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ARTICLE

# Completeness of the road-to-health card and factors affecting knowledge and practices of growth monitoring and promotion in caregivers of young children in KwaZulu-Natal

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**Introduction:** Malnutrition is an increasing public health challenge in low- and middle-income countries. Growth Monitoring and Promotion (GMP) is a United Nations International Children's Emergency Fund (UNICEF) strategy to combat malnutrition. This study aimed to measure factors associated with knowledge and practices of GMP in caregivers of children from birth to 24 months referred to Inkosi Albert Luthuli Central Hospital (IALCH) from health facilities in KwaZulu-Natal (KZN) during 2018.
**Methods:** An observational, analytic cross-sectional study design was used. The study sample comprised 383 caregivers of these children. Data were obtained from interviewer-administered questionnaires.
**Results:** Most caregivers ($n = 201$, 52%) were between the ages of 21 and 30 years; 95% ($n = 360$) had more than primary education. Most ($n = 341$, 89%) caregivers presented the Road-to-Health Card (RTHC) for assessment, but only 7.6% ($n = 26$) were complete. Most caregivers ($n = 281$, 73%) had an excellent overall knowledge of how an RTHC contributes to GMP. However, only 38 (10%) had the skill to interpret all four of the test growth charts. There was a statistically significant association ($p < 0.05$) between some caregivers' variables and their knowledge of the RTHC.
**Conclusion:** Despite having good theoretical knowledge concerning the information in the RTHCs, most caregivers could not correctly interpret the growth charts. The education of caregivers and health workers on the importance of appropriate use of the RTHC for GMP is recommended.

**Keywords** knowledge of caregivers, growth monitoring and promotion, malnutrition, road-to-health-charts

## Introduction

Malnutrition in children is a global public health challenge. Malnutrition includes undernutrition (stunting, wasting and essential micronutrient deficiencies) and overnutrition (obesity or over-consumption of specific nutrients). Undernutrition can lead to stunted growth, delayed cognitive development, higher morbidity and childhood mortality. Overnutrition and obesity are associated with adverse psychological (anxiety, depression, negative self-image) and health (diabetes, cardiovascular events) outcomes during childhood, adolescence and adulthood.[1,2]

The 2019 report, Levels and Trends in Child Malnutrition, published by the United Nations Children's Fund (UNICEF), the World Health Organization (WHO) and the World Bank estimates that, globally, 149 million children (22% of all children) under 5 years old are stunted, more than 49 million (7.3%) are wasted and nearly 17 million (2.5%) have severe wasting.[3] In Southern Africa, 29% of the children under 5 years are stunted, and 3.5% are wasted.[3]

In South Africa (SA), an upper-middle-income country, stunting is the most common form of malnutrition, with more than 20% of children affected.[4] The 2016 South Africa Demographic and Health Survey (SADHS) reported that 27% of children under 5 were stunted with 10% being severely stunted, and 3% were wasted.[5] In KwaZulu-Natal (KZN), the same survey showed that 28% of children under 5 were stunted, with 13% being severely stunted, and 2.5% are wasted.[5]

The nutrition transition is characterised by the coexistence of undernutrition, overweight and obesity amongst the same communities. It is associated with changes in food consumption patterns linked to urbanisation in South Africa.[2,6] The global prevalence of overweight and obese children increased from 4.2% in 1990 to 6.7% in 2010.[7] In 2018, about 40 million children (5.9%) worldwide under 5 years of age were overweight.[3] In Southern Africa, 13% of children under 5 years of age were overweight in the same year.[3] In SA, the SADHS reported that 13% of children under 5 years of age were overweight and 18% in KZN.[5]

Several strategies have been developed in response to malnutrition in children. Growth Monitoring and Promotion (GMP) is an important element of the nutrition strategy of UNICEF.[8] The Road-to-Health Chart (RTHC) is a tool used to record GMP activities and in SA is incorporated into a Road-to-Health Booklet.[9]

GMP is an essential part of the Integrated Nutrition Programme (INP) of the Department of Health of SA. The purpose of the INP is to ensure optimum nutrition for all South Africans by preventing and managing malnutrition. Its goal for infants and young children is to establish and strengthen sustainable growth monitoring practices at health facilities and communities.[10] GMP seeks to empower mothers to provide appropriate child care.[11] It is one of the most visible child health actions to identify and address malnutrition and thus contribute to child survival goals.[12,13]

The authors of the SANHANES-1 made strong recommendations to improve child nutrition: to focus GMP activities on the first 1 000 days of a child's life and early diagnosis of stunting by regular, accurate measurement of height/length.[14] The KZN Nutrition Directorate embraced the SANHANES-1 recommendations and has incorporated them into its policy, 'Revised implementation guidelines for nutrition interventions at health facilities'.[6] The policy specifies that every child should be part of GMP and have their RTHC brought on every health facility visit, weight and height or length measurements should be accurately taken and recorded, malnutrition should be detected early, caregivers counselled and appropriate action taken. Healthcare workers should educate at every primary health care (PHC) or community-based centre visit, which should include an explanation of growth charts and interpretation thereof so that caregivers are empowered to monitor their children's growth. The policy states that children from birth to 2 years should have their weights and heights plotted on the RTHB monthly, and children aged 3–5 years should be monitored every 3 months.[6]

Several research studies have been done on GMP in SA. Problems and challenges faced at the PHC level include poor understanding of RTHC by nurses, inconsistent weighing methods, incorrect plotting of anthropometric measurements, incomplete RTHC and incorrect interpretation of growth charts. Some reasons reported for these challenges are lack of time and human resources, equipment shortages and lack of training.[9,15–18] There are very few studies from SA regarding caregivers' knowledge and practices of GMP. Poor interpretation of growth charts by caregivers[17,19] and poor compliance with GM frequency recommendations were reported for GM practices beyond 12 months.[19]

The current study aimed to measure factors associated with knowledge and practices of GMP of caregivers of in- and outpatient children from birth to 24 months, referred for any medical and health-related condition to a large quaternary-level hospital in eThekwini Metropolitan Health District from health facilities in KZN in 2018. The objectives of the study were (a) to describe the sociodemographic profile of the caregivers and children, (b) to assess the completeness of the RTHC, (c) to assess caregivers' knowledge of the RTHC, (d) to measure the association between the caregiver's sociodemographic profile, GMP practice and their knowledge.

## Methods

### *Study design and population*

An observational, analytic cross-sectional study design was used. The study was conducted at Inkosi Albert Luthuli Central Hospital (IALCH), a large referral hospital in Durban, in the eThekwini Metropolitan Health District. As the study was done in a referral hospital, this has implications for the generalisability of the results. The study population comprised caregivers aged 18 and older, of children from birth to 24 months referred for any medical and health-related reasons from other KZN health districts.

### *Sample size and selection*

A non-probability convenience sample was compiled. Caregivers were approached while in the outpatient waiting areas and in the wards. The purpose of the study was presented to all eligible caregivers and interviews were done with those who gave consent to participate and were interested in doing so. Outpatients were assured that they would not lose their place in the queue. The interviews with the 386 caregivers were conducted in private after consent was obtained. The response rate was 97%. The sample size was calculated assuming that 50% of the charts would be complete. A 5% level of precision and a 95% confidence interval were assumed. Recruitment continued until the pre-calculated sample size of 384 was reached.

### *Data collection and tools*

Interviews with the caregivers were conducted between August and October 2018, regardless of whether they had an RTHC. The principal investigator (PI) conducted all the interviews. A structured, interviewer-administered questionnaire was used to collect data. The questionnaire was modified from pre-existing and pre-validated ones, done in an African context.[20,21] It had questions concerning the sociodemographic profile of the caregiver, child's information, knowledge questions, questions to check completeness of the chart, and questions to assess the caregiver practices of GMP. An RTHC was considered complete if the child's weight, length and mid-upper arm circumference (MUAC) measurements were correctly recorded at appropriate intervals according to the child's age. Weight and length should be measured and plotted monthly in the first year and bimonthly in the second year. These can be done monthly from birth until two years if caregivers take children to the GM clinic often. The plotted points had to be joined, where applicable. MUAC measurements should be done at least every three months from the age of six months. Data on completeness were obtained by observing the child's RTHC. Caregivers were also asked about interventions received, such as receiving supplements if a child was underweight or referral to a dietitian or nutritionist if a child was overweight. Clinical notes in the RTHB were reviewed.

Knowledge was assessed by awarding one point for each correct answer (Appendix 1). Knowledge questions were scored out of 15, and graded as poor = 0–39%, good = 40–49% or very good = 50–100%.[20]

All caregivers were given a unique study number to ensure confidentiality, and identification details were captured on a sheet. The study was pilot tested in the same study site, at a different outpatient clinic to validate the questions. The 20 participants whose data were captured in the pilot were not included in the main study. The pilot study findings were not analysed with the Statistical Package for the Social Science (SPSS), due to time constraints, but were entered on an Excel spreadsheet (Microsoft Corp, Redmond, WA, USA) and discussed with colleagues. No changes were made to the data collection tool after the pilot studies.

The database containing the data obtained from the study sample was stored on two computers in password-protected files. The completed questionnaires containing raw data were filed and stored safely in a lockable cupboard with restricted access.

## Data analysis

The main study data from the questionnaires were entered, cleaned and analysed using IBM SPSS Statistics (2017) version 25 (IBM Corp, Armonk, NY, USA). Appropriate descriptive statistics were used to summarise categorical and numeric data. Pearson chi-squared test and Fisher's exact test measured the association between categorical variables. The Kruskal–Wallis test was used to estimate statistically significant differences in knowledge scores with varying levels of the caregivers' education and the child's age. A Bonferrroni adjustment was

performed to make a pairwise comparison of caregivers' education and children's age. A *p*-value less than 0.05 was considered statistically significant.

### Ethical considerations

Ethical approval was obtained from the Biomedical Research and Ethics Committee at the University of KwaZulu-Natal (Reference number BE641/17) and the KZN Department of Health Research and Knowledge Management (number HRKM020/18). Permission to conduct the study was also obtained from IALCH management. Nursing managers of different clinics and wards gave permission to conduct the study. Participants' information sheets were given to all study participants before written informed consent was obtained. The participant information sheets and other study explanations were written and communicated in IsiZulu and English.

## Results

### Sociodemographic characteristics

A total of 386 female caregivers participated in the study. The data from three interviews were excluded from the final sample size as they had children over 24 months of age. The mean age of the 383 caregivers was 29 years. The majority ($n = 201$; 53%) were between the ages of 21 and 30 years (Table 1).

**Table 1:** Characteristics of caregivers of children 0–24 months sampled for the study in IALCH, 2018 ($n = 383$)

| Variable | *n* | % |
|---|---|---|
| Caregiver's age (years): | | |
| 18–20 years | 39 | 10.2 |
| 21–30 years | 201 | 52.5 |
| 31–40 years | 124 | 32.4 |
| 41–53 years | 19 | 5.0 |
| Marital status: | | |
| Single | 327 | 85.4 |
| Married | 54 | 14.1 |
| Divorced or widowed | 2 | 0.5 |
| Grades completed ($n = 381$, 2 missing): | | |
| Never went to school | 2 | 0.5 |
| Grade 1 to Grade 7 | 19 | 5.0 |
| Grade 8 to Grade 12 | 310 | 81.4 |
| Tertiary | 50 | 13.1 |
| Source of income: | | |
| Child-care grant | 248 | 64.8 |
| Father contributes money | 109 | 28.5 |
| Assistance from other family members | 13 | 3.4 |
| No child-care grant (salary only) | 8 | 2.1 |
| Old-age pension of grandmother | 2 | 0.5 |
| Piecework | 2 | 0.5 |
| Disability grant | 1 | 0.3 |
| Salary + grant | 63 | 16.4 |
| Number of children: | | |
| One child | 114 | 29.8 |
| More than one child | 269 | 70.4 |
| Child's age (months): | | |
| 0–5 months | 131 | 34.2 |
| 6–12 months | 129 | 33.7 |
| 13–18 months | 77 | 20.1 |
| 19–24 months | 46 | 12.0 |

### Completeness of the RTHC

Three hundred and forty-one RTHCs (89%) were available on the interview days and were therefore assessed. Of those RTHCs seen, only 7.6% ($n = 26$) were complete. Of 80 children who needed specific interventions like nutrition counselling and enrolment in the nutritional supplementation programme (NSP), 61 (76%) received it (Table 2).

### Practices of GMP by caregivers

According to the caregivers, all children had an RTHC, even though some caregivers did not bring them to the hospital on the day of interview. Caregivers were asked about the education and advice they were given at their local clinics, to get an idea of the kind of services provided at healthcare facilities (Table 3).

### Caregivers' knowledge of GMP

About 73% ($n = 281$) of caregivers had very good overall knowledge of information on the RTHC. However, only 9.9% ($n = 38$) correctly interpreted all four growth charts (Table 4).

### Associations between caregivers' sociodemographic profile, practice and knowledge of GMP

Table 5 shows differences in knowledge regarding RTHC and in interpretation of simulated growth charts across sociodemographics and practices of GMP of caregivers. Only caregivers with correct chart interpretations are shown. Results show a statistically significant difference in knowledge score of RTHC across education level of caregivers and across children's ages. There were significant differences between caregivers who completed grades 1–7 and 8–12, also grades 1–7 and tertiary education. For children's age, the significant differences were between 0–5 months and 19–24 months, also 13–18 months and 19–24 months. The median knowledge score was 9, with an interquartile range of 7–11.

## Discussion

This study aimed to measure factors associated with knowledge and practices of GMP of caregivers of in- and outpatient children from birth to 24 months, referred for any health or medical-related reason to IALCH from health facilities in KZN in 2018. The mean age of caregivers in this study was 29 years, and most were single. In a study done in Nigeria to assess mothers' knowledge and understanding of growth charts, the mean age was 26 years. In Ghana, a study was done to determine the association between maternal knowledge on growth charts and the nutritional status of children,

**Table 2:** Completeness of RTHCs at IALCH in 2018 ($n = 341$)

| Variable | *N** | *n* | % |
|---|---|---|---|
| RTHC available for evaluation | 383 | 341 | 89.0 |
| All items on RTHC filled in correctly | 341 | 26 | 7.6 |
| Weight measurements correctly graphed | 341 | 331 | 97.1 |
| Weight measurements joined by lines | 341 | 216 | 63.3 |
| Length measurements correctly graphed | 341 | 235 | 68.9 |
| Length measurements joined by lines | 341 | 76 | 22.3 |
| MUAC done[1] | 221 | 132 | 59.7 |
| Necessary intervention given[2] | 80 | 61 | 76.3 |

[1]MUAC measurements for children less than 6 months were excluded as they were not applicable ($n = 120$), [2]Intervention not applicable, hence excluded ($n = 261$).
*N varied because data was unavailable for some caregivers.

**Table 3:** Practice of GMP by caregivers, IALCH, 2018, ($n = 383$)

| Variable | n | % |
|---|---|---|
| The child has the RTHC* | 383 | 100.0 |
| Caregiver was taught how to interpret the plotted weight | 42 | 11 |
| Caregiver was taught how to interpret plotted length | 18 | 4.7 |
| Caregiver was always advised to bring RTHC to the clinic | 368 | 96.0 |
| Caregiver was always advised to bring RTHC for immunisation | 369 | 96.3 |
| The reason you take a child to a clinic generally:* | | |
| Immunisation | 258 | 67.4 |
| Ill health | 123 | 32.1 |
| Growth monitoring | 2 | 0.5 |
| Caregiver who took a child for growth monitoring only ($n = 368$)* | 215 | 58.4 |

*Caregiver practices.

and the mean age was 31. In both studies most caregivers were married, which differs from this study.[20,22]

The study revealed that approximately 92% of RTHC were incomplete. Essential weights, lengths and MUAC measurements were not reported correctly at appropriate intervals according to a child's age. Even though measurements of weights, lengths and MUAC were ticked as recorded, they were not all completed as prescribed for specific age groups. Appropriate nutritional diagnoses will most likely be missed if weights and lengths are not measured appropriately. The poor plotting of length measurements is particularly concerning, especially because stunting has been highlighted as a problem globally and locally.[3,4,14,23,24] The poor recording of length measurements was previously highlighted in an earlier study in KZN clinics, particularly eThekwini District,[25] and later in Western Cape districts,[18] and in Gauteng.[15,26] Stunting has been associated with poor cognitive and motor development, morbidity and mortality.[24] Reasons for incomplete RTHCs were not investigated in this study and health professionals were not interviewed, but previous studies that highlighted this issue mentioned a lack of time and resources, staff and equipment shortages as some of the reasons.[15,18]

**Table 4:** Caregivers' knowledge of GMP, IALCH, 2018 ($n = 383$)

| Variable | n | % |
|---|---|---|
| Caregiver knows: | | |
| The main purpose of RTHC | 116 | 30.3 |
| First-year weighing schedule | 250 | 65.3 |
| Second-year weighing schedule | 213 | 55.6 |
| The information recorded on an RTHC | | |
| Patient's name | 376 | 98.2 |
| Patient's home address | 210 | 54.8 |
| Information about the child | 371 | 96.9 |
| Information about the child's siblings | 166 | 43.3 |
| Immunisation records | 361 | 94.3 |
| Information about breastfeeding | 335 | 87.7 |
| Information about interpreting the child's growth | 268 | 70.0 |
| Preparation of oral rehydration solution | 211 | 55.1 |
| Correct interpretation of the different growth charts: | | |
| Growth chart 1: a child who is overweight | 86 | 22.5 |
| Growth chart 2: a child who is gaining weight normally | 130 | 33.9 |
| Growth chart 3: a child who is not gaining weight | 154 | 40.2 |
| Growth chart 4: a child who is underweight | 225 | 58.7 |
| Number of growth charts correctly interpreted: | | |
| 0 | 120 | 31.3 |
| 1 | 74 | 19.3 |
| 2 | 85 | 22.2 |
| 3 | 66 | 17.2 |
| 4 | 38 | 9.9 |
| Overall knowledge of information on RTHC: | | |
| Poor (0–39%) | 54 | 14.1 |
| Good (40–49%) | 48 | 12.5 |
| Very good (50–100%) | 281 | 73.4 |

It is encouraging that most children received the necessary interventions based on their needs. For instance, caregivers of underweight and overweight children received counselling. Some children received nutritional supplements where indicated, according to the NSP. Some were referred to dietitians or nutritionists and were followed up appropriately. The point of GM is to do regular anthropometric measurements to assess growth adequacy and for appropriate action to be taken when abnormal growth is detected.[9,17]

Remarkably, when caregivers were asked about reasons for taking their children to the clinic, only 0.5% mentioned GM. However, when prompted about taking children for GM alone, 58% indicated that they did. Some 67% of caregivers in this study stated that they took their children to the clinic for immunisations. This outcome is inconsistent with the study in Nigeria, where 38.1% and 16.1% of caregivers take children to the clinic for immunisation and for GM, respectively.[20] The discrepancy might indicate that GM is not as emphasised at the primary health care (PHC) level as with programmes like immunisation. Therefore, GMP was not seen as necessary by caregivers. GMP empowers mothers to provide appropriate child care,[11] and is one of the most visible child health actions to reduce malnutrition and, thus, contribute to child survival goals.[12,13] A review of studies done in developing countries was undertaken. The purpose was to analyse evidence of effectiveness of GMP. The impact and effectiveness of GMP has long been questioned. The frequency of taking and plotting measurements has been debated. Some reports recommended focusing on the first 12–18 months. It was also recommended that GM be stopped at 12 months for children with less or equal to one episode of faltering in the first year. Instead, the time gained by not monitoring older children should be used to provide better nutrition counselling services. Monthly GMP services were recommended, but taking into consideration local circumstances and resources. It was further suggested that GMP be combined with other services like immunisation, ensuring the provision of sufficient staff and time to permit adequate counselling.[27]

Approximately 30% of caregivers thought that the purpose of the RTHC was to monitor the child's weight. In Ghana, 78% of caregivers mentioned that the purpose of the growth chart was to monitor growth.[28] Nevertheless, a study in Nigeria indicates that only 27% of mothers thought that the purpose of the growth chart was to monitor the child's weight.[20] Most caregivers in this study thought that the RTHC was for immunisations, recording a child's health, recording illness, taking a child to the clinic and getting a birth certificate. These might be justifiable answers in the South African context because RTHCs are in a booklet, including more areas than just growth monitoring.

**Table 5:** Association between caregivers' sociodemographic profile, practice and their overall knowledge and interpretation of RTHC, IALCH, 2018, ($n = 383$)

| Factor | Total *n* per category | Correct growth chart 1 (overweight) interpretation *n* (%) | Correct growth chart 2 (normal weight) interpretation *n* (%) | Correct growth chart 3 (weight remains the same) interpretation *n* (%) | Correct growth chart 4 (underweight) interpretation *n* (%) | Overall score on RTHC knowledge Median score out of 15 |
|---|---|---|---|---|---|---|
| Education: | | | | | | |
| Never went to school | 2 | 0 (0%) | 0 (0%) | 0 (0%) | 1 (50%) | 6.5 |
| Grade 1–7 | 19 | 3 (16%) | 4 (21%) | 4 (21%) | 5 (26%) | 7[#] |
| Grade 8–12 | 310 | 69 (22%) | 102 (33%) | 117 (38%) | 179 (58%) | 9[#] |
| Tertiary | 50 | 14 (28%) | 24 (48%) | 33 (66%) | 40 (80%) | 10[#] |
| *p*-value | | 0.694 | 0.073 | < 0.001* | < 0.001* | 0.001* |
| Children's age: | | | | | | |
| 0–5 months | 131 | 22 (17%) | 40 (31%) | 55 (42%) | 74 (57%) | 9[#] |
| 6–12 months | 129 | 38 (30%) | 42 (33%) | 55 (43%) | 81 (63%) | 10 |
| 13–18 months | 77 | 14 (18) | 25 (33%) | 20 (26%) | 37 (48%) | 9[#] |
| 19–24 months | 46 | 12 (26%) | 23 (50%) | 24 (52%) | 33 (71%) | 11[#] |
| *p*-value | | 0.066 | 0.104 | 0.021* | 0.046* | 0.001* |
| Earns a salary | 63 | 21 (33%) | 21 (33%) | 33 (52%) | 45 (71%) | 10 |
| *p*-value | | 0.024* | 0.911 | 0.031* | 0.025* | 0.010* |
| Taught to interpret plotted weight | 42 | 12 (29%) | 22 (52%) | 24 (57%) | 34 (81%) | 10.5 |
| *p*-value | | 0.314 | 0.007* | 0.018* | 0.002* | 0.000* |
| Taught to interpret plotted length | 18 | 6 (33%) | 11 (61%) | 13 (72%) | 15 (83%) | 11.5 |
| *p*-value | | 0.255 | 0.013* | 0.005* | 0.030* | 0.0028* |
| Caregivers who take children to a clinic for growth monitoring only | 215 | 50 (23%) | 63 (29%) | 84 (39%) | 123 (57%) | 9 |
| *p*-value | | 0.932 | 0.018* | 0.511 | 0.348 | 0.196 |

[#]Categories that differed significantly.
*Statistically significant results ($p < 0.05$).

It is commendable that 65% and 55% of caregivers knew about the frequency of GM for zero to 1 and 1–2- year-olds, respectively. An earlier South African study also found that 83.3% and 41.7% of the caregivers knew about the 0–1-year and the 1–2 years GM frequency, respectively.[19] The study in Ghana also showed that 96.3% and 86.3% of caregivers had good knowledge of the frequency of GM for the 0–1 year and 1–2 years age groups, respectively.[22] In contrast, the Nigerian study reported that 38.3% and 8.1% of caregivers had poor overall knowledge about GM frequency for 0–1 year and 1–2 years, respectively.[20] The fact that most RTHCs were incomplete in this study might mean that this knowledge did not necessarily translate into action. If caregivers know about GM frequency, then it would be expected that they would take their children more regularly to the clinics for GM and therefore have more complete RTHC. However, health system factors could contribute to the incompleteness of RTHCs. For instance, staffing and lack of equipment in health facilities could be the contributing factors.[15,16,18]

In this study, less than 10% of caregivers were taught about weight and length interpretation by healthcare workers at PHC. Caregivers must be able to interpret growth charts and understand how to use them.[27] The Nigerian study also reported that few caregivers were taught about these measurements.[20] Some studies have reported poor knowledge and understanding of RTHC by nurses.[9,16,18,25,29] Therefore, it might be argued that if nurses themselves do not fully understand RTHCs, they will not be able to teach caregivers. This is very concerning and needs urgent attention. This area was not investigated in this study, and a definite conclusion cannot be made. A study in Limpopo concluded that the fact that weight and length measurements were not plotted means that caregivers were not taught about RTHC.[19]

In this study, the caregivers' overall knowledge was excellent, but most caregivers did not interpret the growth charts correctly. Caregivers' poor interpretation of growth charts has been a finding in previous studies.[19,20,22,28,30] Only 10% of caregivers correctly interpreted all four growth charts, almost similar to the study in Ghana, where only 18.7% of caregivers could interpret all four growth charts.[28] On a positive note, the graph reflecting underweight had the most correct interpretations, with 59% of caregivers interpreting it correctly. This outcome may suggest that caregivers can identify this feature and therefore seek help. If malnutrition is detected early, it is possible to treat it with the correct interventions. Conversely, malnutrition has detrimental effects like stunted growth and delayed cognitive development if left untreated.

There was a positive association between education and knowledge concerning RTHC. This is consistent with several studies that investigated caregivers' knowledge of RTHC.[20,22,30,31] A positive correlation was also found in this study between a

child's age and a caregiver's knowledge concerning RTHC. The study in Ghana also reported an association between a child's age and the caregiver's knowledge on growth graphs.[22] There was an association between knowledge of RTHC and caregivers being taught about the charts in the clinic. A study in Ethiopia also reported an association between GM knowledge of caregivers and education received from health professionals.[31] This is an important finding and should be used to encourage the education of caregivers by health professionals in the clinics, as it yields positive results.

Recommendations for future studies include the need for more focused studies, such as checking anthropometry at specific ages and focusing on one district at a time. Reasons for incomplete RTHC need to be explored; these could include interviewing health professionals, as done in other studies, or questioning caregivers more fully. Questionnaires should also be more specific to the scenario. For example, the question on completeness could reflect the completeness of RTHCs more accurately, which could be fully, partially, or not completed, and not applicable.[15] More effort and attention need to be paid to teaching health workers and caregivers regarding the importance and benefits of GMP, ensuring that facilities are well resourced with staff and equipment. Training topics for health professionals and caregivers could include the consequences of not detecting malnutrition early and the burden of malnutrition on individuals, societies and healthcare. Strengthening community-based growth-monitoring centres is encouraged for high population coverage in their own communities.[17,32]

### *Limitations of the study*

This study was done at IALCH only. Even though it is a quaternary-level hospital and a referral centre for all districts, sample sizes from most districts were small. Stratification by the health district was not done, so results cannot be generalised to the whole of KZN. Stratification was not done because of time constraints and uncertainty concerning the number of people referred from each district. Although caregivers were willing to answer questions and consented voluntarily, honesty and accuracy in answers could not be guaranteed. Because these children were ill enough to require referral, their caregivers may have received more education than the average caregiver attending a clinic. As such, their knowledge is not reflective of all caregivers in the area.

Certain specific information was not collected during interviews, which gave an incomplete picture of the RTHC, e.g. the actual number of anthropometric measurements. Some data might have been erroneously missed, such as MUAC measurements recorded elsewhere and not on the designated table. Even though the PI did browse through the clinical notes, it is possible some data were missed.

## Conclusion

The study showed that most RTHC were incomplete and that most caregivers could not interpret growth charts correctly, even though overall knowledge about RTHC contents was very good. Most caregivers knew about GM frequency and did take their children to the clinic for GM only. Infrequent recording of length measurements is a big concern because of the high rate of stunting in KZN. There is a gap in GMP and this needs intervention and education.

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## Appendix 1: Knowledge questions

- What is the main purpose of the growth chart?

  For immunization

  For monitoring the weight of the child

  Don't know

- How regular should children between 0 and 1 year be weighed for growth monitoring?

Once a month

One in two months

Two times a year

Don't know

Whenever the child is brought for immunisation or illness

Other

- How regular should children between 1 and 2 year be weighed for growth monitoring?

Once a month

One in two months

Two times a year

Don't know

Whenever the child is brought for immunisation or illness

Other

- Do you know if the following information is recorded on a growth chart? ( 1 point for yes)

Patient's names

Patient 's home address

Information about the child

Information about the child's siblings if any

Immunisation records

Information about breast feeding

Information on how to interpret the child's growth

How to prepare oral rehydration solution to treat diarrhoea

What is the interpretation of the following? (Note: show different charts; correct answer in bold)

*chart 1*

**Child is overweight**

Child is underweight

Child is gaining weight normally

I don‘t know

*chart 2*

Child is underweight

**Child is gaining weight normally**

Child is growth is in danger

I don‘t know

*chart 3*

Child is gaining weight too much

Child is gaining weight normally

**Child is not gaining weight- remains the same for months**

I don’t know

*chart 4*

Child is gaining weight too much

Child is gaining weight normally

Child is not gaining weight-weight remains the same for months

**Child is grossly underweight**