patient children is similar to that of hospital in-patient children allocated a degree of malnutrition, we would infer a suspected degree of malnutrition. Table 39 shows the additional suspected cases of malnutrition from the out-patient referrals to the SRD.

Table 39 Number of Suspected Malnutrition from Feeding Problems (783.3) and Growth Failure (783.4) Referred to the State Registered Dietician

<table>
<thead>
<tr>
<th>Degree of Malnutrition</th>
<th>783.3</th>
<th>783.4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mild</td>
<td>15</td>
<td>13</td>
</tr>
<tr>
<td>Moderate</td>
<td>12</td>
<td>14</td>
</tr>
<tr>
<td>Severe</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Total</td>
<td>32</td>
<td>32</td>
</tr>
</tbody>
</table>

5.3.8 No Recorded Anthropometric Measurements at the Time of Referral to the State Registered Dietician

Ninety-three percent (74) of children referred to the SRD had no recorded anthropometric measurement accompanying the referral. Moreover, the dietician failed to complete an anthropometric measurement during the nutritional assessment. Seven percent (6) of children had an anthropometric measurement at the time of the referral: 2, obesity; 2, feeding problems; and 2, medical. No children referred for growth failure had an anthropometric measurement at the time of the SRD referral.
5.4 Discussion

It is clear malnutrition is being seen in the out-patient clinic. Eighty-one percent of the children referred to the dietician assigned the requested activity codes could be malnourished. The inability to classify out-patient data, as part of a national administrative data for analysis of the prevalence of disease, further weakens the recognition of malnutrition in the 0-4Y population. Britt (1993) discusses the importance of collecting data from secondary sectors. He comments that out-patient data provides a clearer picture for both resource use and patient outcome in the future. If cases of malnutrition are not recorded for national analysis, it is difficult to validate a diagnosis (Leibson et al, 1994) or measure the severity of illness (Phelan, 1994) within a population.

Ninety-three percent (74) of the children were referred to the SRD for intervention had no recorded anthropometric measurement. Lack of obtaining and recording anthropometric measurements in the MR allows malnutrition to go unrecognized. Anthropometric measurements are an essential component of assessing a child's nutritional status. This lack of obtaining and recording measurements suggests that medical staff do not acknowledge the importance of nutrition to the overall care of the patient.

Studies (Bunting et al, 1997; Hall, 1996; Reilly, 1996) have shown that the nutritional status of children is a means of identifying those at risk of malnutrition. Moores (1996) suggests that monitoring a child's growth chart may provide an explicit sign of FTT. Hendrikse et al (1995) undertook a survey at the Royal Hospital for Sick Children, Glasgow, and found that approximately 15% of the children were underweight and underheight for their age. These authors comment that less than one-third of the children were known to the dietician. These findings strongly suggest that the nutritional status of the child is not routinely assessed and thus no record of the efficacy of intervention is available.
In the previous chapter, more malnutrition was seen in the ≤ 0.5Y, in particular, the ≤ 0.25Y. This suggests low infant birthweight or low weight gain during pregnancy could contribute to the malnutrition. However, the reasons for referral to the dietician inferring the likelihood of malnutrition were seen in ≥ 1Y of age. Reasons for referral assigned ICD9 codes 783.3 and 783.4 had the highest inferred likelihood of malnutrition. It appears that young children (≤ 0.5Y) are admitted to hospital for issues relating to feeding problems or poor growth, whereas, older children (≥ 1Y) are seen in the out-patient clinic.

There were only 5 referrals for obesity made to the SRD ranging in age from 1Y to 5Y. Childhood obesity in younger children (0 - 7Y) appears to be handled in the out-patient clinic rather than a hospital admission. The prevalence of obesity in children is hard to measure because of the lack of a standardised criteria needed to define obesity (Satter, 1996; Taitz, 1983). White et al (1995) suggest that there is a need to produce appropriate standards for British children that will assist in identifying children at the extremes of fatness. These authors comment that the actual values of BMI for children at risk of obesity have not yet be defined. The problem of identifying obesity is also supported in North America (Dennison et al, 1997; Flegal, 1996; Rippe, 1996; Satter, 1996). Once established, the use of actual values of BMI will assist in identifying children at risk of malnutrition and obesity. However, malnutrition is more of a health problem than obesity in the 0 - 4Y.

Based on age, different terminology was used to describe the poor growth. Children < 1Y of age were referred using the term 'poor growth,' however, children > 1Y were referred using the term FTT to describe a growth failure. Does the use of FTT mean that these children are experiencing a greater degree of growth failure than a child termed poor growth? Or is this an example of the lack of a standardised definition for FTT? Discrepancies continue in defining FTT (Peterson, 1993). Others have also commented on the lack of anthropometric criteria and cut-off points (Wilcox et al, 1994; Bithoney et al,
1992; Skuse, 1985). The lack of a standardised definition only continues to mask the measure of undernutrition. Whether the terms, FTT or poor growth are used, a child is still experiencing a degree of malnutrition. Unless PEM is recognised and acknowledged, as seen in the out-patient clinic, the prevalence of malnutrition will be underestimated.

Forty-four percent (51) of the reasons for referral to the SRD were for feeding problems. More children were referred to the dietician ≥ 1Y of age for feeding problems. Bithoney et al (1992) comments that FTT is often seen around 18 months of age. Moores (1996) comments that the onset of growth failure begins within weeks of birth, however, FTT is not recognised until around 6 - 18 months of age. ICD9 codes 783.3 and 783.4 had the highest number of referrals between 1 and 2Y of age.

Age seemed to determine the terminology used at the time of referral. The term ‘feeding problem’ was used for a variety of ages whilst the term ‘nutritional assessment’ was used for younger children (mean age 15.82 months). As seen in the previous chapter, feeding difficulties and mismanagement (783.3) could be used to code malnutrition both in hospital and in the out-patient clinic. Even though this out-patient clinic is unlikely to be representative of all paediatric out-patient clinics in the South East, it still provided a picture of the frequency of referrals to the SRD for feeding problems. The SRD would be the health care professional responsible for nutritional counselling. Based on the age range and the types of referrals, nutritional counselling would include energy and nutrients for age.

The skills of the SRD assist in determining the nutritional status of the child. Moores (1996) describes a number of methods available for assessing nutritional intake. She suggests that dietary histories, weighed food intakes, 24-hour recalls or food diaries are examples of assessment tools. These tools can be used to determine present energy intake and possible nutrient deficiencies. Nutritional management in the malnourished child attempts to achieve adequate energy intake to allow for catch-up growth (Moores, 1996;
Maggioni et al, 1995). Catch-up growth is defined (Maggioni et al, 1995; Frank et al, 1988) as the acceleration in growth (weight and height) that occurs when a period of growth retardation ends and favourable conditions are restored.

To achieve an accelerated growth, the child needs to receive nutrients in excess of the normal age-specific requirements of recommended daily allowances (Maggioni et al, 1995; Thomas, 1994; Peterson, 1993; Frank et al, 1988). Frank et al (1988) suggests that when addressing nutritional rehabilitation concerning the undernourished child, micronutrients need to be addressed. These authors comment that iron deficiency is seen in children suffering from FTT. The role of zinc deficiency in FTT is not as clearly defined, but has been implicated in impaired linear growth (Casey et al, 1985). In the refeeding process, a gradual introduction to eating is recommended for the severely malnourished child to reduce the chance of developing vomiting or diarrhoea. The meal plan is based on smaller more frequent feeding until the child advances to a normal meal pattern (Frank et al, 1988).

Pre-school children (1Y - 6Y) often have fair to poor appetites (Lucas, 1993). Parents are often concerned when a pre-school child refuses food or is disinterested in eating. The dietician would advise parents on healthy eating for this age range, meeting the needs for energy, protein and other essential nutrients. Just as important as providing adequate nutrients for growth, the dietician would discuss the importance of a positive eating environment, so that, the child will develop a positive attitude towards food.
5.5 Conclusion

This study clearly found that different terms are being used to describe malnutrition. Neither term, FTT or poor growth, are a diagnosis. PEM is an acceptable diagnosis. Until PEM and FTT are recognised as one and the same, children will continue to be labelled under an ambiguous term.

The failure to obtain and record anthropometric measurements allows a child suffering from malnutrition to go undetected. The nutritional assessment needs to be co-ordinated. Medical staff needs to know who is responsible for making and recording measurements on the growth chart. In-service training must be provided to medical staff on the importance of anthropometric measurements. Training on equipment use and learning proper techniques for obtaining measurements must be on-going in paediatrics. The effectiveness of in-service training could be measured by a clinical audit reviewing medical record documentation.

Obesity was seen in the out-patient clinic but in low numbers for the 0 - 7Y age range. Obesity does not appear to be a health issue in young children. Health education needs to continue to discuss the benefits of adequate energy and nutrients for growth. However, more attention needs to be focused on undernutrition in young children (0 - 7Y) rather than obesity, for more referrals to the SRD were for reasons of feeding problems and growth failure than obesity.

The SRD is the health care professional skilled to provide nutritional advice. Referrals made to the SRD allow the dietician to develop nutrition care plans to meet the individual nutritional needs of the child. In developing nutrition care plans, all pertinent information relating to a child’s health status is required. The SRD was deficient in his/her professional responsibility by not obtaining anthropometric measurements. In-service training must stress to all team members the importance of anthropometric measurements in monitoring a
child's growth. The efficacy of nutritional intervention can not be assessed unless anthropometric measures are made.
Chapter Six
Conclusion

This study revealed that malnutrition is a unrecognised health problem in the 0 - 4Y population. Malnutrition was seen in paediatric hospital admissions and in a paediatric out-patient clinic. This health issue must be addressed because of the long-term detrimental effects on growth and development. This emerging trend showed that undernutrition should be a health issue in young children.

Fifty-six percent of MRs were assigned ICD9 code 783.3 and forty-five percent assigned 783.4 were allocated a degree of malnutrition. Protein-energy malnutrition was hidden in these non-disease ICD9 codes. Hiding malnutrition under non-disease ICD9 codes prevents the recognition of malnutrition as a health issue. Malnutrition was identified. However, national figures are not reflecting the amount of malnutrition in young children. Unless the medical record clearly states malnutrition, ICD coding will not reflect the prevalence of this disease in this population. Appropriate health intervention can not be provided if the undernutrition is not acknowledged. Public health education can not begin to address this health issue unless it is aware of the prevalence of malnutrition/undernutrition.

Twenty-four percent of the hospital admissions did not have a recorded admission weight. Ninety-three percent of the referrals to the dietician did not have a recorded weight. Poor medical record documentation of anthropometric measurements prevents the accurate monitoring of a child’s growth. Poor medical record documentation allows undernutrition to go unrecognised in hospital and out-patient clinics.
The medical record communicates to each member of the health care team the child's well-being. The lack of documentation in the medical record is a serious concern. Providing appropriate patient care is the objective of health professionals. The delivery of quality care is critical. If the medical record is deficient in accurately communicating the health status of the patient, then the objective of patient care has not been met. It is imperative that clinicians understand the importance of documentation in the medical record. Hospital administration must impress upon all health professionals the essential role the medical record plays in health care.

Medical staff are not recognising the nutritional assessment as a fundamental part of medical care. Nutritional intervention can have positive implications to health outcome. A poor nutritional status can have a negative effect on health recovery. Nutrition must be appreciated for its' contribution to health. Nutrition education and training must be compulsory in medical education.

The nutritional assessment is a vital component in assessing a child's well-being. Anthropometric measurements are only a part of the nutritional assessment. The assessment must also include a dietary history. This information is necessary to evaluate the well-being of a child. It is essential that all health professionals understand the role of nutrition in relationship to health outcome.

Thirty percent of the out-patient paediatric referrals to the dietician for nutritional intervention were for poor growth. The dietician failed in his/her professional responsibility by not obtaining measurements or by not communicating to other members of the team, the lack of information provided at the time of the referral. Poor communication among medical staff weakens the effectiveness of quality care. Children suffering from malnutrition will not receive the appropriate nutritional intervention without all pertinent information.
The dietician is the health care professional specialising in nutrition. The dietician’s actions must be proactive towards the role of nutrition in health care. The dietician must be the advocate for nutrition. In-service training, provided by the dietetic department, can inform medical staff of the changes in nutrition care as it relates to disease.

Different terminology was used to describe undernutrition. Age seemed to determine whether the term failure to thrive or poor growth was indicated in the medical record. A diagnosis is based on medical criteria not age. The discrepancies over the definition of failure to thrive continues to be debated. All definitions in current use, including ICD10, are statistical not operational. They do not measure the health consequences of thinness or obesity. More research is needed to clarify what is ‘acceptable’ thinness or fatness in terms of present health or future well-being.

ICD10 (WHO, 1994) has defined protein-energy malnutrition as a weight expressed in standard deviations from the mean of the relevant reference. Failure to thrive is also defined as a decrease in weight-for-age of approximately 1 or more standard deviations from an established growth pattern. The definitions are the same, protein-energy malnutrition and failure to thrive, are synonymous. Until medical staff recognise that protein-energy malnutrition and failure to thrive are the same, both having long-term consequences affecting the well-being of a child, the extent of malnutrition goes unrecognised. This health issue among young children will not receive the attention it warrants. It is acknowledged that all thin children are not malnourished. However, based on the lack of accurate documentation in the medical record and poor awareness of the importance of nutrition by medical staff, further investigation should be pursued.

Feeding problems were seen in hospital, as well as, in the out-patient clinic. Nutrition education on infant feeding must begin at school and be compulsory for girls and boys, before age 16. By providing infant nutrition education, parents will be better advised and
aware of available resources. Better education will assist in reducing the number of hospitalisations and out-patient referrals for feeding problems. Emphasis in infant nutrition education must stress the need to receive adequate amounts of energy, protein and other essential for growth rather than restricting food consumption. Parental misconceptions towards obesity or other health issues can result in underfeeding children. Proper feeding guidelines for age must be emphasised and provided in educational materials.

The health visitor plays a vital role in advising on feeding guidelines. The health visitors input to public health would assist in identifying feeding issues. Awareness of the problem allows public health authorities to assess the future educational needs of the population. Addressing feeding issues in antenatal classes or home visits, may help to reduce the number of feeding problems seen in young children. Educational materials must be available and appropriate to the recipients literacy level and available in other languages.

Only 5 children were referred to the dietician for obesity and no children were admitted to hospital for obesity. Obesity is a public health issue in adulthood, however, obesity is not a health issue in young children. This obsession with body weight and shape could be influencing the feeding pattern of young children. Parents may be restricting food consumption trying to prevent obesity during adolescence or adulthood. Young children need the appropriate amount of energy, protein and other essential nutrients for optimal growth. Health education must inform parents of the health risk to growth and development by imposing adult health guidelines on young children.

A woman or her partner’s obsession with thinness could have a serious influence on pregnancy outcome. A low body mass index < 20 in the childbearing years may be a contributory factor to low birthweights. Prepregnancy weight influences pregnancy outcome. Education on proper eating habits must begin at school and should be compulsory for girls and boys, before age 16. Health education needs to discuss the
importance of nutrition before, during and after pregnancy. As a society, we need to examine, both the physical and psychological consequences this obsession with thinness has on health outcome. Those subgroups requiring more attention are: young boys and girls < 15 years of age, women in the childbearing years and women who smoke.

In summary, malnutrition in young children is a health issue. Medical staff must acknowledge undernutrition as a health issue amongst young children. Accurate documentation in the medical record is the only way public health will be able to assess the measure of malnutrition in this population. Support and encouragement is essential among medical staff to recognise and acknowledge malnutrition. Only when malnutrition is acknowledged, will the appropriate nutritional intervention be provided. Health surveillance is the key to health promotion.

Therefore, in conclusion, although health education discusses obesity as a risk factor to health, there is no doubt that malnutrition in young children is a greater health risk. As the current focus on obesity continues, medical staff must work towards the recognition of malnutrition as a health problem in the 0 - 4 year population.
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Appendix 0

Suggestions for further work
3. Further larger scale studies on the growth pattern of infants with malnutrition. Data obtained from such a study could identify the presence of clinical symptoms of malnutrition. Monitoring the growth patterns of children experiencing malnutrition could assist in development of age and gender BMI standards for young children. Also further investigations of the eating habits of infants during nutritional management of malnutrition.
Suggestions for future work

1. The study highlighted unrecognised malnutrition in hospital. I propose the development of a nutritional assessment screening tool. This tool needs to be designed, implemented and evaluated for its’ usefulness in the identification of patients with malnutrition.

The nutritional assessment screening tool needs to include criterion for the evaluation of malnutrition. The criterion:

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<tr>
<th>Anthropometric Measurements</th>
<th>Nutrition Intake</th>
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<tbody>
<tr>
<td>weight-for-age</td>
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<td>height-for-age</td>
<td>24 hour recall</td>
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<td>weight-for-height</td>
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<td>head circumference</td>
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2. A further study on the attitudes of physicians and nurses in hospital regarding the usefulness of the nutritional assessment. Nutrition is a vital component of a patient’s health status and needs to be recognised by the medical staff for it usefulness in identifying patients at risk of malnutrition. Also further investigation of the physician’s perception of the State Registered Dietician as a health care professional. Dietician’s need to be acknowledged for their expertise in nutrition and contribution to patient care.
Appendix 1

Map of the Standard Regions of England
Appendix 2

Questionnaire (1-13)
## Infant Medical History

### Socioeconomic Information

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<thead>
<tr>
<th>Reference number</th>
<th>Clinic name</th>
<th>Mother's age</th>
<th>Father's age</th>
<th>Child's age</th>
<th>Child DOB</th>
<th>Child's gender</th>
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<th>living with partner</th>
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If yes to alcohol consumption during pregnancy, amount:

- per day
- per week
- per month

Type of alcohol consumed and measure per week:

- wine
- beer
- spirits
- other (specify)

If yes to cigarette smoking during pregnancy, amount:

- per day
- pack(s) per day
- pack(s) per week

If yes to caffeine consumption during pregnancy, amount:

- cups per day
- cups per week
- cups per month
- glasses per day
- glasses per week
- glasses per month

Product(s) consumed containing caffeine:

- tea
- coffee
- soda
- chocolate

If yes to substance abuse, type used:
Nutritional supplementation given during pregnancy

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Was pregnancy planned

Y [ ] N [ ]

Antenatal clinic records

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<th>Prof. consulted</th>
<th>Comments</th>
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Infant: General Information

Full-term infant

Premature infant

If premature, gestation weeks

If premature, hospitalization by total days

Name of hospital

City

Birth weight

kg [ ] lbs [ ] % [ ]

Birth length

cm [ ] in [ ] % [ ]

Birth H/Cirf

cm [ ] in [ ] % [ ]
General practitioner
Health visitor
Health clinic

### Infant feeding history

| weeks | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 4m | 5m | 6m | 7m | 8m | 9m | 10m | 11m | 12m |
|-------|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|
| Breast-feed | | | | | | | | | | | | | | | | | | | | |
| Bottle-feed | | | | | | | | | | | | | | | | | | | | |
| other | | | | | | | | | | | | | | | | | | | | |

### Formula used

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### Route of feeding

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</table>
## Placement of tube
- Nasogastric
- Gastrotomy
- Jejunostomy

## Introduction to door-step milk

| Type                  | Weeks 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 4m | 5m | 6m | 7m | 8m | 9m | 10m | 11m | 12m |
|-----------------------|---------|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|----|----|
| Whole door step cow milk |        |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Semi-skimmed milk     |         |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Skimmed milk          |         |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Evaporated milk       |         |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Condensed milk with sugar |     |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Condensed milk without sugar |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Powdered milk         |         |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |
### Introduction of weaning foods

| weeks | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 4m | 5m | 6m | 7m | 8m | 9m | 10m | 11m | 12m |
|-------|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|----|----|
| rice cereal with breast milk |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |
| rice cereal with cow's milk  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |
| rice cereal with formula    |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |
| rice cereal with water      |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |
| soft fruits without skins   |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |
| soft vegetables without skins|   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |
| meat foods                  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |
| adult fruit juice           |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |
| baby fruit juice            |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |
| yogurt                      |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |
| cheese                      |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |
| small curd cottage cheese   |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |
| egg                         |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |
| crackers                    |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |
| smooth peanut butter        |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |
| other                       |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |
| comments                    |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |
Infant medical history

Hospital admission date

Hospital admission anthropometric measures
- Weight: lb, st, kg
- Length: cm, in
- H/Cirf: cm, in
- Weight for height: lb, st, kg

Growth deficiency first noted in medical record
Confirmed diagnosis of growth deficiency
Professional:
- Noted
- Confirmed
- Other (specify)

Failure to thrive first noted in medical record
Confirmed diagnosis of failure to thrive
Professional:
- Noted
- Confirmed
- Other (specify)
Growth deficiency/ FTT criteria identified in diagnosis
weight below the 3% on growth chart
weight below the 5% on growth chart
weight loss crossing a major percentile
  specify %
sudden weight loss
  specify actual weight loss
  specify % of IBW lost
  specify length of time of weight loss in days
height below the 5% on growth chart

Feeding disorders and/or related disorders
  poor suck in infancy
  fatigue during feeds in infancy
  crying during feeds in infancy
  refusal to switch from liquids to solids in infancy
  vomiting after feeds and/or meals
  rumination
  inadequate supply of food
  inappropriate /lack of feeding schedule
  inappropriate sleep pattern
    specify sleep pattern
  behavioural displays before sleeping
    specify behaviour
  delayed toilet training
  incontinence of faeces and/or urine
  pica
    specify
  frequency of wilfully skipping meals
    specify
emotional abuse
    specify
physical abuse
    specify

Medical illness (specify)

other (describe)
Classification of condition by physician

- organic FIT
- non-organic FIT
- mixed FIT
- other (describe)

Professional consults and/or referrals during hospitalisation

If FTT team consulted, members

Nutritional counselling given by during hospitalisation

If yes, counselling given by
Topics discussed during nutritional counselling

24 Hour Recall of energy
24 Hour Recall of protein
increase energy to 130% of present intake
increase protein to 130% of present intake
increase energy to 150% of present intake
increase protein to 150% of present intake
maintain 3 day food diary
maintain 5 day food diary
concentrate standard infant formula to 24 cal/ounce

concentrate:
  - 20 cal/ounce
  - 24 cal/ounce

using one or more supplements
  - MCT oil
  - liquid vegetable oil
  - glucose polymer
  - dry powdered milk
  - other (specify)

increase volume of formula per feed
explain formula preparation
change to an elemental formula
begin introduction of weaning foods

Discharge date

Discharge hospital anthropometric measures

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Discharge referrals

If yes,  

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If yes to follow-ups,

number of appointments

period of time

mths

years

DNA appointments

If yes  

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<th>N</th>
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number of appointments

period of time

mths

years
Appendix 3

Growth and Development Record - Boys
1. A boy whose height falls above +3SD or below -3SD, or whose growth curve deviates from any numbered centile line, should be monitored and referral to a growth specialist considered.

2. "Mid-parental centile": To calculate his 'mid-parental' centile, an indicator of his adult stature, mark two heights - his father's (F) and his mother's PLUS12.5cm (M) - on the vertical line. Read off the height mid-way between F and M and plot it (X) on the 16yr line. As an adult, he should be somewhere ±8½cm of X.
Appendix 4

Growth and Development Record - Girls
# Girls Growth Assessment Chart

**Preterm-2 years below**

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**2 years to 16 years on reverse side**

Recommended by The Child Growth Foundation

Charts in this publication prepared by
J. M. Tanner and R. H. Whitehouse
University of London, Institute of Child Health
and
Dr. Douglas Gardner and
Dr. Julie Parson
First Published October 1987
© Castlemead Publications 1987

Published by
Castlemead
PUBLICATIONS
12 Little Mundells, Welwyn Garden City,
Hertfordshire AL7 1EW

Ref. 22A
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Printed in England by Fulpsone Press.
1 A girl whose height falls above +3SD or below -3SD, or whose growth curve deviates from any numbered centile line, should be monitored and referral to a growth specialist considered.

2 *Mid-parental centile: To calculate her 'mid-parental' centile, an indicator of her adult stature, mark two heights - her mother's (M) and her father's MINUS 12.5 cm (F) - on the vertical line. Read off the height mid-way between M and F and plot it (X) on the 16yr line. As an adult, she should be somewhere ±6½ cm of X.
Dear Dr Greenwood,

Joint UCL/UCH Committee on the Ethics of Human Research

No: 95/2955
Title: Growth failure in infants and young children

I am writing to let you know that I have looked at the above project and have given it Chairman’s Approval. You may therefore go ahead with your study.

Please note that it is important that you notify the Committee of any adverse events or changes (name of investigator etc) relating to this project. You should also notify the Committee on completion of the project, or indeed if the project is abandoned. Please quote the above number in any correspondence.

Yours sincerely,

[Signature]

Professor M Hobsley
Chairman

Dean of the Medical School and of the Faculty of Clinical Sciences  Professor JR Pattison MA, DM, FRCPath
Dean, Faculty of Life Sciences (Biological and Medical)  Professor AR Lieberman PhD, DSc
Director of Administration  Diana F Sanders MA, PhD

UNIVERSITY OF SURREY LIBRARY
Dear Drs Morgan and Stordy

Re: Growth Failure in Infants and Young Children Study:
Collaborative Study between the Departments of Child Care and Dietetics, Royal Surrey County Hospital, Guildford and the Nutritional Metabolism Group, University of Surrey.

I am writing to confirm our recent discussion regarding a proposed nutritional study to be conducted at the hospital.

I understand the parameter of the study will be to examine medical records with a diagnosis of growth deficiency and/or failure to thrive. The information gathered from this study will be growth data on the infants and children, a review of the criteria or reasons used in making the diagnosis, reviewing the role of the dietitian in the care of this diagnosis and reviewing the nutritional care plan in the management of the patient. The client information reviewed in this study will remain confidential.

I am giving my consent to Dona C Greenwood M Ed SRD, postgraduate student to conduct this study within the Department of Dietetics at the hospital. When in the hospital, she would be supervised by either myself or one of the consultant paediatricians.

Dona Greenwood will require an honorary contract from the Trust to cover her work at the hospital for the period she is involved in this study. Should she require face to face contact with children during the study we will require her to complete a 'child access' form, as is the case for all hospital staff in such circumstances.

If you have any further questions, please do not hesitate to contact me.

Yours sincerely

Joy A Davis (Mrs)
District Dietitian
Dr. Jane Morgan and
Dr. Jacqueline Stordy,
School of Biological Sciences,
University of Surrey,
Guildford,
Surrey GU2 5XH.

18th February 1994

Dear Drs. Morgan and Stordy,

I write to confirm our meeting on 14th April 1994 at the Royal Surrey County Hospital, to discuss a proposed nutritional study to be conducted at the Hospital.

I understand that the basis of the study will be to examine medical records with a diagnosis of growth deficiency and/or failure to thrive. The information gathered from this study will be growth data on the infants and children, a review of the criteria or reasons used in making the diagnosis and a review of the role of the Dietitian in evaluating and managing these conditions. The patient information reviewed in this study will remain confidential.

Provided that the study receives the approval of our Ethical Committee, I give my consent to Dona C. Greenwood, E.Ed., SRD, postgraduate student to conduct this study at the hospital. I understand she is under your supervision during this time. If you have any further questions, please do not hesitate to contact me.

Yours sincerely,

Dr. D.G. Robins
Consultant Paediatrician