‘Growth and Determinants at Two Years of Age in a South African Birth Cohort’

Masters in Medicine (MMed) in Paediatrics

University of Cape Town

Dr Raphaela Itzikowitz

ITZRAP001

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1 Declaration by Student

I, Raphaela Itzikowitz Geva, hereby declare that the work on which this dissertation/thesis is based is my original work (except where acknowledgements indicate otherwise) and that neither the whole work nor any part of it has been, is being, or is to be submitted for another degree in this or any other university. This work has not been reported or published prior to registration for the abovementioned degree.

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2 Declaration by Supervisor

I, Professor Heather Zar, support the submission of the thesis entitled "Patterns and determinants of Growth at two years of age in a South African Birth Cohort" by student Raphaela Itzikowitz towards the degree of MMed in Paediatrics and confirm the planned publication meets all requirements to be included in the dissertation, namely:

The journal publishing the paper is accredited by the department of higher education and training or it has been approved by the UCT Health Sciences Specialist Training Committee and:

- The candidate is the first author on the paper
- The candidate contributed the most to the paper
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- The candidate was involved in the analysis, presentation and interpretation of results
- The other authors and their contributions to the paper are stated
- The above statements will be included in the declaration page of the dissertation

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Date: February 2024

3 Acknowledgements

I would like to thank my supervisor Professor Heather Zar who has always been available to guide and advise me, even beyond expectation and any call of duty. Your humility, patience and expertise is unmatched. I continue to be inspired by and grateful for your gentle encouragement, your firm dedication to scientific excellence, and above all, your incredible kindness and humanity. I thank my co supervisor Dr Liz Goddard for your encouragement and input in assisting me to refine and expand my thoughts and skills. I remain grateful to Marilyn Lake whose statistical input was concise and incredibly reliable. I am so grateful to the Department of Paediatrics for their guidance, patience and encouragement on this journey.

I am forever indebted to my parents Gary and Angela, and to my family, my big wonderful family, who have allowed me, supported me, uplifted me, and instructed me in all the appropriate ways at all the appropriate times. This village has made all dreams come true.

There are no measures of gratitude adequate for my immensely patient husband and our magical three children, Sofia, Micah and Nova- who are entirely responsible for the delay in the submission of this thesis, but also my inspiration, my meaning, and my everything.

4 Author Contributions

Raphaela Itzikowitz and Prof Heather Zar identified an important aspect of growth from data collected as part of the Drakenstein Child Health Study, of which Prof Zar is Principal Investigator. A literature search was conducted, and a standard protocol was drafted whereby secondary analysis of DCHS data would be done for purposes of this thesis. The final protocol was approved by the Departmental Research Committee, Department of Paediatrics and Child Health, University of Cape Town. Ethics approval letters, hospital approval letters and protocol amendment parties were written by Dr R Itzikowitz, and all necessary approvals were obtained. Prof Heather Zar supervised and assisted in all aspects of the process. Data cleaning and statistical support was provided by the REACH data team, mainly by Marilyn Lake whose assistance was invaluable. Liz Goddard assisted in review of the final manuscript and provided feedback during write up and journal selection. Dan Stein, Francesca Little and Shrish Budree assisted in final review of manuscript.

Raphaela Itzikowitz prepared the final manuscript in accordance with the guidelines for authors of the Journal of Maternal and Child Nutrition, and finalized the document in accordance with submission requirements of UCT for the MMed in Paediatrics, in Publication Ready Format.

5 Abbreviations

DCHS	Drakenstein Child Health Study
LMIC	Low Middle Income Countries
SADHS	South African Demographic and Health Survey
MUAC	Mid Upper Arm Circumference
HC	Head Circumference
BMI	Body Mass Index
SES	Socio Economic Screening
HIV	Human Immunodeficiency Virus
ASSIST	Alcohol, smoking and substance involvement screening test
USA	United States of America
PTSD	Post-Traumatic Stress Disorder
MPA	Maternal Psychosocial Assessment
IPV	Intimate partner Violence
WHO	World Health Organisation
LRTI	Lower Respiratory Tract Infection
LBW	Low Birth Weight
WFAZ	Weight for age Z score
HFAZ	Height for age Z score
WFHZ	Weight for height Z score
BMIZ	Body Mass Index Z score
BMI	Body Mass Index
OWFA	Overweight For Age
SGA	Small for Gestational Age
EED	Environmental Enteric Dysfunction
WASH	Water Sanitation and Hygiene

6 List of Figures and Tables

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8 Publication Ready Journal Article

8.1 Title Page

Growth and Determinants at Two Years of Age in a South African Birth Cohort

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8.1.1 Ethical Considerations

Ethical approval was obtained from the University of Cape Town, Faculty of Health Sciences Human Research Ethics Committee, and the Provincial Child Health Research committee. Written informed consent was obtained from a mother at enrolment and renewed annually.

8.1.2 Data Sharing

Collaborations from external researchers are welcome. The study has a large and active group of investigators and postgraduate students with a track record of successful partnership with researchers or students from other institutions. Researchers who are interested in collaborations or access to study datasets can find additional information on our website http://www.paediatrics.uct.ac.za/scah/dclhs.

8.1.3 Acknowledgements

We thank the hospital, clinic, and study staff at Paarl Hospital, Mbekweni and TC Newman for supporting this study, together with the families and children who took part.

8.1.4 Financial Support

The Drakenstein Child Health Study was funded by the Bill and Melinda Gates Foundation (OPP 1017641), The South African Medical Research Council,

8.1.5 Conflict of interest

The authors have no conflicts of interest to declare.

8.1.6 Contributor Statement

RI and HZ identified an underexplored topic of interest within the DCHS dataset of which HZ is principal investigator. RI conducted a comprehensive literature search, devised a protocol which was submitted to HREC. ML conducted the statistical analyses. HZ supervised the project throughout. LZ, DS, FL and SB reviewed the final protocol and provided additional support in the writing of this manuscript.

8.1.7 Word Count

Abstract 329 words

3,667 excluding Abstract and References

8.2 Main Text File

8.2.1 Abstract

Aim:

Early childhood is a critical period for optimal growth but there are limited data from low- and middle-income countries (LMICs) on the determinants of growth during this time. This study aimed to investigate growth and its determinants in children at 2 years of age in a South African birth cohort in a resource-limited region.

Methods:

Mother-child pairs enrolled in a South African birth cohort, the Drakenstein Child Health Study (DCHS), were followed from birth to two years. Comprehensive socio-demographic and psychosocial data collected during the antenatal period and nutritional information, intercurrent illness and immunisation data collected longitudinally in the first 2 years was used. Anthropometric data, measured at 2 years, were analysed as z-scores adjusted for child age, sex, and prematurity, and used to classify undernutrition (wasting, underweight for age and or stunting), overweight for age or obesity. Logistic regression was done to identify predictors of undernutrition, overweight or obesity at 2 years.

Results:

Anthropometric data from 897 children (51% male; 22% HIV-exposed, uninfected) were included. 69 (8%) were underweight, 20 (2%) were wasted and stunting occurred in 167 (19%) children; 116 children were overweight (13%), and 42 were (5%) obese. Overall, 351 (39%) had some form of growth impairment. Higher birth weight, or length, higher maternal height or better maternal education were associated with lower odds of undernutrition or stunting at 2 years. Male sex, antenatal maternal smoking or prematurity were associated with increased odd of undernutrition or stunting. Higher birth weight was associated with increased odds of being overweight for age. Better maternal education was associated with increased odds of obesity, but antenatal smoke exposure reduced the risk.

Conclusion:

There is a substantial burden of malnutrition in South African children during early childhood encompassing both undernutrition and obesity. Stunting, indicative of chronic growth impairment, is most prevalent. Antenatal risk factors are important predictors of poor growth outcomes. Strengthened strategies to improve childhood nutrition and address modifiable factors in the antenatal and early childhood periods are needed.

Key Words: Anthropometry, child growth, Low-middle income countries, stunting, obesity.

8.2.2 Introduction

Childhood malnutrition, encompassing both under-nutrition and overweight or obesity, is highly prevalent in low- and middle-income countries (LMIC) and represents a double burden of disease. (1) Undernutrition may manifest as stunting, wasting or underweight for age. Although global rates of stunting in children under-5 years have decreased over the past 2 decades, the prevalence of stunting in Sub-Saharan Africa has continued to rise. (1) The 2016 South Africa Demographic and Health Survey (SADHS) found that stunting was the most common manifestation of malnutrition prevalent in 27% of children under 5 years. Wasting and underweight rates for children under 5 years were substantially lower, but prevalent. (2, 3) Undernutrition was most marked in the first 1000 days of life. Another 2016 South African survey reported that a third of children up to 2 years of age were stunted. (2) Concurrently, obesity rates in children in LMIC have been rising. (1,4)

Childhood undernutrition contributes to under-5 mortality and morbidity. An audit of hospital child deaths in South Africa found that 30% of infants and 42% of children aged 1 to 5 years who died were severely malnourished. (5) Stunting in early life is also associated with adverse functional consequences, including impaired neurocognition and poor educational performance, as well as increased risk of infection and mortality. (6)

Several factors may impact child growth including socioeconomic circumstances, psychosocial factors (such as depression, alcohol use and intimate partner violence), infectious exposures and feeding practices. Such factors may be especially prevalent in LMICs. (6,7) Rapid growth in infancy is associated with a greater risk of lifetime obesity, and development of non-communicable diseases. (8,9)

Understanding predictors of growth impairment is essential to identify vulnerable children and implement effective preventive and treatment interventions. However, there are limited data on growth and its determinants in early childhood in South Africa. (10,11) We previously described growth from birth until 1 year of age in a South African birth cohort, the Drakenstein Child Health study (DCHS)(11,12) We extend this work through early childhood, to describe patterns and determinants of growth at two years.

8.2.3 Methods

A prospective study of growth from birth through 2 years in children enrolled in the DCHS was conducted. Briefly, pregnant women were enrolled between 1 March 2012 and 31 March 2015 in their second trimester of pregnancy, followed through birth, and mother-child pairs followed from birth to at least 2 years of age as described. (12) Comprehensive measures of key risk factors across several domains including environmental, infectious, nutritional, psychosocial, maternal, and immunological factors that may impact child health were measured.

8.2.3.1 Study Population

Pregnant women (>18 years old) living in a resource-poor peri-urban area of South Africa were enrolled at two primary healthcare facilities where they received antenatal care, as previously described. (12). Enrolment criteria was broad to ensure generalisability and that the cohort would be representative of the general population; participants had to be able to provide informed consent and intend to remain in the area for at least 1 year. All births occurred at a single public hospital.

8.2.3.2 Antenatal Measures

Maternal physical health including self-reported questionnaires, physical examination (including blood pressure and anthropometry,) and urine dipstick were done. Maternal height was measured to the nearest 0.1 cm at enrolment, using a wall-mounted stadiometer. Maternal blood pressure was measured (single arm, single measurement using an electronic blood pressure cuff). Pre-eclampsia was defined as new onset of hypertension with proteinuria or another organ dysfunction. Gestational diabetes was assessed through urine dipstick and fasting blood glucose if urine glucose was positive. HIV serology was taken at the first antenatal visit if maternal HIV status was unknown. Antenatal questionnaires were administered at 28 to 32 weeks' gestation to assess maternal mental health. The Edinburgh Postnatal Depression Rating Scale was used to assess maternal depression; a score of at least 13 was classified as probable depression (13,14). An Intimate partner violence (IPV) questionnaire adapted from the WHO multi-country study and the Women's Health Study in Zimbabwe as described was used to assess recent exposure to violence (14). Exposure was categorised as above threshold if a participant reported more than one incident of IPV during the previous year. Alcohol exposure was assessed using The Alcohol, Smoking and Substance Involvement Screening test (ASSIST) in combination with two retrospective self-

report questionnaires. In addition, any self-reported smoking was used to assess tobacco use. (14).

8.2.3.3 Birth Measures

Gestational age at birth was based on an antenatal ultrasound in the second trimester and if this was unavailable, then fundal height or maternal recall of the last menstrual period was used. Infants were classified as preterm if they were born at less than 37 weeks of gestational age. Late preterm was defined as birth between 34 and 37 weeks of gestation. Low birthweight (LBW) was defined as birth weight less than 2,500g.

8.2.3.4 Growth Measures

Weight and height measurements were taken by study staff at birth, as well as at several time points until 2 years. Data at 2 years was used for analysis. Length was measured in centimetres to the nearest completed 0.5 cm, using the seca 210 length-measuring mat (seca, Hamburg, Germany) from birth until eighteen months. Standing height was measured at 2 years using a wall-mounted stadiometer. Infant weight was measured, in light or no clothing, using the TAN1584 digital platform scale (Tanita, IL, USA). Equipment was calibrated weekly. All anthropometric measurements were done twice, with a third measurement if the difference between the first and second measurement differed by more than 0.5 cm for length or more than 0.1 kg for weight. Study staff underwent regular anthropometric training and assessment every three months.

8.2.3.5 Feeding Practice Variables

Infant feeding practices were assessed including duration of exclusive breastfeeding and age at introduction of solid food. Duration of exclusive breastfeeding and age at initiation of complimentary feeding was included in regression models.

8.2.3.6 Intercurrent Illness

Any intercurrent illness (hospitalisation and ambulatory events) within the first two years of life, was documented focusing specifically on lower respiratory tract infection (LRTI) or gastroenteritis episodes. Measurement of LRTI included severe or very severe pneumonia, as defined by WHO criteria. Active surveillance performed by trained study staff was used for LRTI. (15)

8.2.3.7 Statistical Analyses

All analyses were conducted in R (R Core Team, 2022). (16)

Weight and length measurements following birth were converted to z-scores adjusting for age and gender, using WHO Anthro reference standards (WHO, Geneva, Switzerland) for full-term infants, and the Fenton growth reference chart for preterm infants (10,17). Additionally, the WHO Anthro Reference was exclusively used to convert anthropometric measurements at 2 years into age, sex and prematurity adjusted z-scores, using gestational duration-corrected age from premature-born infants and chronological age from term infants. Weight-for-age z-scores (WFAZ), height-for-age z-scores (HFAZ), weight-for-height z-scores (WFHZ) and body mass index (BMI) for age z scores (BMIZ) were calculated. Underweight (WFAZ), stunting (HFAZ) and wasting (WFHZ were defined by a z-score of <-2. In addition, overweight was defined by a BMI z score > 2, and obesity by a BMI z-score > 3.

Children with undernutrition were defined as either underweight, stunted and/or wasted. Multivariable logistic regression models were conducted to investigate potential determinants of malnutrition and included the following potential determinants which were selected a priori based on previously published literature, from the birth cohort and from global data sources: maternal HIV and height, prenatal alcohol use or smoking, maternal

education, household income, maternal depression, IPV, child sex, prematurity, standardised birth weight and length, exclusive breasting feeding duration, age at complementary feeding, as well as intercurrent hospitalization and illness.

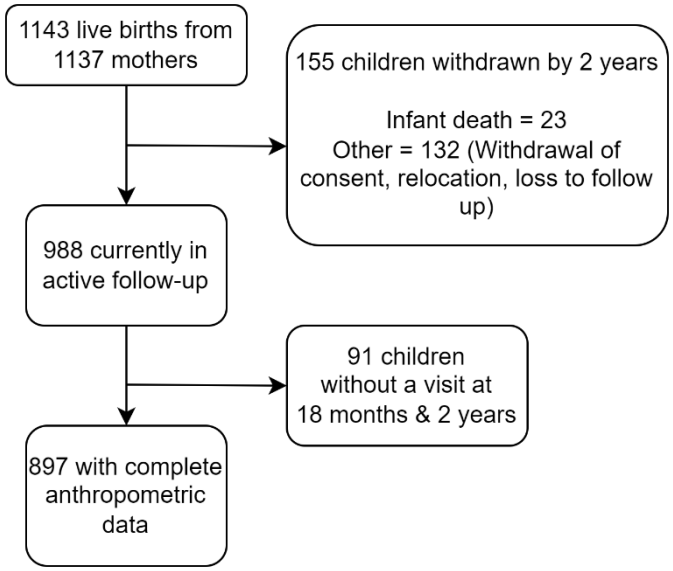
8.2.3.8 Ethical Considerations

Ethical approval was obtained from the University of Cape Town, Faculty of Health Sciences Human Research Ethics Committee, and the Provincial Child Health Research committee. Written informed consent was obtained from a mother at enrolment and renewed annually.

8.2.4 Results

There were 1137 mothers who gave birth to 1143 live infants (four sets of twins; one set of triplets). Of these, 155 infants (13.6%) were excluded, including 23 children (2%) who died by 2 years of age, and others who relocated or withdrew consent. (Fig 1). Among 988 participating children in active follow-up by 2 years, 91 (9.2%) children were excluded as they did not have a study visit at 18 months and 2 years, providing 897 children for this analysis. Of these 897 children who had complete anthropometric data at 2 years, 149 children had incomplete predictor data and some missing variables. Complete case analysis for the predictor models were therefore run on N=748.

Figure 1: Cohort inclusion and 2 years:



The median age of mothers at enrolment was 25. 8 years (IQR 22.0, 30.8); 392 (35%) were primigravida and 244 (21%) were living with HIV. (Table 1)

Most mothers (692, 61%) had obtained a secondary level education or below; only half (578, 51%) were employed. Household income was low with 385 (34%) households earning less than R1000 per month, 592 (52%) earning between R1000 and R5000 per month, and only 159 (14%) earning more than R5000 per month.

There were 137 (13%) mothers who reported having used alcohol during pregnancy, and 323 (28%) self-reported smoking. A third of mothers (333, 34%) had experienced some form of IPV, and depression was reported by 237 (24%). Only 15 (1.3%) had gestational diabetes, and 30 (2.6%) had pre-eclampsia. Median maternal height was 159cm (IQR 155,163)

8.2.5 Child Outcomes

Amongst 1143 infants, 586 (51%) were male, with a median gestational age of 39 weeks (IQR 37.5 ,40). There were 192 (17%) infants born prematurely, of which 129 (67%) were late preterm. Median birth weight was 3080g (IQR 2710, 3420) with 176 (15%) born less than 2500g. Only 2 (0.2%) infants were HIV Infected.

The median duration of exclusive breastfeeding was 1.6 months (0,69, 3.22) 190 (21%) reported exclusive feeding for at least 4 months,

The median age of introduction of complimentary feeding beside milk formula was 5 (IQR 3.22,6.00,) months.

8.2.6 Outcomes at 2 years

By 2 years almost half (406, 45%) had a LRTI and 240, (27%) had an episode of gastroenteritis. (Table 2)

There were 193 (22%) children who had undernutrition at 2 years. Of these, 123 (14%) were stunted only, 12 (1.3%) were underweight only, 1 child was wasted only, whilst 38 (4.2%) were both underweight and stunted, 13 (1.4%) were underweight and wasted and 6 (0.7%) were underweight, stunted, and wasted. Overall, 167 (19%) were stunted, 69 (7.7%) were underweight, 20 (2.2%) were wasted. 116(13%) were overweight for age and 42 (4.7%) were obese. Concerningly, 34% had some manifestation of impaired nutrition, with 22% being undernourished. (Table 2)

Table 1: Baseline characteristics and birth outcomes

Antenatal characteristics (N = 1137)		
Maternal age at enrolment (years)	[median, IQR]	25.8 (22.0,30.8)
Maternal HIV	HIV positive [n, %]	244 (21%)
Maternal education	Lower than secondary [n, %]	692 (61%)
	At least secondary or higher [n, %]	445 (39%)
Parental employment	Currently employed [n, %]	578 (51%)
Household income	< R1000 p/m	385 (34%)
	R1000-R5000 p/m	592 (52%)
	>R5000 p/m	159 (14%)
Asset ownership	[median, IQR]	7 (5,8)
Maternal alcohol use	Yes [n, %]	137 (12%)
Maternal smoking	Yes [n, %]	323 (28%)
Maternal depression	Above threshold [n, %]	237 (21%)
Recent intimate partner violence (past year)	Above threshold [n, %]	333 (29.2%)

Primigravida	Yes [n, %]	392 (34%)
Maternal height (cm)	[median, IQR]	159 (155,163)
Gestational diabetes	Yes [n, %]	15 (1.3%)
Pre-eclampsia	Yes [n, %]	30 (2.6%)
Birth characteristics (N = 1143)		
Child sex	Male [n, %]	586 (51%)
Gestational age (weeks)	[median, IQR]	39 (37.5,40)
Prematurity (<37 weeks' gestation)	[n, %]	192 (17%)
Late preterm (>=34 & <37 weeks)	[n, %]	129 (11%)
Early preterm (< 34 weeks)	[n, %]	63 (5.5%)
Birth weight (grams)	[median, IQR]	3080 (2710, 3420)
Low birthweight (<2500g)	[n, %]	176 (15%)
Birth length (cm) HIV Exposed, Uninfected	[median, IQR] [n,%]	50 (48,52) 242 (21.7%)

Table 2: Infant feeding, intercurrent infection and anthropometry

Feeding (N=897)		
Exclusive breastfeeding (at least 6 months)	[n, %]	63 (7%)
Exclusive breastfeeding (at least 4 months)	[n, %]	190 (21%)
Duration exclusive breastfeeding (in months)	[median, IQR]	1.61 (0.69,3.22)
Complementary feeding start (in months)	[median, IQR]	5.00 (3.22, 6.00)
Immunisations up to 2 years (N=897)		
All immunisations received	[n, %]	863 (96%)
LRTI episode (LRTI) [1]	[n, %]	406 (45%)
Gastroenteritis episode [1]	[n, %]	240 (27%)
Child anthropometry at 2 years (N=897)		
Child age (months)	[median, IQR]	24.8 (23.9, 25.5)
Undernourished composite	Undernourished [n, %]	193 (22%)
Weight-for-age (WFAZ)	Underweight [n, %]	69 (8%)
Height-for-age (HFAZ)	Stunted [n, %]	167 (19%)
Weight-for-Height (WFHZ)	Wasting [n, %]	20 (2%)
BMI-for-age (BMIZ) > 2 z-score	Overweight [n, %]	116 (13%)
BMI-for-age (BMIZ) > 3 z-score	Obese [n, %]	42 (5%)

8.2.7 Predictors of Growth

Of 897 children, 149 did not have complete data for all determinants, providing a sample of 748 for complete case analysis of predictors of growth.

8.2.7.1 Undernutrition

Higher birth weight birth length or higher maternal height and better maternal education was significantly associated with lower relative odds of undernutrition. Antenatal smoke exposure was associated with an increased risk of undernutrition. Prematurity (P<0.001, OR 3.07 CI 1.8-5.23) or male sex (P<0.05 OR 1.67 CI 1.11-2.51) were significantly associated with higher odds of being undernourished. **(Table 3)**

8.2.7.2 Stunting

Prematurity or male sex were associated with higher relative odds of stunting, as was antenatal smoke exposure. Higher maternal height, better education or higher birth weight were protective. (Table 3)

8.2.7.3 OWFA and Obesity

Higher birthweight was the only significant predictor of overweight for age at 2 years. Better Maternal education was associated with a greater likelihood of obesity whilst antenatal smoking exposure reduced this risk. **(Table 4)**

Table 3: Multivariable analysis of determinants of undernutrition and stunting at 2 years

		Undernutrition			Stunting		
		OR	CI	p	OR	CI	p
Intercept		0.09	0.04-0.20	<.001	0.07	0.03-0.16	<.001
Birth weight-for-age		0.61	0.48-0.78	<.001	0.58	0.45-0.75	<.001
Birth length-for-age		0.85	0.73-0.99	.034	0.88	0.75-1.03	.108
Maternal HIV	[HIV seropositive]	1.01	0.59-1.69	.980	1.10	0.63-1.87	.734
Maternal height		0.68	0.54-0.84	<.001	0.60	0.47-0.76	<.001
Prenatal alcohol use	[Yes]	0.96	0.56-1.63	.875	1.09	0.62-1.89	.753
Prenatal smoking	[Yes]	1.79	1.16-2.76	.008	1.68	1.06-2.63	.026
Maternal education	[At least secondary or higher]	0.47	0.29-0.73	.001	0.50	0.30-0.80	.005
Household income	[R1000-R5000 p/m]	0.84	0.55-1.28	.409	0.79	0.51-1.23	.296
	[>R5000 p/m]	0.95	0.46-1.87	.878	1.01	0.47-2.04	.989
Maternal depression	[Yes]	1.37	0.85-2.19	.185	1.35	0.82-2.21	.228
Recent IPV	[Yes]	0.79	0.51-1.22	.298	0.64	0.39-1.01	.060

		Undernutrition			Stunting		
		OR	CI	p	OR	CI	p
Child sex	[Male]	1.64	1.09-2.47	.017	1.56	1.02-2.39	.042
Prematurity	[<37 weeks' gestation]	2.89	1.70-4.89	<.001	2.75	1.58-4.75	<.001
Exclusive breastfeeding		1.08	0.97-1.19	.150	1.07	0.96-1.19	.233
Timing of introduction of complementary feeding		1.04	0.92-1.16	.509	1.07	0.94-1.20	.296
LRTI episode	[Any]	0.92	0.61-1.38	.681	1.04	0.68-1.59	.859
Gastroenteritis episode	[Any]	1.45	0.91-2.28	.115	1.40	0.86-2.26	.168
Note: $p < 0.05$; $p < 0.01$; $p < 0.001$							

Table 4: Multivariate analysis of determinants of overweight for age or obesity at 2 years

		Overweight			Obesity		
		OR	CI	p	OR	CI	p
Intercept		0.17	0.07-0.39	<.001	0.05	0.01-0.17	<.001
Birth weight-for-age		1.54	1.17-2.04	.002	1.37	0.90-2.08	.143
Birth length-for-age		0.95	0.80-1.12	.530	0.91	0.71-1.19	.477
Maternal HIV	[HIV seropositive]	1.53	0.87-2.64	.132	1.05	0.41-2.49	.922
Maternal height		1.13	0.90-1.41	.300	1.18	0.83-1.66	.348
Prenatal alcohol use	[Yes]	0.74	0.29-1.67	.495	1.37	0.30-4.67	.647
Prenatal smoking	[Yes]	0.56	0.29-1.00	.059	0.26	0.06-0.79	.035
Maternal education	[At least secondary or higher]	1.55	0.96-2.49	.071	2.43	1.15-5.27	.021
Household income	[R1000-R5000 p/m]	0.73	0.44-1.20	.210	0.76	0.35-1.69	.495
	[>R5000 p/m]	0.97	0.48-1.88	.927	0.92	0.30-2.54	.873
Maternal depression	[Yes]	1.53	0.90-2.56	.111	1.54	0.64-3.45	.309
Recent IPV	[Yes]	0.86	0.51-1.43	.565	0.56	0.21-1.33	.216
Child sex	[Male]	1.05	0.66-1.67	.838	1.39	0.67-2.91	.371
Prematurity	[<37 weeks' gestation]	0.93	0.46-1.76	.823	0.96	0.30-2.51	.932
Exclusive breastfeeding		0.92	0.81-1.05	.223	0.79	0.60-0.99	.054

		Overweight			Obesity		
		OR	CI	p	OR	CI	p
Complementary feeding		1.00	0.88-1.13	.985	1.09	0.90-1.30	.326
LRTI episode	[Any]	1.23	0.78-1.96	.374	0.90	0.42-1.86	.770
Gastroenteritis episode	[Any]	0.86	0.50-1.43	.559	0.87	0.37-1.93	.746
Note: $p < 0.05$; $p < 0.01$; $p < 0.001$							

8.2.8 Discussion

This study found a high prevalence of malnutrition in early childhood with several antenatal, and early childhood determinants in a peri-urban area of SA despite almost no paediatric HIV infection and excellent primary health care including very high immunisation coverage. Stunting was the most common manifestation of malnutrition occurring in almost 1 in 5 children, while obesity was an emerging issue present in approximately 5% of children at 2yrs, with 13% overweight. These data highlight the double burden of nutritional disease emerging in children in LMICs encompassing under and over nutrition.

The prevalence of malnutrition was higher in our study than that reported in this cohort at 1 year of age, most marked for stunting which increased from 13% at 1 year to almost 20% by two years. The South African demographic and health survey of 2016 (SADHS)(18) reported that 27% of children under 5 years were stunted, higher than our findings of 19% at 2 years, but confirmatory of a chronic, increasing rate of poor nutritional intake, rather than acute wasting or UWFA findings which remained consistent and relatively low. The prevalence of being overweight for age almost doubled in the second year of life, as did the prevalence of obesity when compared to 1 year prevalence as previously reported in this cohort.

Globally chronic undernutrition was reported to affect approximately 22% of children under five years, (19) consistent with our study findings, at 2 years of age. Stunting, the most prevalent growth outcome, has been decreasing slightly annually in South Africa, but remains highly prevalent. (19,20)

The significant associations between birth weight, maternal height, maternal education, and malnutrition/stunting are consistent with previous research (21-30). These results emphasize the importance of antenatal modifiable factors including maternal health, education, smoking and socio-economic factors, in optimising early childhood nutritional status. Although the association between gastroenteritis episodes and malnutrition was not significant, gastroenteritis occurred in 27% in the cohort, highlighting the need for effective preventive and treatment strategies. Rotavirus vaccination is included in the SA immunisation schedule, and the high rates of immunisation coverage may have ameliorated the incidence of gastroenteritis and potential impact on growth. While evidence suggests that stunting may not be solely a result of insufficient diet or diarrhoeal disease, environmental enteric dysfunction (EED) – a direct result of chronic pathogen exposure and a consequence of the status of water sanitation and hygiene (WASH) has shown to be a possible mechanism of linear growth failure. (32) The Incidence of LRTI by 2 years was high at 45%, despite good coverage for vaccination against common respiratory pathogens. (33)

Although most preterm births were late prematurity, being born preterm was associated with malnutrition and stunting at 2 years, highlighting the importance of strengthening antenatal care to reduce preterm births and prevent long term growth impairment. (34)

Higher maternal education was consistently protective against under nutrition but associated with obesity in the first two years. Our findings are consistent with a metanalysis done in China, showing protection from stunting and undernutrition, but an increased risk of obesity in children whose mothers were more educated. (35) Previous literature has shown that maternal education is related to quality of diet, level of physical activity, and amount of screen time that children utilise but exploration of this association was beyond the scope of this paper. (36) Almost 62% of mothers did not receive a secondary education or higher, which is concerning given that maternal education has important implications not only for growth but also for cognitive, social, emotional, and other child health outcomes. (37,38,39) Of note, despite this, we still showed high rates of obesity.

Male sex was associated with poorer growth outcomes. This is consistent with previous studies showing that in many LMICs, the decrements in growth are worse amongst male than female children, predominantly with greater rates of stunting (40-45) Studies done In Tanzanian populations found that most of this growth faltering in males occurs early, at least by 6 months, with failure of growth catch up by 18 months. (46) The mechanisms are not clearly understood, but may include increased vulnerability of males to infectious diseases, sex hormone differences and different parenting styles across cultures. (47)

Antenatal maternal smoking was another important predictor of poor growth, Of concern 28% of mothers self-reported smoking almost 3.5 times higher than that in pregnant European women, and 27 times higher than the global incidence of 1.7%. (48) There is considerable existing evidence linking tobacco use during pregnancy with adverse birth outcomes such as LBW and SGA (49-57) growth and other health impairments. (58)

8.2.8.1 Strengths and Limitations

Some antenatal variables such as smoking, alcohol, and tobacco use, were self-reported, which could lead to under-reporting, possibly because of stigma, but high rates were reported. It is also possible that some episodes of child illness may have been missed, but the active surveillance systems in place were robust and effective, as described. In addition, some children were not included in the determinants analyses due to incomplete data (17%) which might have resulted in some bias in the analysis. This risk was mitigated by a very well phenotype cohort, very careful phenotyping, comprehensive measures of exposures and high cohort retention, but exploration of the differences between those lost to follow up and those participants for which we had complete data were beyond the initial scope of this paper. We intend to explore this further in a follow up to this study.

8.2.8.2 Conclusion and Implications

The study has shown high rates of nutritional impairment in young children with both under and overnutrition occurring. Stunting was the most common manifestation of poor growth. Key exposures in the antenatal and early childhood periods affecting growth were identified with several modifiable factors Future work should address the more long-term impact though childhood. This study highlights the need for strengthened antenatal programs to optimise maternal health, prevent maternal smoking, and for early childhood education and feeding programmes.

8.2.8.3 Data Sharing

Collaborations from external researchers are welcome. The study has a large and active group of investigators and postgraduate students with a track record of successful partnership with researchers or students from other institutions. Researchers who are interested in collaborations or access to study datasets can find additional information on our website http://www.paediatrics.uct.ac.za/scah/dclhs.

8.3 Acknowledgements

We thank the hospital, clinic, and study staff at Paarl Hospital, Mbekweni and TC Newman for supporting this study, together with the families and children who took part.

8.4 Financial Support

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8.5 Conflict of interest

The authors have no conflicts of interest to declare.

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10 Appendices

10.1 Appendix A: List and timing of administered maternal questionnaires

10.2 Appendix B: Faculty Research Ethics Approval Letters and Progress Reports

UNIVERSITY OF CAPE TOWN
Faculty of Health Sciences
Human Research Ethics Committee

Room E53-46 Old Main Building
Groote Schuur Hospital
Observatory 7925
Telephone [021] 406 649
Email: sumayah.arlefdien@uct.ac.za
Website: www.health.uct.ac.za/fhs/research/humanethics/forms

31 October 2018

HREC REF: 699/2018

Prof H Zar
Department of Paediatrics
7th Floor, ICH Building
Red Cross Children's Hospital

Dear Prof Zar

PROJECT TITLE: TRENDS AND DETERMINANTS OF GROWTH IN THE FIRST 2 YEARS OF LIFE IN A SOUTH AFRICAN BIRTH COHORT (MMED Candidate - Dr R Itzikowitz) Sub-study linked to 401/2009

Thank you for submitting your study to the Faculty of Health Sciences Human Research Ethics Committee (HREC) for review.

It is a pleasure to inform you that the HREC has **formally approved** the above-mentioned study.

Approval is granted for one year until the 30 November 2019.

Please submit a progress form, using the standardised Annual Report Form if the study continues beyond the approval period. Please submit a Standard Closure form if the study is completed within the approval period.
(Forms can be found on our website: www.health.uct.ac.za/fhs/research/humanethics/forms)

We acknowledge that the student: Dr Raphaela Itzikowitz will also be involved in this study.

Please quote the HREC REF in all your correspondence.

Please note that the ongoing ethical conduct of the study remains the responsibility of the principal investigator.

Please note that for all studies approved by the HREC, the principal investigator **must** obtain appropriate institutional approval, where necessary, before the research may occur.

Yours sincerely

PROFESSOR M BLOCKMAN
CHAIRPERSON, FHS HUMAN RESEARCH ETHICS COMMITTEE

Federal Wide Assurance Number: FWA00001637.
Institutional Review Board (IRB) number: IRB00001938

HUMAN RESEARCH ETHICS COMMITTEE
28 AUG 2023
HEALTH SCIENCES FACULTY
UNIVERSITY OF CAPE TOWN

UNIVERSITY OF CAPE TOWN
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FACULTY OF HEALTH SCIENCES
Human Research Ethics Committee

FHS016: Annual Progress Report / Renewal

HREC office use only (FWA00001637; IRB00001938) This serves as notification of annual approval, including any documentation described below.			
☑ Approved	Annual progress report	Approved until/next renewal date	30.08.2024
☐ Not approved	See attached comments		
Signature Chairperson of the HREC		Date Signed	28/8/2023

Comments to PI from the HREC
Thank you for your Study Deviation HREC Chair Signature Date: 28/8/2023

Principal Investigator to complete the following:

1. Protocol information

Date (when submitting this form)	July 2023		
HREC REF Number	699/2018	Current Ethics Approval was granted until	Feb 2021
Protocol title	Original title: Trends and determinants of Growth in a South African Birth Cohort. Project amended to focus on one of the four proposed objectives included in original protocol – *"Evaluation of various anthropometric measures as indicators of growth in the first 2 years in a South African Birth Cohort - a cross sectional analysis"*		
Protocol number (if applicable)			
Are there any sub-studies linked to this study?	☐ Yes x No		

(Note: Please complete the Closure form (FHS010) if the study is completed within the approval period)

10.3 Appendix C: Instructions to Author of Maternal and Child Nutrition Journal

Author Guidelines – Journal of Maternal and Child Nutrition

https://onlinelibrary.wiley.com/page/journal/17408709/homepage/forauthors.html#preparing

Contents

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New submissions should be made via the Research Exchange submission portal. Should your manuscript proceed to the revision stage, you will be directed to make your revisions via the same submission portal. You may check the status of your submission at any time by logging on to submission.wiley.com and clicking the "My Submissions" button. For technical help with the submission system, please review our FAQs or contact submissionhelp@wiley.com.

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Maternal & Child Nutrition addresses fundamental aspects of nutrition and its outcomes in women and their children, both in early and later life, and keeps its audience fully informed about new initiatives, the latest research findings and innovative ways of responding to changes in public attitudes and policy. Drawing from global sources, the Journal provides an invaluable source of up to date information for health professionals, academics and service users with interests in maternal and child nutrition. Its scope includes pre-conception, antenatal and postnatal maternal nutrition, women's nutrition throughout their reproductive years, and fetal, neonatal, infant, child and adolescent nutrition and their effects throughout life. Topics covered include:

- Nutritional needs of mothers and their children in health and disease
- Physiological, sociocultural, psychological, economic and political aspects of nutrition
- Health Improvement
- Health education
- Health policy and assessment in practice
- Inter-agency initiatives
- Food safety and related environmental and regulatory issues
- Nutritional risk assessment
- Evaluation of interventions aimed at improving health
- The role of nutrition in both healthy and vulnerable groups
- Development of research methods, validation of measures

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Word limit: 5,000 words maximum, excluding abstract and references. In exceptional cases MCN will consider submission of manuscripts longer in length, but this should be negotiated with the Editor prior to submission.

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Structure: Abstract; introduction; key messages; methods; results; discussion; conclusion (optional); references; legends; tables and figures.

Figures/Tables: Total of no more than 5 figures and/or tables. Additional tables or figures and/or extra methodological detail can be included in a separate Supplementary Appendix.

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Word limit: 5,000 words maximum, excluding abstract and references.
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Structure: Abstract; introduction; key messages; methods; results; discussion; conclusion (optional); references; legends; tables and figures.
References: Maximum of 100 references.

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Word limit: 250 words. Do not include Abstract.
Description: Correspondence relating to work that has been published in the journal, and/or other brief comments, case reports or observations, may be submitted as a succinct Letter to the Editor.

iv. Perspective Articles

Perspective articles allow authors to take a position on a topic of current major importance or controversy in the field of maternal and child nutrition. These articles may include commentaries, study design and methods with implementation data, and meeting reports. Perspective articles should be written within the context of an informed consideration of the state of the art of the topic. Views should be defended with published literature to the extent possible and should acknowledge alternative points of view. Papers submitted to the MCN Perspectives section will go through the journal peer review process.

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Manuscripts can be uploaded either as a single document (containing the main text, tables and figures), or with figures and tables provided as separate files. Should your manuscript reach revision stage, figures and tables must be provided as separate files. The main manuscript file can be submitted in Microsoft Word (.doc or .docx) or LaTex (.tex) format.

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The title page should contain:

i. A title containing the major key words. The title should not contain abbreviations (see Wiley's Wiley's best practice SEO tips). The recommended length for the title is up to 12 words only or less.
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Any ethical statements listing approval by ethical boards, particularly those related to any institutions that the authors are affiliated to, should be listed under section of 2 of the manuscript.

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Please refer to the journal's Authorship policy in the Editorial Policies and Ethical Considerations section for details on author listing eligibility.

Acknowledgments

Contributions from anyone who does not meet the criteria for authorship should be listed, with permission from the contributor, in an Acknowledgments section. Financial and material support should also be mentioned. Thanks to anonymous reviewers are not appropriate.

Conflict of Interest Statement

Authors will be asked to provide a conflict of interest statement during the submission process. For details on what to include in this section, see the 'Conflict of Interest' section in the Editorial Policies and Ethical Considerations section below. Submitting authors should ensure they liaise with all co-authors to confirm agreement with the final statement.

Contributor Statement

A contributor statement should be included listing the individual contributions of each author. It should use authors' initials and state that all authors have read and approved the final manuscript.

- We look for something like this: SW, NJ, DW and SS performed the research. SW, NJ, HH and TL designed the research study. HH and SS contributed essential reagents or tools. SW, NJ and DW analysed the data. SW and NJ wrote the paper.

Main Text File

As papers are double-blind peer reviewed, the main text file should not include any information that might identify the authors.

Manuscripts can be uploaded either as a single document (containing the main text, tables and figures), or with figures and tables provided as separate files. Should your manuscript reach revision stage, figures and tables must be provided as separate files. The main manuscript file can be submitted in Microsoft Word (.doc or .docx) or LaTex (.tex) format.

10.4 Appendix D: University of Cape Town MMed Guidelines

MMed Minor dissertation guidelines: May 2021: Approved via Dean's Circular MED1321

UNIVERSITY OF CAPE TOWN
FACULTY OF HEALTH SCIENCES
(FOR ALL SPECIALTIES, EXCEPT PUBLIC HEALTH AND OCCUPATIONAL MEDICINE)

MMed Part III (minor dissertation)
Guidelines for candidates, supervisors and examiners

The MMed minor dissertation is one of three examination components of the MMed degree. This minor dissertation carries one third of the weight of a full master's dissertation in terms of its credit weighting, i.e. 60 credits (nominally 600 hours of work). In order to register as a specialist in South Africa, the Health Professions Council of South Africa (HPCSA) requires all specialist trainees who register for training after 1 January 2011 to have completed a relevant research study. The MMed Part III fulfils HPCSA research requirements as well as research requirements by the specialties who include a research project as part of their examination process by the Colleges of Medicine of South Africa (CMSA).

Educational aims

The research project should demonstrate that the student:

- can work independently and ethically under supervision (contributions/assistance must be acknowledged);
- is sufficiently acquainted with the relevant literature to provide appropriate motivation for the research question;
- can plan research or clinical audit (write a protocol), which is approved by an assessor group (delegated by the head of department) and ethics committee where relevant, that contributes new or additional data to the collective knowledge base (the specific data has not been presented as part of other research), but need not produce a unique contribution to the scientific literature;
- uses an appropriate method/design/technique and analysis;
- can adequately present and discuss the significance of the results of the study;
- can present the study in an academically acceptable manner.

Type and scope of the research

The following types of studies are acceptable:

- A clinical audit with or without a repeat data collection cycle;
- A detailed systematic review of the literature with data extraction and meta-analysis where appropriate, using recognised research methods (eg Cochrane, PRISMA);
- A systematic scoping review using recognised methods (eg Arksey & O'Malley) is acceptable with appropriate motivation referring to Munn, Z. *et al. BMC Med Res Methodol* **18,** 143 (2018). https://doi.org/10.1186/s12874-018-0611-x
- A research study – pro-/retrospective lab or clinical or database review;
- Description and analysis of a case series or cohort, deemed sufficient to supply new knowledge/data, even if only contextual or exploratory;
- Epidemiological research;
- Health service/systems/education research;
- Qualitative research;

Sample size, design and scope:

- *The sample size* can be limited by time (Registrars have limited time allocated/available to collect data and write it up concurrently with their clinical training) - data collection and write up should be possible to complete within two consecutive or cumulative months.

- *Data analysis* may use simple descriptive statistics alone – more advanced analysis can be used, but the student must demonstrate (in the write up) insight into the choice of analysis.

- The above limitations may be associated with the use of descriptive cohort studies based on medical record review; exploratory or pilot studies with small convenience samples; or audits without a repeat data collection cycle to prove quality improvement (QI). Despite limitations, these studies can provide an adequate basis for learning research methodology and can add new data to the collective knowledge base – they may also provide the basis for further publishable work such as a second audit to complete a full QI cycle. As long as these limitations are appropriately acknowledged, these studies should still be acceptable.

- The topic, study design and scope of research may depend on the particular discipline and must be agreed on in consultation with the supervisor(s). The topic must be approved as being suitable for MMed dissertation by the Departmental Research Committee (DRC) and/or a group appointed for this purpose by the head of department.

Registration and approval of the research proposal

a) Communication

Registrars should be registered under MMed part 3 during active supervision and must at least be registered during the year of submission for examination.

NOTE: All communication from UCT regarding the MMed and the examination process will occur via student UCT e-mail address – [student number]@myuct.ac.za. Students must also make sure they have usernames and passwords and are able to access the PeopleSoft Student Administration Self Service.

Instructions for accessing the PeopleSoft service are available at Student Self Service Help (http://www.sss.uct.ac.za/sss/students) or by emailing sss-helpdesk@uct.ac.za.

Administrative announcements and ad hoc training opportunities are disseminated to the uct email address via the Vula Health Sci Postgrads site: https://vula.uct.ac.za

b) Registration forms and submitting the research proposal

1. **Register online on PeopleSoft: Complete a Memorandum of Understanding (MOU) form online as part of the registration process:** Complete an *abridged* MOU **(*Form ACA47b*)** if a provisional title and synopsis is not available. This form includes appointment of up to three supervisors. Complete the *full* MOU ***(Form ACA47a)*** if or when a provisional/final title and synopsis outlining your planned research is written – the full MOU outlines expectations of registrar and supervisor and publication agreement (see page 8 of this form). The process of assigning a supervisor and topic is managed according to individual department guidelines. These forms are processed and signed online by registrar, supervisor and HOD. By signing this form, the HOD approves that the supervisor has requisite experience. Although the forms must be completed online as part of the registration process, they are also available for reference at http://www.forms.uct.ac.za/studentforms.htm.

2. **Appointment of additional supervisors or change supervisor after completing the MOU** must be done using the ***appointment/change of supervisor form*** – available at the Vula Health Sci Post Grad site. The change must also be reflected in the online annual approval form 48 (see below under annual approval).

3. **Write a research proposal** according to the structure described in ethics form ***FHS 015*** **and** form ***FHS 015hlp*** *(all ethics forms available at* http://www.health.uct.ac.za/fhs/research/humanethics/forms).

4. **Write synopsis** according to ethics form ***FHS014.***

5. **Complete a new protocol application:** ethics form **FHS 013** – the supervisor should be the principle investigator on this form. This form must be signed by registrar and supervisor and submitted as below for further signatures.

6. **If funding is received from outside UCT, complete a C1 Clearance form FHS002 –** refer to this link to determine whether it is needed: http://www.health.uct.ac.za/sites/default/files/image_tool/images/116/documents/When%20to%20submit%20FHS%20C1%20form%20080216.pdf

7. **Submit proposal, synopsis, the completed form FHS 013 and a cover letter addressed to the relevant Departmental Research Committee (DRC)**. The DRC review process confirms both the scientific validity and the appropriateness for the degree.

8. **Following signed approval by DRC, submit all the same paperwork above to the Human Research Ethics Committee (HREC)**. Ensure that all the required Departmental signatures are present in all the forms before submission to HREC. Systematic, scoping reviews and bench-side reviews do not require HREC approval, but candidates are encouraged to obtain a formal written waiver from HREC.

9. **Following HREC approval, the registrar and supervisor will be sent an approval letter** – this letter must be kept for inclusion in the minor dissertation submission. A copy of this letter should also be sent to the registrar's administrative supervisor/mentor. HREC sends a list of all approvals to the post graduate office on a monthly basis, and all MMed approvals will be published in the relevant Dean's Circular for approval by the faculty board.

10. **Obtain approval from the relevant hospital administration and regional Department of Health (online).** After the UCT Research Ethics Committee approval has been obtained, all research that is taking place in a provincial or local authority health facility, must be approved by the relevant authorities (see below) and study databases need to be registered on the National Health Research Database: https://nhrd.hst.org.za
Teaching hospitals and the local authorities approve research projects in-house – apply to the COO/superintendent for approval. All other province approvals are done via the Directorate: Health Impact Assessment (Sub-directorate: Research) at provincial head office. If research crosses these boundaries, up to five approvals may be needed. Further details can be found at: https://www.westerncape.gov.za/general-publication/health-research-approval-process.
A copy of the approval should be appended to the dissertation.

Supervisors

The supervisor must have research experience, ideally a Master's degree, equivalent (e.g. appropriate publications), or higher; be able to relate to the candidate's research project; be available for regular discussion and advice; and be someone with whom the candidate can develop a good working relationship. If the primary supervisor does not have adequate experience, then a secondary supervisor who has appropriate experience will need to be appointed in addition. **Supervisors who have not had extensive experience supervising are required to attend a supervisor training course.** Where specialised equipment and/or laboratory work is required for the study, the supervisor should assist in facilitating access to appropriate facilities.

The primary supervisor may be based outside the candidate's home department, faculty or university. In such a case, a member of UCT staff will also be required as co-supervisor in addition to the primary supervisor, to serve as a guide and link to UCT faculty and discipline-specific procedures. Primary supervisors retain responsibilities to the candidate and the university until the dissertation process is complete.

Timelines

Submission of the research protocol for approval should generally be made within the first 12 - 24 months of the registrar programme, but this varies between disciplines. Heads of Departments or

Divisions should meet with their registrars at least biannually to review progress towards their research project. Unless otherwise stipulated by the Division / Department, the research project should generally be completed by the end of Year 3. For a number of specialties, a dissertation must be submitted before writing the Part II examination. Often the research component of specialist training is only initiated after successful completion of the Part I examination.

Annual approval

After 1 year, apply to HREC for continuing approval on ethics form **FHS016** (for intervention study) or **FHS017** (for record review) or submit a study closure form, **FHS010** if the study is complete. If registration in MMed part III is required for more than one year, then complete **form ACA 48** (Progress and planned activity report for returning masters) online when registration is renewed on PeopleSoft.

Doing the research

Data collection should not begin before ethics approval. Refer to the faculty resources described on the Vula Health Sci post grad site and to departmental resources. The Health Sciences Faculty provides limited funding to support MMed research activities. The funding and the provision of protected research time may be administered variably in different departments – registrars must apply to their specific department research committees for access to this funding.

Writing the dissertation

The dissertation may be presented in one of two formats:

I: Published/Publication-ready format;
II: Monograph format.

As disciplines differ in their requirements, it is important that the format chosen is acceptable to the discipline and appropriate College within the CMSA.

The dissertation should be presented according to guidelines in form D4 (available at the Vula Health Sci Post Grads site), and the publication-ready/already published formats should use the style required by the relevant journal. The following sections should be included, in order:

The title page should contain the candidate's name, dissertation title and the name of the university. It must also state the degree, e.g. Master of Medicine (MMed) in, Medicine, Paediatrics, etc.

The declaration page should include a statement to the effect that the research reported is based on independent work performed by the candidate and that neither the whole work nor any part of it has been, is being, or is to be submitted for another degree to any other university. It must also state that this work has not been reported or published *prior to registration* for the abovementioned degree. A plagiarism declaration should be written on this page (wording on form D19 – available at the Vula Health Sci Post grad site)

Acknowledgements, format and contributions. This section should describe the format of the thesis and indicate if the manuscript has been submitted, accepted for publication or already published. The full citation must be stated if the manuscript has been published. The author should acknowledge and describe the support or input from supervisors and other co-author(s) if applicable. If the dissertation is derived from work started by others, e.g. analysis of data collected for another project, the origin of the data and the candidate's contribution must be clearly stated. The candidate must complete the dissertation after his/her registration for the degree and therefore under supervision. The candidate must be first author when the manuscript is/was submitted for publication.

The Table of contents: referring to list of appendices, list of tables, list of figures, abbreviations, abstract, chapters, chapter sections, references,

List of appendices
List of Tables
List of Figures
Abbreviations

The abstract should summarise the study rationale, methods, results, discussion and conclusion in fewer than 500 words – or as stipulated by the journal if published/publication-ready format is used.

The remainder of the dissertation must be presented according to the chosen format:

I: Published/Publication-ready format

The body of the dissertation must be structured as follows:

Published or Publication-ready Manuscript

This section must be presented in the format of a manuscript of an article submitted to a named peer reviewed journal, meeting all the requirements of the "Instructions for Authors" of that journal, including the word count and referencing style. Unless specially motivated, the journal chosen should allow for between 2000 to 5000 words, excluding abstract, tables, figures and references. The "Instructions to Authors" of the journal must be appended. The co-authors should be listed in the appropriate order, and each of their contributions to the manuscript stated. The journal chosen for publication must be appropriate to the subject matter of the dissertation and listed in the citation index of the Institute for Scientific Information (ISI) or accredited by the Department of Education.
http://www.lib.uct.ac.za/lib/search/journals-accredited
Other journals with similar review processes, particularly South African journals, may be acceptable if permission is obtained from the PMC Chair after appropriate motivation is provided.

In this format, the candidate need not have submitted the article for publication, nor is the acceptance of the article for publication a requirement for passing the degree. However if the manuscript has already been accepted/published, the reviewer comments from the journal and the candidate's given or planned responses must be attached as an appendix.

Supervisor declaration

When the thesis is submitted in this format the supervisor must sign a declaration within the supervisor's report stating that the planned or accepted publication meets all requirements to be included in the dissertation, namely:

The journal publishing the paper is accredited by the department of higher education and training or it has been approved by the UCT Health Sciences Specialist Training Committee and:

- The candidate is the first author on the paper
- The candidate contributed the most to the paper
- The candidate developed the protocol and wrote the paper under supervision
- The candidate was involved in the analysis, presentation and interpretation of results
- The other authors and their contributions to the paper are stated
- The above statements will be included in the declaration page of the dissertation

Appendices

Append all supporting documents including:

- Questionnaire/data capture instrument(s)
- Consent forms and any related participant information sheets
- Technical appendices, including, if considered necessary, any additional tables not included in the main manuscript for the examiner to have available - these should be accompanied by a brief narrative
- Ethics approval letter from the Faculty Research Ethics Committee (except for a systematic

review) and any other approvals required (e.g. Hospital/Provincial Government)
- Instructions to Authors of the chosen journal
- Reviewer comments from journal if already accepted – and author responses
- Letter of acceptance from journal if already accepted and if citation not yet available.

II: Standard monograph format

Some disciplines and constituent Colleges of the CMSA require a standard monograph presented in a comprehensive and scholarly style to be submitted as part of the examination. If the length is not stipulated by the relevant college, the monograph should be 6000 – 16000 words, excluding references and tables.

A recommended structure for the body of the dissertation is as follows;

Chapter 1: Introduction and Literature review
This section must give the background and context of the research question and must include a review of the literature relevant to the subject matter and methods of the study. The review should summarise and interpret the existing knowledge in the field with relevance to the research setting and should identify knowledge gaps and hence the rationale for the dissertation. This chapter should end with a clear statement reflecting the aims and objectives of the research reported in the publication-ready manuscript. This chapter should be between 2 000 and 5 000 words.

Chapter 2: Methods
Material and methods of the study must be fully described and factually presented.

Chapter 3: Results

Chapter 4: Discussion and conclusions

References

Appendices (see guidelines above, but omit the instructions to authors, reviewers' comments and the letter of acceptance)

Language and writing

Clear, grammatically correct English is essential.

Supervisors may assist candidates in developing scientific communication skills, but they are not required to do detailed editing or correction of spelling, grammar, or style. Training in scientific writing is available at the Health Sciences Writing Centre. Registrars need to make an appointment via the website: http://www.writingcentre.uct.ac.za/about/healthsciences

Candidates should refer to Form D4, Guidelines on the Layout and Style of the Dissertation or Thesis. As long as the dissertation is readable and internally consistent, any of a number of styles are acceptable for the standard monograph format manuscript. For a publication-ready manuscript, references should be formatted according to the instructions to authors for the journal selected, and candidates should use the same style throughout their dissertation. For a monograph format manuscript, the Harvard style for referencing is recommended, but not compulsory. For reference management, Refworks or Endnote can be downloaded from the ICTS or UCT library website.

Candidates should look at previous examples of masters dissertations in the library. Masters dissertations are available in the Health Sciences Library. A search will need to be done to obtain a list of titles and authors. This search can be done using search words (e.g. dissertation, health, health sciences, etc.). The librarian can be asked for assistance. Some of these dissertations are available via: http://www.lib.uct.ac.za/lib/search/theses-dissertations

MMed Minor dissertation guidelines: May 2021: Approved via Dean's Circular MED1321

Submission of dissertation

INTENTION TO SUBMIT THE RESEARCH

At the conclusion of the research, registrars are required to complete and upload an 'intention to submit' form on PeopleSoft, followed by the upload of their dissertation/thesis. **All communication from UCT regarding the examination process will occur via uct e-mail addresses.**

Upload intention to submit at least 6 weeks before submission of the dissertation.
The following documents must be digitally uploaded, via PeopleSoft:

- Form D8 (Intention to Submit) – details of how to submit are on the form
- An up-to-date abstract
- Intellectual Property Form D15 (IP Assessment form)
- A copy of the HREC approval letter

The above D forms are obtainable from the Health Sci Post Grads Vula site (resources -dissertation forms) at *https://vula.uct.ac.za*.

After submission of Intention to Submit, the faculty office will request the supervisor to submit names of examiners and complete a supervisor's form.

SUBMIT THE THESIS TO TURNITIN

Detailed instructions on how to submit the thesis to turnintin can be found at:
https://www.uct.ac.za/usr/current_students/postgrad/Using_Vula_and_Turnitin.pdf
and also at (interpretation guides also found here):
https://libguides.lib.uct.ac.za/c.php?g=182316&p=2575733

The turnitin report does not need to be submitted with the thesis – instead, a plagiarism declaration that refers to the report (form D19) must be included as described below.

SUBMIT THE RESEARCH

The submission of the dissertation must consist of the following documents uploaded via PeopleSoft:

1. Form D18 (Declaration/Word Count form) – to be uploaded, as a separate pdf document, with the dissertation and abstract.
2. The Thesis (saved as Thesis.pdf) including a signed plagiarism and turnitin declaration page (form D19) – **the plagiarism page must be included within the dissertation (the thesis), following the title page.**
3. Abstract – see below for naming standards

Detailed submission instructions
Log in to the *Peoplesoft Student Administration Self Service*. Select 'Self-service' and navigate to the 'Research Activities' section. Go to 'Service Requests' and select 'Create New Request'. On the following screen, select the Request Category of 'Thesis/ Dissertation related requests'. Then choose 'Upload Thesis/ Dissertation for Examination' as the request type.

Choose the Request Subtype, (Master's) and the relevant faculty, and upload the dissertation/thesis for examination. All registrars must again upload an abstract (it may have changed since it was first uploaded at the 'intention to submit' stage).

If permission for embargo of your dissertation/thesis has been sought and granted, registrars must additionally provide a neutralised/ restricted abstract which will be placed on *OpenUCT* after examination.
The abstract files must be named as follows:
Abstract-open.pdf (the full abstract)
Abstract-Restricted.pdf (neutralised abstract - sensitive information removed)

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This will ensure that the correct versions of the documents are made available on OpenUCT. Registrars may view what has been uploaded to confirm that the correct file will be submitted. Please type the following confirmation statement in the comment box:
"*I confirm that the uploaded document is the thesis/dissertation to be examined.*" and then click 'Submit'.

Once the dissertation/ thesis has been submitted and processed, registrars will receive an acknowledgement of receipt by email, and will be asked to confirm the word count of the dissertation/thesis. Supervisors will be requested by the Faculty Postgraduate Officer to submit a letter supporting submission, and clearly specifying the format of submission, so that the appropriate instructions are sent to the examiners. This letter should be supplied by the primary supervisor. If this supervisor is external, the internal supervisor must be kept informed at every stage of the process.

Specific submission requirements may be set by individual disciplines or constituent Colleges of the CMSA, and registrars are obliged to ensure that their research projects and dissertations meet these specific requirements. Candidates must check the submission deadlines with the faculty office – usually, these are:

1. March 15th for June graduation
2. August 15th for December graduation

Note on fees: To avoid attracting fees, dissertations need to be submitted before the beginning of the first quarter (first day of academic year), and before the start of the second semester (mid July) to qualify for a 50% fee rebate.

Examiners

The full dissertation will be submitted for examination through the Postgraduate Office to two examiners (nominated by the supervisors and HOD) – at least one examiner must be external to UCT. The internal examiner must not be involved in the research.

It is the supervisors' responsibility to submit names of three potential examiners (or two examiners who have already agreed to examine pending approval of the Post Graduate Office) to the Faculty Officer when the candidate is ready to submit. Appointment of examiners from outside South Africa is encouraged. These nominations need to be approved by the Deputy Dean: Postgraduate Affairs on behalf of the Faculty Board and submitted to the Faculty Board for ratification via a Dean's Circular. Details required for each examiner are: academic qualifications, postal and/or physical address, telephone numbers and e-mail address, and one paragraph description of their standing in the relevant field (drawn from their CV if need be). The examiners will be sent a copy of these guidelines as well as a guideline for marking. *The candidate may not be informed of the identity of the examiners*. After the outcome of the minor dissertation has been finalised, the examiners' identities are made known if the examiners have indicated that they do not object to this.

Note: After examiners have been appointed, the supervisor may not discuss any aspect of the dissertation or process with the examiner - all subsequent communication from examiners regarding the candidate must be directly and exclusively with the postgraduate office.

Examination process

The format, examination procedures and result categories are identical for the publication-ready, already published and monograph dissertation formats. Examiners will be sent instructions, an evaluation template, and a mark sheet – these documents are available at the Health Sci Post Grads Vula site *https://vula.uct.ac.za* (resources - MMed resources - examiner forms)

The results and assessment forms are reviewed by specialist training committee and subsequently sent to candidate and supervisor(s).

Procedure following receipt of results

After receiving the result of the examination of the dissertation/ thesis, registrars must upload a final corrected copy as a PDF file type for the library in order to be eligible for graduation.

To do this, log in to the PeopleSoft Student Administration Self Service. Select 'Self-service' and navigate to the 'Research Activities' section. Go to 'Service Requests' and select 'Create New Request'. On the following screen, select the Request Category of 'Thesis/ Dissertation related requests'. Then choose 'Library Copy – upload final Thesis/Dissertation for Library' as the request type.

Please choose the Request Subtype, (Master's) and the relevant faculty and upload the corrected dissertation/thesis for the library. Registrars may view the uploaded files to confirm that the correct file will be submitted. Once confirmed, please click 'Submit'.

Once the dissertation/thesis has been submitted and processed, registrars will receive an acknowledgement of receipt and will be asked to confirm that the loaded thesis/dissertation is the corrected version.

Publication agreement

The university has a moral responsibility to publish all research undertaken, when publication is stated as an anticipated output. A candidate who fails to submit a manuscript to a journal for publication within 1 year of submission of their thesis, must accept that their supervisor(s) are entitled to publish their data on their behalf, with the student as co-author **- this should be stated in the memorandum of understanding.**