Evidence Table 1. Studies associating anthropometrics to Failure to Thrive cases compared to healthy control roup in developed countries
Part I

Author, Year, UI	Demographics	Maternal / household demographics	Inclusion criteria	Exclusion criteria	Definition of FTT	Study design
Mitchell, 1980 80166667	Country: US Setting: Outpatient clinic FTT / Ctrl Age(y) 2-5 / 2-5 Wt/age ND / ND Ht/length ND / ND Enrolled : cohort of 312(323)* Evaluated 30 / 282 % Male 36.7 / 51.8 % Black 70 / 70 * See Potential biases column	Maternal educ: ND Income: ND Health insur: FTT-53% Medicaid Ctrl-49% Medicaid	See Definition of FTT Controls - wt = 80% of nl, matched for age, sex, mother's age/ marital status & family problems	Organic cause of FTT, single anomalous low wt recorded, clinic registration by age 6 mo, < 3 visits	Wt for age < 80% of nl up to age 24 mo	Ambidirectional longitudinal 1 fwup at age 3 – 6 y
Haynes, 1984 84233543	Country: US Setting: Inpatient & Outpatient Age: ND Wt/age: ND Ht/length: ND FTT1* / FTT2† / Ctrl Enrolled/Eval 25 / 25 / 25 % Race Sp-Am? 44 / 44 / 44 Sp-Am? 40 / 52 / 52 White? 36 / 44 / 36 White? 36 / 24 / 28 Black? 20 / 12 / 20 Black? 24 / 24 / 20 % Male: ND * std care & lay health visitor intervention, † std care only	Maternal Educ / Income* Gp1 10 / 379(0-750) Gp2 11 / 372(0-950) Ctrl 10 / 362(0-1100) Health insur: ND * @ mo	Consecutive admissions for NOFTT Controls - thriving non-hospitalized patients matched for age, sex, birth wt, & mother's age, ethnicity, number of living children	ND	< 5 percentile or significant decline from birth wt percentiles	Prospective longitudinal 1 assessment 6 mo after intake

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Part I

Author, Year, UI	Demographics	Maternal / household demographics	Inclusion criteria	Exclusion criteria	Definition of FTT	Study design
Kelleher, 1993 93234174	Country: US Setting: Primary care clinic FTT / Ctrl GA(wk)* 33.0 / 33.1 Wt(g)* 1679 / 1845 Enrolled: 842* Evaluated 180 / 591 % Male 52.2 / 47.9 Race: % Black 50 / 53.8 * At birth	FTT / Ctrl Maternal educ(%) <HS 40.6 / 38.1 HS 30.0 / 29.3 Some col 14.4 / 20.8 ≥col grad 15.0 / 11.8 Income <10K 38.6 / 34.5 10-20K 19.9 / 23.9 >20K 38.1 / 37.4 Health insur: ND	Gestation age ≤ 37 wks, birth wt ≤ 2500 g, FTT Controls matched for – birth wt +/- 250 g, maternal education, maternal race, & infant sex	Live outside catchment area, discharged outside recruitment period, discharge or died within 48 hr, hospitalized > 60 d, oxygen support > 90 d, twin, triplet or quadruplet of ineligible child, maternal drug/alcohol abuse, insufficient Eng skills, psychiatric hosp	< 5th percentile for gestation corrected age based on NCHS, growth status on "wt curve below that recorded at last regular assessment visit."	Prospective longitudinal Fwup at ages 12, 24, 36 mo
Reif, 1995 95362505	Country: Israel Setting: Outpatient FTT / Ctrl Mean age(y) 6.2 / 6.8 Wt/age* 18.05 / 36.15 Ht/length* 21 / 33.55 Enrolled 86 / 65 Evaluated 61 / 65 % Male 52.5 / 54 Race: Sephardic 38 / 36 Ashkenazi 23 / 29	FTT / Ctrl Maternal educ* 12.27 (0.29) / 12.14 (0.24) Income: ND Health insur: Socialized medicine * Mean (SD)	FTT, < 2 y, term infants > 2500g birth wt Controls matched for age, sex, social class, & ethnic affiliation; admitted or evaluated in ER for intercurrent & nonsign disease	Organic cause of FTT, malnutrition, serious perinatal morbidity	Ht & wt < 5% in ≥ 2 measurements within 6 mo on Hamill PVV, Drizd TA growth chart,	Ambidirectional longitudinal Re-evaluation at mean 5.12 yr

Evidence Table 1. Studies associating anthropometrics to Failure to Thrive cases compared to healthy control roup in developed countries
Part I

Author, Year, UI	Demographics	Maternal / household demographics	Inclusion criteria	Exclusion criteria	Definition of FTT	Study design
Corbett, 1996 97113595	Country: UK Setting: Clinic Age: 6-7 yr FTT / Ctrl Wt/age ND / ND Ht/length ND / ND Enrolled 52 / 52 Evaluated 48 / 46 % Male: ND Race: 100% White	Maternal educ: ND Income: "…most economically deprived wards in Newcastle" Health insur: National healthcare	Full term singleton with records of 6 or more weights over first 18 months age Consecutive controls matched for age & sex	Non-Caucasian, "poor growth resulting from major organic disease"	Weight deviated downward from maximal centile achieved at 4-8 wks, across ≥ 2 centile lines, & stayed at level ≥ 2 measurements (1 mo (Tanner & Whitehouse)	Ambidirectional longitudinal 5 year follow-up of cases
Black, 1999 99162090	Country: US Setting: Outpatient FTT / Ctrl Age: ND / ND Wt/age <5% / >5% Ht/length <5% / >5% Enrolled/Eval 127 / 98 Male: ND Race: 92% African American	FTT / Ctrl Maternal educ* 11.4 (1.62) / 10.76 (1.44) Income: AFDC 76% Health insur: ND * Mean (SD)	< 25 mo, full-term, AGA, no congenital or handicapping conditions	ND	< 5% for wt for age or wt vs. ht by NCHS growth charts	Prospective longitudinal FTT: three 6 mo followed by annual visits from ages 3-6 Control: annual visits ages 3-6

Evidence Table 1. Studies associating anthropometrics to Failure to Thrive cases compared to healthy control roup in developed countries
Part I

Author, Year, UI	Demographics	Maternal / household demographics	Inclusion criteria	Exclusion criteria	Definition of FTT	Study design
Drewett, 1999 9928405 4	Country: UK Setting: Clinic / home visits FTT Ctrl Age(y) 8.12(0.62) 8.10(0.57) Wt(kg)* 23.8 27.9 BMI* 14.9 16.3 Enrolled 136 136 Eval† 107/111 117/122 % Male‡ 40 38 % White‡ 91 91 * Median, † Psychological / anthropometric evaluation, ‡ FTT = 107, Ctrl = 117	FTT Ctrl Maternal educ* 72 66 Income: NA Health insur: National healthcare * % left school at 16 y	At least 1 wt at age 0-2 mo & 2 subsequent wts, thrive index < 5th centile = 2 occasions between 3 & 18 mo Controls with at least 1 wt at age 0–2 mo & 2 subsequent wts, no thrive index < 10th centile, age ± 1 mo, similar/same residential area or GP practice	ND	Lowest 5% for change of SD score; avg taken of SD scores for all wt bet 0-2 mo, expected wt from 3-18 mo calculated for "thrive index"	Ambidirectional longitudinal Five years from enrollment of age 1 y

Evidence Table 1. Studies associating anthropometrics to Failure to Thrive cases compared to healthy control group in developed countries Part II

Author, Year	Correlates	Associations found	Potential biases	Comments
Mitchell, 1980 80166667	Weight - % of normal Height - % of normal HC - % of normal	Expect wt and HC of the FTT group was significantly lower than the controls ($p < .05$ each), wt remained ~15% below control group through age 5, ht ~5% below till age 4. Expected ht was not significant. FTT girls recovered more slowly.	Physical exams & growth status by PI not blinded	Government & privately funded
Haynes, 1984 84233543	Weight	All FTT had some wt gain during hospitalization, at reeval-some minor wt gain, 8 FTT gain > 20 percentile pts or within 5 percentile of birth wt percentile. There were no differences for both FTT groups compared to the controls after 6 mo for wt gain except in some minor cases.	"…because of scheduling, few admissions were not evaluated", 2 refused participation; 10 Gp1 & 3 Gp2 premature – overall similar from FTT vs. Ctrl; at 6 mo fwup: for FTT1 & FTT2 each-3 cases refused reevaluation & from1 dissolution of pair, 1Gp1 died SIDS, 1 Gp2 mother gave up child	Block assignment to Gp1 & Gp2 for hospital convenience & case load requirements; government funded
Kelleher, 1993 93234174	Anthropometric outcomes	FTT length, weight, & head circumference below 5th percentile at 12, 24, 36 mo, below Control averages, $p < 0.0001$.	Of 985 enrolled, 71 LTF	21% of sample developed FTT by 36 wks; ND on funding source
Reif, 1995 95362505	Final weight Final height Ideal weight Long-term weight of FTT Long-term height of FTT Mother's education Persons @ room	There were significant differences between FTT and Control groups for height ($p < .01$) and weight ($p < .001$), as well as compared to ideal ht/wt ($p < .001$). Mother's education was a significant covariate for FTT long-term wt ($p < .05$). Number of person's per room was a significant covariate for FTT long-term wt ($p < .05$) & long-term ht ($p < .0005$)	25 cases not re-evaluated because not located or refused participation; inpatient enrollment of FTT-48 & Ctrl-42; outpatient enrollment of FTT-13 & Ctrl-23(ER)	ND on funding source

Evidence Table 1. Studies associating anthropometrics to Failure to Thrive cases compared to healthy control group in developed countries
Part II

Author, Year	Correlates	Associations found	Potential biases	Comments
Corbett, 1996 97113595	Mean height SDS Mean weight SDS	Height and weight centiles were significantly lower ($p = .020$ & $p < .001$) in the FTT group at time of entering school	3 from each group refused consent at follow-up, LTF or moved - 2 cases, 3 controls, 1 case not originally studied participated for follow-up study, 4 of those cases were the slowest growing 5% - also removed from home, all controls stayed with parents. Edward's diagnostic criteria for growth measure considered limited.	ND on funding source.
Black, 1999 99162090	Height Weight Gender	Despite catch-up, wt & ht growth were significantly slower than controls for all fwup intervals; sex & education did not predict outcome; perception of poor child health correlates with poor growth; no gender differences for ht or wt, but girls grew faster than males.	---	Government funded
Drewett, 1999 99284054	Height Weight Head circumference	FTT children were smaller in ht ($t = 6.3$, $p < .01$), wt ($\chi^2 = 27.9$, $p < .001$), and head circumference ($t = 3.86$, $p < .01$), as well as have fathers who were also shorter than the controls.	Of 136 cases, 1 died, 9 LTF, 15 declined psychological testing, 4 moved; of 136 controls, 2 were preterm, 5 LTF, 12 declined psychological testing, 14 moved & were replaced. 2 FTT cases & 1 control with medical condition affecting growth, & 9 FTT cases & 2 controls with possible medical conditions	Testers blinded to child's status; privately funded

Evidence Table 2. Studies associating anthropometrics with malnourished patients compared to well-nourished control subjects in developing countries

Part I

Author, Year	Demographics	Maternal / household demographics	Inclusion criteria	Exclusion criteria	Definition of malnutrition	Study design
Branko, 1979 79228898	Country: Ethiopia Setting: Outpatient Gp1* / Gp2† / Ctrl Age(y): 5.5-14 / 5.5-12.8 / 5-14 Wt/age: ND / ND / ND Ht/age: ND / ND / ND Enrolled/eval: 44 / 43 / 559 % Male: 61 / 48 / 52 Race: 100% Black * Marasmus, † Kwashiorkor	Maternal educ: ND Income: ND Health insur: Free medical care	Formerly hospitalized & for successful treatment of marasmus or kwashiorkor	ND	Marasmus: nutritional etiology, wt < 60% of Boston 50th percentile for age/sex, absence of edema Kwashiorkor: nutritional edema, growth retardation, muscular atrophy, "psychomotor alterations", hair or pigment chg, or "moon face"	Ambidirectional Last assessment avg 7½ (2.5) y after D/C
Evans, 1980 81008912	Country: South Africa Setting: outpatient clinic Wt/age: See Correlates column Ht/length: See Correlates column Gp1 / Ctrl1 / Gp2 / Ctrl2 Mean age(SD): 8.9 (0.5) / 10.7 (1.0) / 13 (1.9) / 12 (2.1) Enrolled: 14 / 14 / 14 / 14 Evaluated: 14 / 13 / 14 / 13 % Male: 64 / 54 / 100 / 77 Race: "Cape coloured"	ND	Gp1 – newborns of families with hx of undernutrition Ctrl1 – siblings with hx of undernourishment, record of `< 3rd percentile for ht & wt Gp2 – at least 1 hospitalization for kwashiorkor Ctrl2 – siblings closet in age Gp2 w/no hx of kwashiorkor but underweight	ND	ND	Prospective longitudinal Fwup 6 ½ y after intervention

Evidence Table 2. Studies associating anthropometrics with malnourished patients compared to well-nourished control subjects in developing countries

Part I

Author, Year	Demographics	Maternal / household demographics	Inclusion criteria	Exclusion criteria	Definition of malnutrition	Study design
Galler, 1985a 85241832	Country: Barbados Setting: Outpatient Age(y): 9-15 Gp / Ctrl Wt/age: ND / ND Ht/length: ND / ND Enrolled: 141 / 129 Evaluated: 108 / 107 % Male: 57 / 60 Race: 100% Black	Maternal educ: ND, universal education, 95% population literate Income: lower for cases compared to control group Health insur: ND	Discharged 5 – 11 yr olds w/dx at age 1 yr with PEM Grade II-III, BW > 5 lbs Controls without PEM, matched for age, gender, handedness, & same school / neighborhood	Pre- or peri-natal complications, edema, seizures, head trauma, loss of consciousness, high fever 1985a/1985b: hx head seizures	Gomez Scale PEM: Grade II- 61-75% or Grade III- ≤ 60% standard wt for age on Harvard Standard Scale	Ambidirectional longitudinal Fwup 6 – 12 y after D/C
Alvear, 1986 86185605	Country: Chile Setting: Outpatient Gp / Ctrl Age(mo): 16(8-20) / ND Wt/age*: ND / ND Ht/length*: ND / ND Enrolled/Eval: 40 / 38 % Male: 45 / 47 Race: ND* * See Inclusion criteria	ND	Hx of hospitalization for PEM at yrs 1-2, Chilean population & white Amerindian origin from Santiago Chile, SES grade 5 or 6 (modified Graffar scale) Controls matched for age/sex/SES, attend same nursery sch as cases, no hx of mal-nourishment, normal wt & ht (WHO)	Hormonal imbalance, debilitating disease not due to nutritional deficiency	PEM at yrs 1-2; < 60% wt for age, < 85% wt for length	Prospective longitudinal 4 y after D/C

Evidence Table 2. Studies associating anthropometrics with malnourished patients compared to well-nourished control subjects in developing countries

Part I

Author, Year	Demographics	Maternal / household demographics	Inclusion criteria	Exclusion criteria	Definition of malnutrition	Study design
Grantham-McGregor, 1987, 1982 82236679 87117313	Country: Jamaica Setting-Recruitment: hospital Follow-up: hospital & home Gp1* Gp2† Ctrl† Age: 12.8 (2.9) 13.4 (4.5) 12.2 (4.4) Ht/age‡ 89.0 (4.5) 88.4 (4.4) 101.3 (3.5) HC/age‡ 91.3 (3.7 91.2 (3.3) 99.0 (3.8) Wt/ht‡ 74.9 (9.2) 72.4 (10.2) 89.0 (10.1) Enrolled 21 18 21 Evaluated 18 16 20 % Male: 67 38 60 Race: ND, assumed Black Mean (SD) for evaluated cases; * Intervention, † Standard care, ‡ % of expected value	Maternal educ: HS not completed Income: housing 'below certain defined standards' Health insur: ND Maternal PPVT Gp1 62.3(14.7) Gp2 59.7(15) Ctrll 67.4(9.3)	Gp, age 6 – 24 mo, attempt for SES of mothers who had not completed secondary education, substandard housing, residence in city of Kingston Control - included above criteria but adequately nourished, hospitalized with diseases other than malnutrition	Physical handicap, disease that might affect mental development (other than malnutrition)	Severe PEM based on Wellcome classification	Prospective longitudinal 6 fwups from 6 to 72 m after D/C l
Bénéfice, 1992 92296639	Country: Senegal Setting: Outpatient Age: ND Enrolled: 100 Evaluated: Gp 64, Ctrl 34 % Male: 46 Race: ND	ND	Age 9 – 14 y from 2 villages with per capita caloric intake of 2200 & 2400	Recent serious illness, clinical signs of malnutrition or anemia	Wt/age < -1 SD median WHO/NCHS	Prospective cross-sectional

Evidence Table 2. Studies associating anthropometrics with malnourished patients compared to well-nourished control subjects in developing countries

Part I

Author, Year	Demographics	Maternal / household demographics	Inclusion criteria	Exclusion criteria	Definition of malnutrition	Study design
Walker, 1996 97154651	Country: Jamaica Setting: Outpatient Mean age*: 18.7(4.1) mo Enrolled: Stunted 129 Nonstunted 32 Gp1† Gp2‡ Gp3§ Ctrl1‖ Ctrl2¶ Eval 31 29 30 32 32 Wt(kg)** Ht(cm)** % Male†† Gp1 8.61(0.97) 73.3(3.5) 61 Gp2 8.43(0.90) 72.9(3.9) 55 Gp3 8.37(0.99) 72.9(3.6) 57 Ctrl1 8.65(1.03) 72.8(4.3) 59 Ctrl2 11.46(1.06) 82.3(4.6) 56 Race: ND Mean(SD), * N = 129, † Supplement, ‡ Psychosocial, § Both intervention, ‖ No intervention, ¶ Nonstunted, ** Enrollment, †† Evaluation	ND	Stunted children 9 – 24 mo, weight for age < -2 SD, housing & maternal education below standard level, singleton, BW > 1,8 kg Nonstunted children matched for age, sex, & neighborhood	Physical or mental handicap	See Inclusion criteria	Prospective longitudinal Assessments @ 2 & 4 y after intervention

Evidence Table 2. Studies associating anthropometrics with malnourished patients compared to well-nourished control subjects in developing countries

Part II

Author, Year	Correlate & measures					Associations found	Potential biases	Comments
Branko, 1979 79228898		Gp1	Gp2	Ctrl*		Maramus gp was on avg 3 cm smaller than Ctrl (p < .011), weighed 2.1 kg less, (p < .011), and their HC was 0.85 cm less (p < .007); The Kwashiorkor gp was smaller than Ctrl on avg 0.84 cm (p < .607), weighed 0.6 kg less (p < .082), & their HC was 0.3 cm smaller (p < .368); Comparing Marasmus vs. Kwashiorkor gps, the Kwashiorkor gp was heavier (p < .05), taller (p < .02), & had larger HC (p < .05).	---	ND on funding source
	Ht (cm)	93-154	90.0-143	99.1(3.6)-144.7(3.3)				
	Wt (Kg)	11.4-35.0	11.0-29.5	14.6(1.2)-34.3(5.4)				
	HC (cm)	47.0-53.0	48.0-53	49.0(0.8)-53.4(1.1)				
	* mean range by sex & age ranges of 6 mo from age 5 to 14 y							
Evans, 1980 81008912		Gp1	Ctrl1	Gp2	Ctrl2	2 years after supplementation had ceased, height & weight were significantly higher for Gp1 (p < 0.01) vs. 3 other groups; by 6.5 + y post-intervention, there were no differences.	1 child died in each of the controls, sex unkn	Gp1 received supplements until mean 28 mo, examiner blinded to subject's group status, testing 6-7 y after cessation of supplements; US government & South African Medical Research Council
	~Wt1*	86	77	75	72			
	~Ht1y*	90	84	82.5	82			
	~Wt2†	79	78	77	76			
	~Ht2†	90	89.5	90	90			
	* 2 y after supplements, † 6.7 y after supplements							

Evidence Table 2. Studies associating anthropometrics with malnourished patients compared to well-nourished control subjects in developing countries

Part II

Author, Year	Correlate & measures					Associations found	Potential biases	Comments
Galler, 1985a 85241832		Gp?	Ctrl?	Gp?	Ctrl?	At ages 9-15, there was persistent poor height & weight gain for the index group with emphasis on the girls' weight (F = 28.88, p < .001). Early PEM was a predictor of sexual maturation for females (F = 5.69, p < .001).	1983-Withdraws/non-participation – 4 refused consent, 7 LTF, 1 cerebral palsy; Severe PEM	Relevant WISC subtests utilized & some items altered for cultural setting; findings of dominant hand performance of fine motor skill tasks deficient in formerly malnourished children correlates or co-varies with IQ & other soft neurologic signs; private & hospital funded
	Ht*	148.92 (12.5)	150.4 (12.18)	145.25 (11.4)	149.63 (11.02)			
	Wt†	37.02 (10.74)	39.37 (10.35)	35.42 (7.63)	41.9 (35.42)			
	*cm, † kg							
Alvear, 1986 86185605		Gp?	Gp?	Ctrl?	Ctrl?	At birth, the cases were smaller in wt (boys p < 0.01, girls p < 0.001) and length (boys p < 0.01, girls p < 0.001) compared to controls. At the end of follow-up, there was no difference in bone age between cases and control groups by group or by sex, but there was a significant difference for female cases who were smaller than male cases for bone age (p < .01). Arm fat areas were greater for controls vs. cases (girls p < .001, boys p < .05).	---	No data on whether children were failing to thrive at 4-6 years when anthropological data were collected; university funded
	Birth wt	3018.2 (490.3)	2654.6 (579.0)	3453.5 (522.3)	3328.4 (563.4)			
	Birth length	48.4 (2.2)	46.8 (2.6)	51.1 (2.3)	49.5 (2.2)			
	Bone age*	60.3 (8.6)	76.7 (14.2)	69.2 (9.7)	86.7 (27.2)			
	Arm fat area	73.5 (15.3)	64.5 (16.5)	91.0 (24.7)	95.7 (28.5)			
	* Gp n=25 (?=12, ?=13), Ctrl n=20 (?s=9, ?=11)							

Evidence Table 2. Studies associating anthropometrics with malnourished patients compared to well-nourished control subjects in developing countries

Part II

Author, Year	Correlate & measures	Associations found	Potential biases	Comments
Grantham-McGregor, 1987, 1982 82236679 87117313	Gp1 / Gp2 / Ctrl Wt for ht * 91.7(7.5) / 95.1(8.4) / 92.5(6.8) Ht for age* 94.9(2.5) / 93.9(4.5) / 100.6(3.8) Assessment at 72 mo, * Mean percentages	Assessments 6, 12, 18, 24 months; weight for height measures were not statistically significant, but the two case groups were significantly shorter for all time points than the control group (p < 0). At 24, 36, 48, 60, & 72 month; height for age was significantly lower for the two groups vs. controls.	Controls had better housing than other 2 groups regardless of attempts to match; 2 died & 1 WD from intervention group, 1 from nonintervention moved & 1 was adopted by middle-class family, 1 from control WD; edema: Gp1 10 of 21, Gp2 4 of 18, Ctrl 0 of 21	Tester blinded to subjects' group, controls hospitalized mainly for gastroenteritis & respiratory infections; government & private funding
Bénéfice, 1992 92296639	Gp / Ctrl % body fat 15.0(0.28) / 16.9(0.39) Arm muscle area 18.7(0.33) / 21.8(0.47) Adjusted mean (SD)	Children with malnutrition had less body fat (t = 3.5, p < .001) & arm muscle (t = 6.0, p < .001) compared to nourished controls.	Child's age determined by recall, no records available; no explanation on missing case from each group not in analyses	ND on funding source
Walker, 1996 97154651	Gp1 / Gp2 / Gp3 / Ctrl1 / Ctrl2 Ht(c) 119.8 (5.0) / 119.5 (5.4) / 118.8 (4.1) / 118.9 (4.7) / 130.9 (4.9) Wt(k) 21.2 (3.5) / 20.9 (3.1) / 19.9 (1.9) / 20.4 (2.2) / 26.2 (2.3) HC(c) 51.2 (1.3) / 50.9 (1.4) / 51.0 (1.3) / 50.8 (1.5) / 52.4 (1.4)	Signf for three measures of Ctrl2 vs. combined stunted groups, p < .001, covariates - sex & age (mean 7.7 @ gp) No difference between the different groups of stunted children in height, weight, and head circumference, but difference between the combined stunted groups with non-stunted children.	127 of 129 children completed studies; 4 yr after completion of intervention, of stunted gps - 3 relocated & 2 LTF	Observers blinded to child's group, evaluation 4 y after 2 y intervention; privately funded

Evidence Table 3. Studies associating immunologic response or infectious diseases with Failure to Thrive patients compared to healthy control subjects in developed countries

Part I

Author, Year, UI	Demographics	Maternal / household demographics	Inclusion criteria	Exclusion criteria	Definition of FTT	Study design
Carvalho, 1984 85145406	Country: Brazil Setting: Outpatient clinic Age: ND FTT / Ctrl Enrolled/Eval 20 / 40 % Male: ND Race: ND	ND	Moderate & chronic primary PCM, > 6 mo < 5 y, body wt 25.1 & 40% of "standard values", subcutaneous tissue, absence of edema, arm circumference < 13.5 cm, ht "within normal limits", low SES Controls - same criteria but "normal" body weight, "good-economic level and enjoyed good nutritional intake"	Infection, transfusions, general anesthetics, corticosteroids or immunotherapy < 6 mo prior, drug tx	ND	Prospective cross-sectional
Sherrod, 1984 85026403	Country: US Setting-Recruitment: Prenatal clinic Follow-up: Pediatric clinic NOFTT / Ctrl Birth wt(g) 3031 / 3054 Enrolled/ Eval* 31 / 24 Race-White 10 / 14 Black 21 / 10 % Male: ND * 4 arm study – Data for FTT & Ctrl only; abused or neglected cases excluded	NOFTT / Ctrl Maternal educ 10.3 / 11.2 Income* 13 / 13 Health Insur† ND / ND * # employed, † p < .05, ‡ p < .01	NOFTT, abused, or neglected Controls – no hx of abuse, FTT, or neglect	ND	Wt gain fallen below 2/3 of Harvard 50th percentile on growth curve	Retrospective longitudinal 3 annual assessments

Evidence Table 3. Studies associating immunologic response or infectious diseases with Failure to Thrive patients compared to healthy control subjects in developed countries

Part II

Author, Year, UI	Correlates		Measures				Method / Instruments utilized
Carvalho, 1984 85145406			FTT	Ctrl	% variation		Light microscope phagocytosis assay (% zymosan particles ingested)
	Phagocytosis						
	Eagle solution		18.7(7.3)	27.6(9.2)	-32.3	p < .01	
	Nl human serum		54.2(24.6)	78.5(7.8)	-30.9	p < .001	
	Patient serum		56.7(22.4)	75.9(10.9)	-25.3	p < .01	
	Chemotaxis						Boydan chamber (avg distance cells migrate)
	Eagle solution		25.4(10.0)	34.2(8.0)	-26.0	p < .01	
	LPS & nl human serum		42.6(17.7)	64.4(15.3)	-33.8	p < .001	
	LPS & patient serum		44.3(19.0)	68.5(18.4)	-35.3	p < .001	
	Total complement (u/ml)		235.2(55.1)	244.6(61.6)	-3.8	NS	Percent cell lysis
	C3 (mg/dl)		89.3(21.3)	80.5(19.3)	+10.9	NS	
	C4 (mg/dl)		38.5(11.2)	37.3(13.3)	+3.4	NS	
Sherrod, 1985 85026403	Infections		NOFTT	Ctrl			Chart review
		1y	1.13	.46			
		2y	.35	.29			
		3y	.03	.00			

Evidence Table 3. Studies associating immunologic response or infectious diseases with Failure to Thrive patients compared to healthy control subjects in developed countries

Part III

Author, Year	Associations found	Potential biases	Comments
Carvalho, 1984 85145406	The values for phagocytosis response and chemotactic function were significantly lower for the malnourished children in 3 tests: Zymosan incubated in Eagle, incubated with pooled normal human serum & incubated with serum from patient. The values were not significant for total complement, C3 and C4 components.	Cases and controls from different hospitals serving different SES groups; no data on age matching	Phagocytosis tests on 20 children, chemotaxis on other 20, total complement on 20 chosen at random; privately funded
Sherrod, 1985 85026403	NOFTT had more infections than controls during the 1st year (χ^2 = 5.38, p < .025) and across all 3 years (χ^2 = 5.79, p < .025). NOFTT illness were significantly increased during first 6 mo of life.	Attending physicians alerted to give special treatment to children suffering from maltreatment, analysis showed no increase in outcome variability; study design to identify relationship of illness to abuse, not FTT to illness	Data collectors blind to child group assignment; government & privately funded

Evidence Table 4. Studies associating immunologic response or infectious diseases with malnourished patients compared to well-nourished control subjects in developing countries

Part I

Author, Year, UI	Demographics	Maternal / household demographics	Inclusion criteria	Exclusion criteria	Definition of malnutrition	Study design
Ferguson, 1974 75022280	Country: Ghana Setting: Cases – inpatient Controls – ND Gp / Ctrl Mean age(mo): 28.9 (12-48) / 38.8 (24-55) Wt/age: ND / ND Ht/length: ND / ND Enrolled/Eval: 10 / 10 % Male: ND / ND Race: ND / ND	ND	Severe protein-calorie malnutrition Controls – "normal", matched for age	ND	Severe protein-calorie malnutrition	Prospective cross-sectional
Neumann, 1975 75106463	Country: Ghana Setting: hospital/in & outpatient clinic Age: 6 mo – 6 y Wt/age: ND Ht/length: ND Gpl* / Gp2† / Ctrl Enrolled/Eval: 34 / 42 / 41 % Male: 62 / 50 / 44 Race: Africans (assumed black) * Severely malnourished: kwashiorkor(23) & marasmus(11), † Moderately malnourished	ND	See Definition of FTT Controls matched for age, = 81% Harvard Std, nl serum albumin, no signs of malnutrition	ND	Gp1: 51-60% of 50th percentile Harvard Std for American children & albumin < 2.5 g/100ml, Gp2: 71-80% of Harvard Std & albumin > 2.5 g/100ml	Prospective cross-sectional

Evidence Table 4. Studies associating immunologic response or infectious diseases with malnourished patients compared to well-nourished control subjects in developing countries

Part I

Author, Year, UI	Demographics	Maternal / household demographics	Inclusion criteria	Exclusion criteria	Definition of malnutrition	Study design
Tuck, 1979 79254720	Country: Australia & Indonesia Setting: Hospital Age(mo): ND Wt/age: ND Ht/length: ND Enrolled/Eval: Gp1 marasmic 21 Gp2 underweight 23 Gp3 normal 25 % Male: ND Race: ND	ND	ND	Immunological deficiencies in normal children attending hospital in one site	NA (Patients classified according to Wellcome Working Party: underweight - 60-80% SWFA, marasmic - < 60% SWFA)	Prospective cross-sectional
Friedland, 1992 93159117	Country: South Africa Setting: Inpatient Gp / Ctrl Age(mo) 11 / 12 Enroled/Eval 1582 / 7282 % Male ND / ND Race: ND (assumed all black)	ND	Children w/kwashiorkor, marasmus, marasmic kwashiorkor admitted, ages 2 – 84 mo Controls - "well-nourished & children w/nutritional growth retardation admitted during same time period", same age range	ND	Wellcome criteria with growth charts from NCHS	Prospective cross-sectional

Evidence Table 4. Studies associating immunologic response or infectious diseases with malnourished patients compared to well-nourished control subjects in developing countries

Part I

Author, Year, UI	Demographics	Maternal / household demographics	Inclusion criteria	Exclusion criteria	Definition of malnutrition	Study design
Ballard, 1995 95239862	Country: Kenya Setting: Rural village/ community outreach Mean age*: 19.2 m (17.7-25.1) Wt/age: ND Ht/length: ND Enrolled: 114 Evaluated† Gp1 27, Gp2 51, Ctrl 31 49% Male (enrollment) Race: 100% Black Africans * At enrollment, † Gp1 Mod-severe malnutrition, Gp2 Mild malnutrition	Maternal reading level – average 3.5 yrs of schooling	14-25 mo, free from lower respiratory infections for = 4 wks Controls – "normal"	ND	Gp1 - ht/age < 90% of median Gp2 - ht/age 90% to <95% of median	Prospective longitudinal cohort Followed for max of 12 mos
Pandey, 1996 97246349	Country: India Setting: Outpatient Age(mo): Range 0-59, Mode 24-35 Enrolled: 200 households Evaluated: Gr1 37, GrII 56, GrIII 18, GrIV 4, NI 85 % Male: ND Race: ND	ND	Random selection of < 5 y	ND	Graded nutritional status as GrI though GrIV clinically & by wt/age	Prospective longitudinal Assessments @ 2 wks for 1 y

Evidence Table 4. Studies associating immunologic response or infectious diseases with malnourished patients compared to well-nourished control subjects in developing countries

Part II

Author, Year	Correlates / Outcomes and measures	Associations found	Potential biases	Comments
Ferguson, 1974 75022280	Immunologic - Rosette forming cells	(percent of total lymphocytes) Gp - 16.6% (2.7 SE), Ctrl – 59.7% (1.4 SE) Marked decrease in rosette forming cells (measure of cellular immunity) in severe malnutrition; RFC re-measured in 5/10 cases 7-17 d after feeding high protein, high calorie diet – values returned to nl (%RFC = 63.2% ± 2.4). Other measures of impaired immune function – in vitro response of lymphocytes to PHA stimulation showed trend to be diminished in cases, but NS (no data)	7 diagnosed kwashiorkor & 3 with marasmus	US government funded

Evidence Table 4. Studies associating immunologic response or infectious diseases with malnourished patients compared to well-nourished control subjects in developing countries

Part II

Author, Year	Correlates / Outcomes and measures				Associations found	Potential biases	Comments
Neumann, 1975 75106463	Clinical infections / parasites				There was a marked increased in infections for severely malnourished group (Gp1), slight increase for the moderate malnourished group (Gp2) compared to Ctrl. The incidence of intestinal parasites were similar across the 3 gps, except for 10x increase in strongyloides stercoralis for Gp1, and 1 malarial case @ gp. Tonsil sz was decreased signf in Gp1 vs. Gp2 & Ctrl. Antibody responses were similar across all 3 gps. Lymphocyte response was signf lower in Gp1 vs. Gp2 or Ctrl. Cutaneous delayed hypersensitivity to PHA, monilia, SK-SD was signf lower in Gp1 & Gp2 vs. Ctrl. Response to KLH was slightly lower in the cases. Vitamin deficiencies in all groups, most prevalent in Gp1. Complement C3 decreased signf in Gp1 vs. Gp2 & Ctrl; NS results for C4. Other nutritional deficiencies included decreased iron & transferrin in Gp1.	Gp1 hospitalized cases, 16 of 34 had received nutritional tx before studies, Gp2 included 25 newly admitted & 17 living in orphanage or attendance at rehab clinic & were treated. Controls attended private nursery school or resided in orphanage & had some vitamin/mineral deficiencies	Government funded
	Antibody responses						
		Gp1	Gp2	Ctrl			
	Tonsil size*	(%)	(%)	(%)			
	Score† 0	36	5	0			
	1+	52	50	34			
	2+	12	40	56			
	3+	0	5	10			
	Delayed hypersensitivity response						
	Lymphocyte response†	19	0	0			
	PHA‡	44	29	5			
	Monilia‡	59	38	20			
	SK-SD‡	76	57	23			
	KLH‡	5	0	0			
	Total serum proteins(SE)	5.1(.4)/ 6.3(.4)§	7.5(.1)	7.9(.1)			
	CBC & differential						
	Hemoglobin	60	17.5	12.5			
	Iron	44.8	29.7	20			
	%Transferrin saturation	41.3	55.3	50			
	Complement - C3	60.4(4.1)	86(3.9)	86.9(2.4)			
	* 0 = trace or absent, 1 = visible, 2 = enlarged beyond arch, 3 = extended past arch to uvula midline; † Percent reduced response; ‡ Percent nonresponders, § kwashiorkor/marasmus						

Evidence Table 4. Studies associating immunologic response or infectious diseases with malnourished patients compared to well-nourished control subjects in developing countries

Part II

Author, Year	Correlates / Outcomes and measures	Associations found	Potential biases	Comments
Tuck, 1979 79254720	Candida killing capacity Marasmic: 13.7% (3.4)* Underweight: 17.6% (4.4)* Normal: 44.5% (8.8)* * SEM	Candida-killing ability, as determined by Kolmogorov-Smirnov test, was reduced in each of two underweight populations compared with the well-nourished population (p < .001), NS between the underweight & marasmic gps	Normal adults included in the control group, number of adults not known, site(s) of adults unknown, one of the 3 sites had no malnourished children who may have also been outpatients	NS between the two malnourished groups on ability to resist candida; ND on funding source
Friedland, 1992 93159117	Bacteraemia (Gp %, Ctrl %) Community acquired: 7.7, 4.9 Nosocomial: 2.2, 1.1 Overall: 9.9, 6.0 Mortality Overall: 13.3, 4.1 With bacteremia: 31, 13	Index group are statistically significantly at higher risk than control group for community-acquired bacteremia (p < 0.001, RR for FTT 1.6, CI 1.3 – 1.9), nosocomial bacteremia (p < 0.001, RR for FTT 2.0, CI 1.4 – 3.0), and mortality, including mortality related to bacteremia (p < 0.001, RR for FTT 3.2, CI 2.7 – 3.8).	Index group considered severe malnutrition. Control group consisting of "nutritional growth retardation" which most likely represents what is recognized as FTT. Both factors invalidates the "controls'	Risk of death of malnourished children 2.5 more likely to die than bacteremic non-malnourished; ND on funding source; Government, private, & hospital funded
Ballard, 1995 95239862	Acute lower respiratory infection	Children classified as having moderate to severe stunting/malnutrition were at higher risk for ALRI (RR = 4.5, ht/age < 90% median) compared to non-stunted/malnourished children (ht/age = 95% of median) (classification by NCHS criteria)	8 LTF within 1 month of enrollment or had ALRI 4-8 wk period prior to observation; inconsistent data for # pts at evaluation; potential recall bias	US government & privately funded

Evidence Table 4. Studies associating immunologic response or infectious diseases with malnourished patients compared to well-nourished control subjects in developing countries

Part II

Author, Year	Correlates / Outcomes and measures	Associations found	Potential biases	Comments
Pandey, 1996 97246349	No. of children / # ARI episodes per child / yr Vit A deficient: 28 / 7.4 Not deficient: 172 / 5.6 Age(mo): 0-11, 12-23, 24-35, 36-47, 48-59 # ARI: 6.2, 5.8, 5.7, 5.9, 5.8 Sample n: 27, 31, 62, 34, 46 ARIs / year GrI: 5.6 GrII: 6.9 GrIII: 7.4 GrIV: 7.7 NI: 4.8	The 28 children with evidence of vitamin A deficiency had significantly higher # ARI than children without vit A deficiency ($\chi^2 = 8.64$, $p < .01$). There was association of increased malnutrition with more frequent # ARIs ($\chi^2 = 36.17$, $p < .05$). There was no age or sex difference.	Vit A deficiency diagnosed by "ocular signs using a brightly illuminated torch"	Follow-up intervals @ 2 wk for 1 yr; ND on funding source

Evidence Table 5. Studies associating behavioral problems with Failure to Thrive patients compared to healthy control subjects in developed countries

Part I

Author, Year, UI	Demographics	Maternal / household demographics	Inclusion criteria	Exclusion criteria	Definition of FTT	Study design
Pollitt, 1976 76109110	Country: US Setting: Outpatient FTT / Ctrl Mean age*: Male 33(14) / 34(13) Female 39(14) / 39(15) Mean ht†: Male 93(2) / 101(1) Female 90(2) / 102(3) Enrolled/Eval 19 / 19 % Male 47 / 47 Race: ND * Months, † centimeters	FTT / Ctrl Maternal educ 11 (2) / 12 (1) Income - Gross annual 6943 (3444) / 9541 (4768) Per capita 1557 (725) / 2648 (1517) Health insur ND / ND	Outpatient clinic, 12-60 mo, ht & wt < 3%, bw = 2500 gm, GA = 36 wks, nl birth, nonorganic, singleton, maternal ht = 154.5 cm & English-speaking ability Controls matched for age (± 3 mo), sex, race, ht & wt = 25%	Birth complications, physical disability, genetic or organic retardation, brain damage, organic growth retardation	Boston Growth Standards – ht & wt = 3rd percentile	Prospective cross-sectional Weekly interviews for 7-11 sessions
Mitchell, 1980 80166667	Country: US Setting: Outpatient clinic FTT / Ctrl Age(y) 2-5 / 2-5 Wt/age ND / ND Ht/length ND / ND Enrolled : cohort of 312(323)* Evaluated 30 / 282 % Male 36.7 / 51.8 % Black 70 / 70 * See Potential biases column	Maternal education: ND Income: ND Health insur: FTT-53% Medicaid Ctrl-49% Medicaid	See definition of FTT Controls: wt = 80% of nl, matched for age, sex, mother's age/ marital status & family problems	Organic cause of FTT, single anomalous low wt recorded, clinic registration by age 6 mo, < 3 visits	Wt for age < 80% of nl up to age 24 mo	Ambidirectional longitudinal 1 fwup at age 3 – 6 y

Evidence Table 5. Studies associating behavioral problems with Failure to Thrive patients compared to healthy control subjects in developed countries

Part I

Author, Year, UI	Demographics	Maternal / household demographics	Inclusion criteria	Exclusion criteria	Definition of FTT	Study design
Polan, 1991 92098539	Country: US Setting: Outpatient clinic FTT / Ctrl Mean age*: 16.7(6.9) / 18.9(7.3) Wt/age: ND / ND Ht/age: ND / ND Enrolled/Eval: 28 / 14 % Male: 50 / 43 Race: ND / ND * Months	Maternal education: ND Income($1,000): FTT / Ctrl Mean: 39.4 (51.4) / 40.1 (49.6) Median: 27.5 / 28.5 Health insur: ND / ND	FTT, age 6 – 36 mo Controls from same site, wt & ht = 10th percentile on NCHS growth charts	Life threatening or terminal illnesses	= 35 wks gestation & normal birth wt, wt fell < 5th percentile, or decrease in wt gain in 6 mo = 2 major percentiles based on NCHS	Prospective cross-sectional
Drotar, 1992 92372721	Country: US Setting: Outpatient fwup FTT / Ctrl Mean age*: 4.92(2.81) / 5.05(2.85) Wt/age: ND / ND Ht/length: ND / ND Enrolled: 68 / 68 Evaluated: 48 / 47 % Male: 71 / 57 Race: Black: 29(60%) / 35(74%) White: 29(40%) / 12(26%) *At intake	FTT / Ctrl Maternal educ: 10.94 (1.74) / 11.51 (1.57) Income: 5446 (5561) / 7792 (10309) Health insur: ND / ND Mean (SD)	Hospitalized for NOFT with nutritional intervention, age 1 – 9 months Controls matched for age at intake, sex, race, birth order, gestational age, maternal educ & age, family income & size	Physical abuse, residence > 1 hr from hospital, bw < 1500 gm	Wt < 5th percentile based on NCHS, absence of disease, wt gain in hospital, poor wt velocity	Prospective longitudinal 1 fwup at age 42-48 months

Evidence Table 5. Studies associating behavioral problems with Failure to Thrive patients compared to healthy control subjects in developed countries

Part I

Author, Year, UI	Demographics	Maternal / household demographics	Inclusion criteria	Exclusion criteria	Definition of FTT	Study design
Hutcheson, 1993 94015754	Country: US Setting: Primary care clinic FTT / Ctrl Mean age* 15.1(5.2) / 14.9(5.1) Wt/age 2.83 / 63.17 Ht/age 23 / 63 Enrolled/Eval 34 / 34 % Male 62 / 62 Race: Black 32 / 32 * Months	FTT / Ctrl Maternal educ* 38 / 70 Income† 64 / 70 Health insur ND / ND * % HS graduate † % receiving AFDC	NOFTT, age 8 – 24 mo Controls matched for age, sex, race	Congenital disorder, chronic disease, < 37 wk gestation, SGA	Wt for age ≤ 5th percentile, or wt for ht ≤ 10th percentile, based on NCHS	Prospective cross-sectional
Kelleher, 1993 93234174	Country: US Setting: Primary care clinic FTT / Ctrl GA(wk)* 33.0 / 33.1 Wt(g)* 1679 / 1845 Enrolled: 842* Evaluated 180 / 591 % Male 52.2 / 47.9 Race: % Black 50 / 53.8 * At birth	FTT / Ctrl Maternal educ* <HS 40.6 / 38.1 HS 30.0 / 29.3 Some col 14.4 / 20.8 ≥col grad 15.0 / 11.8 Income - <10K 38.6 / 34.5 10-20K 19.9 / 23.9 >20K 38.1 / 37.4 Health insur ND / ND * % HS graduate	Gestation age ≤ 37 wks, birth wt ≤ 2500 g, FTT Controls matched for – birth wt +/- 250 g, maternal education, maternal race, & infant sex	Live outside catchment area, D/C outside recruitment period, D/C or died within 48 hr, hospitalized > 60 d, oxygen support > 90 d, twin, triplet or quadruplet of ineligible child, maternal drug/alcohol abuse, insufficient English skills, psychiatric hosp	< 5th percentile for gestation corrected age based on NCHS, growth status on "wt curve below that recorded at last regular assessment visit."	Prospective longitudinal Fwup at ages 12, 24, 36 mo

Evidence Table 5. Studies associating behavioral problems with Failure to Thrive patients compared to healthy control subjects in developed countries

Part I

Author, Year, UI	Demographics	Maternal / household demographics	Inclusion criteria	Exclusion criteria	Definition of FTT	Study design
Skuse, 1994 94253258	Country: UK Setting: Outpatient FTT / Ctrl Age(mo)* 14.6(1.4) / 14.2(1.4) Wt/age† -2.07(.44) / .10(.96) Ht/length† -1.27(.94) / .18(.73) Enrolled 49 / 50 Evaluated 47 / 47 % Male 49 / 49 % Non-white 43 / 34 * Mean (SD), † z score, p < .001	Maternal educ: ND Income: income/welfare support FTT-16, Control-11 Health insur: National healthcare	District-centered until 12 mo of age, singleton deliveries of 38-41 wks gestation Controls matched for sex, age, ethnic origin, bw within 300 g, ordinal position, SES	≤ 3rd centile, no wt data	Wt for age ≥ -1.88 by 12 mo of age & sustained 3 mo (based on NCHS)	Prospective longitudinal Assessments at age 15 mo & 4y
Puckering, 1995 95378341	Country: UK Setting: Outpatient FTT / Ctrl Age(mo) 48.9(1.8) / 48.2(0.8) Wt/age(SDS)* -2.01(0.6) / -0.32(1.1) Ht/length(SDS)* -2.24(0.5) / -0.6(0.9) Enrolled/Eval 23 / 23 % Male 48 / 48 Race: 100% White * based on NCHS, p < .001	FTT / Ctrl Maternal educ* 15.6 (1.4) / 15.6 (1.4) Income† 11 / 7 48% / 30% Health insur: Socialized medicine * Age leaving full-time education † Income support/welfare	From inner city population sample - Caucasian born in 1980 with longitudinal growth data from birth to 4 years Controls matched for sex, gestational age ≥ 38 wks, & ethnic origin	Prematurity, congenital defects/ diseases affecting growth, no perinatal insults	Ht & wt < 10% based on standard British growth charts (Tanner & Whitehouse)	Ambidirectional cross-sectional

Evidence Table 5. Studies associating behavioral problems with Failure to Thrive patients compared to healthy control subjects in developed countries

Part I

Author, Year, UI	Demographics	Maternal / household demographics	Inclusion criteria	Exclusion criteria	Definition of FTT	Study design
Corbett, 1996 97113595	Country: UK Setting: Clinic Age at follow-up: 6-7 yr FTT / Ctrl Wt/age: ND / ND Ht/length: ND / ND Enrolled: 52 / 52 Evaluated: 48 / 46 % Male: ND Race: 100% White	Maternal educ: ND Income: "…most economically deprived wards in Newcastle" Health insur: National healthcare	Full term singleton with records of 6 or more weights over first 18 months age Consecutive controls matched for age & sex	Non-Caucasian, "poor growth resulting from major organic disease"	Weight deviated downward from maximal centile achieved at 4-8 wks, across ≥ 2 centile lines, & remained at level ≥ 2 measurements ≥ 1 mo – chart based on Tanner & Whitehouse	Ambidirectional longitudinal 5 year follow-up of cases
Wilensky, 1996 97022837	Country: Israel Setting: Community pediatric clinic FTT / Ctrl Mean age(mo)*: 15/20 / 15/20 Wt/age: ND / ND Ht/length: ND / ND Enrolled†: 55 / 1352 Evaluated: 50 / 50 % Male: ND / ND Race: ND; Maternal country of birth – 68% Israel, 25% Europe/America, 5% N Africa, 2% Asia * At entry / assessment	FTT / Ctrl Maternal educ*: 13.8 (1.62) / 13.4 (1.44) Income: AFDC 76% Health insur: ND * Mean (SD), based on record review of potential subjects	FTT infants by review of records who have reached 15 months born in 1991 Controls from same maternal & child health clinic matched for birth month, maternal educ, maternal age, parity, and infants' birth wt	Birth wt < 2500 gm, < 37 weeks, wt/ht ratio > 10 %, organic cause of FTT	Wt < 3% by NCHS for = 3 months prior to age 15 months	Ambidirectional cross-sectional

Evidence Table 5. Studies associating behavioral problems with Failure to Thrive patients compared to healthy control subjects in developed countries

Part I

Author, Year, UI	Demographics	Maternal / household demographics	Inclusion criteria	Exclusion criteria	Definition of FTT	Study design
Chatoor, 1998 99026462	Country: US Setting: Outpatient Gp1* / Gp2† / Ctrl Age(mo) 21.4 / 23.7 / 22.5 range (12-37) / (13-37) / (13-36) Wt/age ND / ND / ND Ht/length ND / ND / ND Enrolled 34 / 34 / 34 Evaluated 33 / 34 / 34 % Male 39 / 58 / 44 Race White 58 / 58 / 59 Af-Am 27 / 27 / 29 Latino 3 / 6 / 6 Asian 15 / 12 / 6 * Infantile anorexia, † Picky eaters	Maternal educ: ND Income: Gp1 / Gp2 / Ctrl SES* II / II / II † I 41 / 35 / 32 II 29 / 32 / 44 III 9 / 26 / 9 IV 9 / 3 / 12 V 12 / 3 / 3 Health insur: ND * Mean Hollingshead Four Factor Index rating of SES † % toddlers in each Hollingshead category	Infantile anorexia, toddlers who are picky eaters Controls & picky eaters matched for age, sex, SES ethnicity	Organic cause for feeding problems, food refusal after traumatic event/post-traumatic feeding disorder, gestational age < 36 wks, psychiatric illness, mother with medical or mental illness that compromised ability to care for child or was nonEnglish speaking	Infantile anorexia: onset 6-36 mo, food refusal ≥ 1mo, acute and/or chronic malnutrition, parental concern & anxiety, conflictual feeding interactions Picky eating: food selectivity ≥ 1mo, no malnutrition, variable parental concern	Prospective cross-sectional
Wright, 2000 20161504	Country: UK Setting: Outpatient FTT / Ctrl Age(mo) 15.1* / ND (7-28) / (16-18) Wt/age -2.00(.93) / ND Ht/length -1.06(.96) / ND Enrolled 120 / 40 Evaluated 97 / 28 % Male 54 / 61 % Nonwhite 9 / 0 * Median	Maternal educ: ND Income: ND FTT* / Ctrl I* Unemployed parent 39 / 13 Nonhome-owner 54.7 / 53.6 No car 48.3 / 50 Health insur: National healthcare * Percent	Baseline wt at 6-8 wk & 2nd wt at 9-18 mo Controls from 3 "generally representative" of Newcastle	2nd twin sibling	Weight decline of 1.26 SD from age 6-8 wks to 2nd weighing at 9-18 months	Prospective cross-sectional

Evidence Table 5. Studies associating behavioral problems with Failure to Thrive patients compared to healthy control subjects in developed countries

Part I

Author, Year, UI	Demographics	Maternal / household demographics	Inclusion criteria	Exclusion criteria	Definition of FTT	Study design
Kerr, 2000 20277217	Country: US Setting: Inner-city hospital clinic Age (mo) / Mean wt/age / Ht/ length Gp1* 73.3±1.9 ND ND Gp2† 74.2±3.2 ND ND Ctrl1‡ 73.0±1.2 ND ND Ctrl2§ 73.5±1.9 ND ND Evaluated / % Male / % Race‖ Gp1 64 56 88 Gp2 28 48 87 Ctrl1 21 53 94 Ctrl2 80 51 97 Mean, * FTT, † FTT & maltreatment, ‡ Maltreatment, § Neither, ‖ % African Am	Maternal educ / Income* Gp1 11.2(1.9) 56 Gp2 10.4(1.7) 81 Ctrl1 11.2(1.4) 65 Ctrl2 11.4(1.9) 62 Health insur: ND Mean, * percent AFDC	FTT, < 24 mo, wt/age < 5th %, gestational age = 37 wks & appropriate birth wt Ctrl from same site, bet ages 3 – 30 mo, wt/age > 10th %, gestational age = 37 wks & appropriate birth wt Subgroups Gp2 & Ctrl1: including hx of maltreatment defined as at least one report with Child Protective Services (CPS) by age 6, including neglect, physical abuse, & sexual abuse	History of perinatal complications, congenital disorders, chronic illness	Wt/age < 5th % by NCHS growth charts	Ambidirectional longitudinal Assessment at age 6 y
Steward, 2001 21291243	Country: US Setting: Outpatient primary care clinic FTT / Ctrl Age (mo) 9.2 8.6 Wt/age(kg)* 7.14 8.54 Ht/length ND ND Enrolled 17 16 Evaluated 14 14 % Male 36 36 Race: white 9 9 black 5 5 Mean * p < 0.05	FTT / Ctrl Maternal educ* 12.2 12.5 Income: ND Health insur: ND * NS for educ & age	Diagnosed FTT, 2-12 months, birthweight ≥ 2500g Controls matched for age, sex, & race – "growing appropriately"	Absence of disease process, pre- or post-natal complications	Weight for age fallen below 5 percentiles or fallen across 2 major percentiles	Prospective cross-sectional

Evidence Table 5. Studies associating behavioral problems with Failure to Thrive patients compared to healthy control subjects in developed countries

Part II

Author, Year	Correlates & correlate measures			Method / Instrument	Associations found
Pollitt, 1976 76109110		FTT	Ctrl	Reported or observed feeding, history of other behaviors, direct measures	FTT were reported to have significantly more feeding behavior problems than controls in difficulty in feeding (χ^2 = 5.97, p < .02); eating patterns (χ^2 = 8.74, p < .03); supported by caloric intake measures (t = 2.06, p = .03). FTT had a trend for exhibiting autoerotic & self-harm behavior problems; analyzed for sum any of these atypical behaviors, the FTT exhibited significant higher incidence (χ^2 = 8.19, p < .01)
	Feeding difficulty	10	2		
	Meal pattern-often skipped/skimpy	16	6		
	Caloric intake	1400(300)	1700(500)		
	Response to food - correlation to wt %	ND	ND		
	Eating disorder – FTT 4 exhibiting eating & drinking nonfood items, polydipsia, gorging, & hiding food Ctrl none reported				
	Autoerotic	2	0		
	Self harm	2	0		
	Sum children with abnormal behavior	10	1		
Mitchell, 1980 80166667	Behavior problems	FTT 3.3%	Ctrl 2.8%	Behavior problems questionnaire	NS but FTT group had higher incidence of behavioral problems.
Polan, 1991 92098539	FTT status on positive & negative affect in feeding in 4 channels of emotion – facial display pattern, vocalization, gesture, body posture & movement			Kiddie Affect Inventory and Assessment of 11 affects scored independently	FTT had significantly decreased positive affect during feeding & nonfeeding (t=-2.92, p=.04; t=-3.151, p = .003, respectively) Also FTT had significantly increased negative affect during feeding (t=2.567, p=.01).
Drotar, 1992 92372721		FTT	Ctrl	California Child Q-set Lock box – Rectangular container w/10 locked compartments Child Behavior Checklist	FTT children have poor problem-solving, behavior problems, & "deficiencies in personality development" versus controls. The ego development score was lower, ego resiliency score was significantly lower (p<.05). FTT behavior organization & problem scores were significant lower (p<.001, p<.05, respectively)
	Personality development				
	• ego control	376.67(32.28)	413.42(30.73)		
	• ego resiliency	376.06(41.21)	397.37(41.45)		
	Behavioral organization	.95(1.92)	8.45(12.08)		
	Behavioral problems	58.5(10.7)	53.2(12.7)		

Evidence Table 5. Studies associating behavioral problems with Failure to Thrive patients compared to healthy control subjects in developed countries

Part II

Author, Year	Correlates & correlate measures						Method / Instrument	Associations found
Hutcheson, 1993 94015754	Child temperament	FTT1*	FTT2†	Ctrl1*	Ctrl 2†		Infant Characteristics Questionnaire	The FTT cases rated as more difficult with significant finding on effect of infant age on maternal report of infant level of difficulty (F=4.21, p = 0.04). Though no age or group differences found on perceived life stresses, parenting stresses, informal support, and negative affectivity, the FTT infants had fewer life events than FTT toddlers, whereas the reverse was true for the comparison group. The maternal effect was less positive toward FTT toddlers than FTT infants. Controlling for maternal education, wt for age, & ht for age - significant group by age interaction for maternal factors (F=4.98, p = 0.02) due to maternal affective tone (F=9.33, p = 0.005)
		0.48	0.49	0.06	-0.19			
	* Infants: 8 – 13.4 mo † Toddlers: 13.5 – 24 mo							
Kelleher, 1993 93234174	Behavioral disorder		FTT	Ctrl			Bates Temperament scale	Sample of LBW or premature infants followed had lower HOME scores at 12 months, NS. There was a trend towards more behavioral problems for the FTT as reported by parents.
	Age(m)	12	73.0	73.6				
		24	9.4	8.9			CBCL	
Skuse, 1994 94253258	Behavior Assessment at 15 mo						TRIB	No difference between groups for expression of positive affect in relation to task directed behavior or task persistence
Puckering, 1995 95378341	Behavior score		FTT	Ctrl			Behavior Screening Questionnaire (BSQ)	There was no difference in BSQ scores for the two groups (p=.2). MANOVA performed on calculated mean GCI & BSQ scores vs. unconditional & conditional interactions grouped by high or low (above & below overall mean value for interaction) – results indicate that parenting style does not account for GCI or BSQ differences between FTT & Ctrl.
			8.7(4.4)	6.9(3.5)				
Corbett, 1996 97113595	Behavioral disorder		FTT	Ctrl			CBCL	There was a trend towards more behavioral problems for the FTT as reported by teachers (NS, p = .296)
	Parental reporting		33	34				
	Teacher reporting		23	14				
	Median							

Evidence Table 5. Studies associating behavioral problems with Failure to Thrive patients compared to healthy control subjects in developed countries

Part II

Author, Year	Correlates & correlate measures					Method / Instrument	Associations found
Wilensky, 1996 97022837	Feeding problems		FTT	Ctrl		Maternal questionnaire	FTT children had significantly more feeding problems than the controls ($p < .05$)
	• showing hunger		53.4%	46.2%			
	• turns head from food		59.7%	20.7%			
	• shows pleasure at meals		76.7%	94.3%			
	• nervous at meals		23.2%	5.6%			
	• eats variety		48.8%	69.8%			
	• spits out food		65.1%	33.9%			
Chatoor, 1998 99026462		Gp1	Gp2	Ctrl		Ainsworth & Cassidy & Marvin attachment classification Strange Situation Security Scale / 9 point Likert	There was significant relationship between diagnostic group and frequency of insecure attachments ($\chi^2 = 8.0$, $p < .05$). Infant anorexia group exhibited more frequent insecure relationships compared to picky eater or healthy eater groups ($\chi^2 = 6.7$, $p < .01$; $\chi^2 = 3.9$, $p < .05$). There was main effect for group for Attachment security scale ($F = 5.8$, $p < .01$) with the infantile anorexia group as least secure. The closer to ideal weight was correlated to increased security ($r = 0.31$, $p < .01$).
	Attachment classification						
	Secure	20	30	28			
	Avoidant	4	3	3			
	Resistant	7	1	3			
	Disorganized	2	0	0			
	Attachment security scale rating	4.9(2.1)	6.1(1.3)	6.0(1.5)			
	Percent ideal weight						
Wright, 2000 20161504	Behavior & temperament		FTT	Ctrl		Parental reporting / Likert scale	FTT had higher maternal reporting of infants as undemanding & shy in temperament ($p = .005$ & $p = .002$, respectively). Higher maternal reporting of infancy feeding problems, variable eating pattern.
		Sociable	47	26			
		Average	17	2			
		Shy	12	0			
		Demanding	18	13			
		Average	48	15			
		Undemanding	11	0			
Kerr, 2000 20277217		Gp1	Gp2	Ctrl1	Ctrl2		There is main effect from risk status (FTT, FTT & maltreatment, maltreatment alone) as being associated with worse scores in cognitive & adaptive performance ($F = 3.527$, $p < .01$), school & home behavior ($F = 2.986$, $p < .01$; $F = 2.453$, $p < .05$, respectively). There was a trend for worse scores in all areas for FTT vs. no risks factors or maltreatment alone.
	Adaptive functioning at school	15.85 (7.2)	13.88 (6.9)	16.92 (6.9)	17.85 (9.7)	Teacher Report Form (↑ numbers = better score)	
	School behavior	31.45 (27.1)	53.53 (35.7)	29.18 (25.0)	28.87 (29.1)	Teacher Report Form (↓ numbers = better score)	

Evidence Table 5. Studies associating behavioral problems with Failure to Thrive patients compared to healthy control subjects in developed countries

Part II

Author, Year	Correlates & correlate measures					Method / Instrument	Associations found
	Home behavior	28.11 (22.8)	34.85 (21.2)	29.00 (20.5)	26.67 (18.4)	Child Behavior Checklist (↓ numbers = better score)	
Steward, 2001 21291243		FTT	Ctrl			PCERA subscale	FTT group scored significantly lower on the communication subscale ($p < 0.02$); during interactions with the mother had less visual contact, more gaze aversion & vocalized less than controls, had difficult to read cues. They also scored lower than controls on the mood scale, were more irritable & apathetic ($p < 0.05$).
	Communication	3.19	4.07				
	Mood effect	3.65	4.26				

Evidence Table 5. Studies associating behavioral problems with Failure to Thrive patients compared to healthy control subjects in developed countries

Part III

Author, Year	Potential biases	Comments
Pollitt, 1976 76109110	4 cases with FTT hx within ht 3rd & 10th percentiles included in study	Government & privately funded
Mitchell, 1980 80166667	Physical exams & growth status by PI not blinded	Government & privately funded
Polan, 1991 92098539	37% of mothers of normal growth children refused study or failed to appear for 1st appointment, no FTT mothers refused study; randomly selected subset of 107 who completed video lab observation session; acute and chronic conditions in sample, 6 organic FTT based on Woolston score	FTT subgroup analyses no difference in sex, mother's marital status, family income, but organic FTT significantly younger at 10.8 mo vs. 18.3 for NOFTT, p = 0.016. NS for degree of acute or chronic malnutrition and positive or negative affect in feeding & nonfeeding activities; government & privately funded
Drotar, 1992 92372721	---	No difference for attrition group vs group evaluated, index gp hospitalized avg 14 d for dx & nutritional intervention; government funded
Hutcheson, 1993 94015754	76% of index group met both criteria for NOFTT (wt for age, & ht for age), 24% met one criterion; unknown n for age by group comparisons	Government & privately funded
Kelleher, 1993 93234174	Of 985 enrolled, 71 LTF, 12%(20) OFTT, 16%(28) were both OFTT & NOFTT	21% of babies develop FTT by 36 wks; ND on funding source
Skuse, 1994 94253258	2 cases & 3 controls didn't complete assessments & were excluded from analyses, 1 case had microcephaly, hypotonia, & an action tremor or ataxia of unknown origin	Researchers blinded to patient's status in measures except anthropometry; privately funded

Evidence Table 5. Studies associating behavioral problems with Failure to Thrive patients compared to healthy control subjects in developed countries

Part III

Author, Year	Potential biases	Comments
Puckering, 1995 95378341	---	Other than clinic anthropometric measures, home visits by assessors blinded to child's group status; The FTT children were significantly smaller than the controls; government funded
Corbett, 1996 97113595	3 from each group refused consent at follow-up, LTF or moved - 2 cases, 3 controls, 1 case not originally studied participated for follow-up study, 4 of those cases were the slowest growing 5% - also removed from home, all controls stayed with parents. Edward's diagnostic criteria for growth measure considered limited.	Additional aubgroup analyses for FTT cases showed significant association between full-scale IQ and cases with lowest Thrive Index values, p = 0.03; ND on funding source
Wilensky, 1996 97022837	Feeding behaviors and HOME environment are causal factors given time dissociation as FTT was established at 15 months, where as, maternal interview/home assessment at 25 months	2/5th of infants diagnosed as FTT no longer fit the criteria at 20-month follow-up, yet had positive association on Bayley MDI. Reported associations for FTT without specific data: paternal age (p<.01), maternal education, & behavioral observations of lower sociability (p<.05) & fear of examiner (p<.05); ND on funding source
Chatoor, 1998 99026462	1 infant anorexia withdrew because mother became ill	Testers blinded to child's status; poor discussion of SES markers, no quantification of malnutrition, no demonstration of equivalency of control groups; government funded
Wright, 2000 20161504	Of 120 cases, 23 recovered above screening threshold & had no subsequent data, 21 families received social work input of which, 4 cases registered at risk of abuse or neglect, 17 cases had "relevant organic conditions"…but only 4 said to be main explanation for their FTT", age difference between groups	Government & privately funded
Kerr, 2000 20277217	Hx of maltreatment not part of original recruitment criteria; unknown number of original sample, also in Mackner 1997 sample (n=177) is reported to be a subsample; maltreatment group may not include all because of definition of a CPS report filed	At 6 year, most FTT children had recovered & 3% had weight for height < 5th percentile; government funded
Steward, 2001 21291243	Withdraws include: mother changed mind, not available for home visit, opposition of mother's significant other (numbers of each not given)	Majority of single mothers, difference in birthwt – FTT, 2822 g vs. controls, 3344 g (p < 0.013); government & privately funded

Evidence Table 5. Studies associating behavioral problems with Failure to Thrive patients compared to healthy control subjects in developed countries

Part III

Author, Year, UI	Demographics	Maternal / household demographics	Inclusion criteria	Exclusion criteria	Definition of FTT	Study design
Galler, 1983b 83136863	Country: Barbados Setting-Outpatient Age(y): 5-11 Gp / Ctrl Wt/age ND / ND Ht/length ND / ND Enrolled 141 / 129 Evaluated 129 / 129 % Male 60 / ND Race: 100% Black	Maternal educ: ND, universal education, 95% population literate Income: lower for cases compared to controls Health insur: ND	Discharged 5 – 11 y olds w/dx at age 1 y with PEM Grade II-III, BW > 5 lbs Controls without PEM, matched for age, gender, handedness, & same school / neighborhood	Pre- or peri-natal complications, edema, seizures, head trauma, loss of consciousness, high fever	Gomez Scale PEM: Grade II- 61-75% or Grade III- ≤ 60% standard wt for age on Harvard Standard Scale	Ambidirectional longitudinal Fwup 4 – 10 y after D/C

Evidence Table 6. Studies associating behavioral problems with malnourished patients compared to healthy control subjects in developing country

Part II

Author, Year	Correlates & correlate measures	Method / Instrument	Associations found	Potential biases	Comments
Galler, 1983b 83136863	Classroom behavior – Gp status by Factor 1-attention deficit Factor 2-social interaction Factor 3-physical appearance	Study specific teacher questionnaire	From ages 5-11, The index group's behavioral development was lower than the comparison group. Early PEM is associated with increased problems in attention, deficit, social interaction, & physical appearance. Signf for – Factor 1 / Factor 2 / Factor 3 Gp status: F = 37.2, p ≤ .001 / F = 8.3, p ≤ .05 / F = 14.3, p ≤ .001 Gp vs. Ctrl: t = 5.5, p ≤ .01 / t =4.1, p ≤ .01 / t = 3.1, p ≤ .01	Withdraws/non-participation – 4 refused consent, 7 LTF, 1 cerebral palsy; severe PEM	Private & hospital funded

Evidence Table 7. Studies associating cognitive & neurological development with Failure to Thrive patients compared to healthy control subjects in developed countries

Part I

Author, Year, UI	Demographics	Maternal / household demographics	Inclusion criteria	Exclusion criteria	Definition of FTT	Study design
Mitchell, 1980 80166667	Country: US Setting: Outpatient clinic FTT / Ctrl Age(y) 2-5 / 2-5 Wt/age ND / ND Ht/length ND / ND Enrolled : cohort of 312(323)* Evaluated 30 / 282 % Male 36.7 / 51.8 % Black 70 / 70 * See Potential biases column	Maternal educ: ND Income: ND Health insur: FTT-53% Medicaid Ctrl-49% Medicaid	See Definition of FTT Controls: wt = 80% of nl, matched for age, sex, mother's age/ marital status & family problems	Organic cause of FTT, single anomalous low wt recorded, clinic registration by age 6 mo, < 3 visits	Wt for age < 80% of nl up to age 24 mo	Ambidirectional longitudinal 1 fwup at age 3 – 6 y
Hack, 1982 82227864	Country: US Setting-Recruitment: Hospital Follow-up: hospital/clinic Gp1* / Gp2† Mean age‡ 32(2.8) / 29(1.9) Wt/age(g) 1141(285) / 1197(206) Length(cm) 37.9(3.8) / 38(2.7) Enrolled|| ND / ND Evaluated 38 / 154 % Male 47 / 47 % Black 52 / 63 * SGA, † AGA, ‡ wks gestation, || n = 204	Gp1 / Gp2 Maternal educ <HS 12 / 32 Income* 28 / 99 Health insur ND / ND * Hollingshead Social Class 4 & 5	VLBW, < 1500g, divided into two groups: SGA < 2 SD or AGA	ND	Wt < 2 SD below mean for age @ term and/or @ 8 mo of age	Prospective longitudinal Assessments at age 40 wk & 8 m

Evidence Table 7. Studies associating cognitive & neurological development with Failure to Thrive patients compared to healthy control subjects in developed countries

Part I

Author, Year, UI	Demographics	Maternal / household demographics	Inclusion criteria	Exclusion criteria	Definition of FTT	Study design
Singer, 1984 85057547	Country: US Setting-Recruitment: hospital Follow-up: ND NOFTT OFTT Ctrl GA(wk)* 39(1.8) 37(3.5) 38(1.8) range 36-40 28-40 36-40 PA(wk)† 30(7.0) 30(7.5) 30(10.1) range 20-44 21-44 20-44 Birth wt 2847 2378 3027 Enrolled 13 13 13 Eval‡ 11 11 11 Age: 20.6 mo % Male: ND Race: ND Mean (SD), * gestational age, † postnatal age, ‡ 20 mo follow-up	NOFTT OFTT Ctrl Maternal educ* 12.5 (1.4) 11.4 (1.4) 12.5 (12.5) Income: ND Health insur: ND * At evaluation	NOFTT-unknown organic cause of condition, absence of wt gain during or shortly after hospitalization NFTT-documented organic cause of condition Controls -"not FTT"	ND	ND	Prospective longitudinal Assessments at age 8 mo, 20 mo, 3 y
Haynes, 1984 84233543	Country: US Setting: In & Out-patient Age: ND Wt/age: ND Ht/length: ND FTT1* FTT2† Ctrl Enrolled/Eval 25 25 25 % Sp-Am? 44 44 44 Sp-Am? 40 52 52 White? 36 44 36 White? 36 24 28 Black? 20 12 20 Black? 24 24 20 % Male: ND * std care & lay health visitor intervention, † std care only	FTT1 FTT2 Ctrl Maternal educ 10 11 10 Income* 379 (0-750) 372 (0-950) 362 (0-1100) Health insur: ND * @ mo	Consecutive admissions for NOFTT Controls - thriving non-hospitalized patients matched for age, sex, birth wt, & mother's age, ethnicity, number of living children	ND	< 5 percentile or significant decline from birth wt percentiles	Prospective longitudinal 1 assessment 6 mo after intake

Evidence Table 7. Studies associating cognitive & neurological development with Failure to Thrive patients compared to healthy control subjects in developed countries

Part I

Author, Year, UI	Demographics	Maternal / household demographics	Inclusion criteria	Exclusion criteria	Definition of FTT	Study design
Drotar, 1992 92372721	Country: US Setting: Inpatient with outpatient follow-up FTT / Ctrl Mean age* 4.92(2.81) / 5.05(2.85) Wt/age ND / ND Ht/length ND / ND Enrolled 68 / 68 Evaluated 48 / 47 % Male 71 / 57 Race: Black 29(60%) / 35(74%) White 29(40%) / 12(26%) * Age in months, at intake	FTT / Ctrl Maternal educ 10.94 (1.74) / 11.51 (1.57) Income 5446 (5561) / 7792 (10309) Health insur ND / ND Mean (SD)	Hospitalized for NOFT with nutritional intervention, age 1 – 9 months Controls matched for age at intake, sex, race, birth order, gestational age, maternal educ & age, family income & size	Physical abuse, residence > 1 hr from hospital, bw < 1500 gm	Wt < 5th percentile based on NCHS, absence of disease, wt gain in hospital, poor wt velocity	Prospective longitudinal 1 fwup at age 42-48 mo
Kelleher, 1993 93234174	Country: US Setting: Primary care clinic FTT / Ctrl GA(wk)* 33.0 / 33.1 Wt(g)* 1679 / 1845 Enrolled: 842* Evaluated 180 / 591 % Male 52.2 / 47.9 Race: % Black 50 / 53.8 * At birth	FTT / Ctrl Maternal educ* - <HS 40.6 / 38.1 HS 30.0 / 29.3 Some col 14.4 / 20.8 ≥col grad 15.0 / 11.8 Income – <10K 38.6 / 34.5 10-20K 19.9 / 23.9 >20K 38.1 / 37.4 Health insur ND / ND * % HS graduate	Gestation age ≤ 37 wks, birth wt ≤ 2500 g, FTT Controls matched for – birth wt +/- 250 g, maternal education, maternal race, & infant sex	Live outside catchment area, D/C outside recruitment period, D/C or died within 48 hr, hospitalized > 60 d, oxygen support > 90 d, twin, triplet or quadruplet of ineligible child, maternal drug/ alcohol abuse, insufficient Eng skills, psychiatric hospitalization	< 5th percentile for gestation corrected age based on NCHS, growth status on "wt curve below that recorded at last regular assessment visit."	Prospective longitudinal Fwup at ages 12, 24, 36 mo

Evidence Table 7. Studies associating cognitive & neurological development with Failure to Thrive patients compared to healthy control subjects in developed countries

Part I

Author, Year, UI	Demographics	Maternal / household demographics	Inclusion criteria	Exclusion criteria	Definition of FTT	Study design
Skuse, 1994 94253258	Country: UK Setting: Outpatient FTT / Ctrl Age(mo)* 14.6(1.4) / 14.2(1.4) Wt/age† -2.07(.44) / .10(.96) Ht/length† -1.27(.94) / .18(.73) Enrolled 49 / 50 Evaluated 47 / 47 % Male 49 / 49 % Non-white 43 / 34 * Mean (SD), † z score, p < .001	Maternal educ: ND Income: Income/welfare support-FTT 16, Ctrl 11 Health insur: National healthcare	District-centered until 12 mo of age, singleton deliveries of 38-41 wks gestation Controls matched for sex, age, ethnic origin, bw within 300 g, ordinal position, SES	≤ 3rd centile, no wt data	Wt for age ≥ -1.88 by 12 mo of age & sustained 3 mo (based on NCHS)	Prospective longitudinal Assessments at age 15 mo & 4 y
Reif, 1995 95362505	Country: Israel Setting: Outpatient fwup FTT / Ctrl Mean age(y)* 6.2 / 6.8 Wt/age* 18.05 / 36.15 Ht/length* 21 / 33.55 Enrolled 86 / 65 Evaluated 61 / 65 % Male 52.5 / 54 Race: Sephardic 38 / 36 Ashkenazi 23 / 29 * At re-evaluation	FTT / Ctrl Maternal educ* 12.27 (0.29) / 12.14 (0.24) Income ND / ND Health insur: Socialized medicine * Mean (SD)	FTT, < 2 yrs, term infants > 2500g birth wt Controls matched for age, sex, social class, & ethnic affiliation; admitted or evaluated in ER for intercurrent & nonsign disease	Organic cause of FTT, malnutrition, serious perinatal morbidity	Ht & wt < 5% in ≥ 2 measurements within 6 mo on Hamill PVV, Drizd TA growth chart,	Ambidirectional longitudinal Re-evaluation at mean 5.12 y

Evidence Table 7. Studies associating cognitive & neurological development with Failure to Thrive patients compared to healthy control subjects in developed countries

Part I

Author, Year, UI	Demographics	Maternal / household demographics	Inclusion criteria	Exclusion criteria	Definition of FTT	Study design
Puckering, 1995 95378341	Country: UK Setting: Outpatient FTT / Ctrl Age(mo) 48.9(1.8) / 48.2(0.8) Wt/age(SDS)* -2.01(0.6) / -0.32(1.1) Ht/length(SDS)* -2.24(0.5) / -0.6(0.9) Enrolled/Eval 23 / 23 % Male 48 / 48 Race: 100% White * based on NCHS, p < .001	FTT / Ctrl Maternal educ* 15.6 (1.4) / 15.6 (1.4) Income† 11 / 7 48% / 30% Health insur: Socialized medicine * Age leaving full-time education † Income support/welfare	From inner city population sample - Caucasian born in 1980 with growth data from birth to 4 years Controls matched for sex, gestational age ≥ 38 wks, ethnic origin	Prematurity, congenital defects/ diseases affecting growth, no perinatal insults	Ht & wt < 10% based on standard British growth charts (Tanner & Whitehouse)	Ambidirectional cross-sectional
Corbett, 1996 97113595	Country: UK Setting: Clinic Age at follow-up: 6-7 y FTT / Ctrl Wt/age ND / ND Ht/length ND / ND Enrolled 52 / 52 Evaluated 48 / 46 % Male: ND Race: 100% White	Maternal educ: ND Income: "…most economically deprived wards in Newcastle" Health insur: National healthcare	Full term singleton with records of 6 or more weights over first 18 months age Consecutive controls matched for age & sex	Non-Caucasian, "poor growth resulting from major organic disease"	Weight deviated downward from maximal centile achieved at 4-8 wks, across ≥ 2 centile lines, & remained at level ≥ 2 measurements ≥ 1 mo – chart based on Tanner & Whitehouse	Ambidirectional longitudinal 5 year follow-up of cases

Evidence Table 7. Studies associating cognitive & neurological development with Failure to Thrive patients compared to healthy control subjects in developed countries

Part I

Author, Year, UI	Demographics	Maternal / household demographics	Inclusion criteria	Exclusion criteria	Definition of FTT	Study design
Wilensky, 1996 97022837	Country: Israel Setting: Community pediatric clinic FTT / Ctrl Mean age(m)*: 20 / 20 Wt/age: ND / ND Ht/length: ND / ND Enrolled†: 55 / 1352 Evaluated: 50 / 50 % Male: ND / ND Race: ND; Maternal country of birth: 68% Israel, 25% Europe/America, 5% N Africa, 2% Asia * At assessment	FTT / Ctrl Maternal educ*: 13.8 (1.62) / 13.4 (1.44) Income: AFDC 76% Health insur: ND * Mean (SD), based on record review of potential subjects	FTT infants by review of records who have reached 15 months born in 1991 Controls from same health clinic matched for birth month, maternal educ, maternal age, parity, and infants' birth wt	Birth wt < 2500 gm, < 37 weeks, wt/ht ratio > 10 %, organic cause of FTT	Wt < 3% by NCHS for = 3 months prior to age 15 months	Ambidirectional cross-sectional
Mackner,[a] 1997 97381196	Country: US Setting: Inner-city hospital prenatal clinic Age* (mo) / Mean wt/age / Ht/ lngth / Enrolled /Eval Gp1†: 14±5.3 / <5% / ND / 27 Gp2‡: 14±5.6 / <5% / ND / 70 Ctrl1§: 16±5.9 / >10% / ND / 23 Ctrl2||: 18±6.9 / >10% / ND / 57 % Male: 58 Race: 94.4 % African American, 5.6 % White * p < 0.001, † FTT & neglect, ‡ FTT only, § Neglect only, || Neither	Maternal* educ / Income† / Health insur‡ Gp1: 10.58 / 70 / 89 Gp2: 11.09 / 68 / 78 Ctrl1: 11.04 / 74 / 82 Ctrl2: 11.72 / 81 / 89 * p < 0.05, † percent AFDC, ‡ percent Medicaid	Original criteria: FTT, , 24 mo, wt/age < 5th %, gestational age = 37 wks & appropriate birth wt Controls from same site, bet ages 3 – 30 mo, wt/age > 10th %, gestational age = 37 wks & appropriate birth wt Neglect defined = 33rd % & normal > 50th % by HOME scale	History of perinatal complications, congenital disorders, chronic illness	Wt/age < 5th % by NCHS growth charts	Ambidirectional cross-sectional

Evidence Table 7. Studies associating cognitive & neurological development with Failure to Thrive patients compared to healthy control subjects in developed countries

Part I

Author, Year, UI	Demographics	Maternal / household demographics	Inclusion criteria	Exclusion criteria	Definition of FTT	Study design
Drewett, 1999 99284054	Country: UK Setting: Clinic / home visits FTT / Ctrl Age(y) 8.12(0.62) / 8.10(0.57) Wt(kg)* 23.8 / 27.9 BMI* 14.9 / 16.3 Enrolled 136 / 136 Evaluated† 107/111 / 117/122 % Male‡ 40 / 38 %White‡ 91 / 91 * Median, † Psychological / anthropometric evaluation, ‡ FTT = 107, Ctrl = 117	FTT / Ctrl Maternal educ* 72 / 66 Income: NA Health insur: National healthcare * % left school at 16 y	At least 1 wt at age 0-2 mo & 2 subsequent wts, thrive index < 5th centile = 2 occasions between 3 & 18 mo Controls with at least 1 wt at age 0–2 mo & 2 subsequent wts, no thrive index < 10th centile, age ± 1 mo, similar/same residential area or GP practice	ND	Lowest 5% for change of SD score; avg taken of SD scores for all wt bet 0-2 mo, expected wt from 3-18 mo calculated for "thrive index"	Ambidirectional longitudinal Five years from enrollment of 1 y old cases
Kerr,[a] 2000 20277217	Country: US Setting: Inner-city hospital clinic Age (mo) / Mean wt/age / Ht/ lngth Gp1* 73.3±1.9 / ND / ND Gp2† 74.2±3.2 / ND / ND Ctrl1‡ 73.0±1.2 / ND / ND Ctrl2§ 73.5±1.9 / ND / ND Evaluated / % Male / % Race‖ Gp1 64 / 56 / 88 Gp2 28 / 48 / 87 Ctrl1 21 / 53 / 94 Ctrl2 80 / 51 / 97 Mean, * FTT, † FTT & maltreatment, ‡ Maltreatment, § Neither, ‖ % African Am	Maternal educ / Income* Gp1 11.2(1.9) / 56 Gp2 10.4(1.7) / 81 Ctrl1 11.2(1.4) / 65 Ctrl2 11.4(1.9) / 62 Health insur: ND Mean, * percent AFDC	History of FTT & Controls see Mackner 1997 Subgroups - Gp2 & Ctrl1: hx of maltreatment defined as at least one report with Child Protective Services (CPS) by age 6, including neglect, physical abuse, & sexual abuse	History of perinatal complications, congenital disorders, chronic illness	Wt/age < 5th % by NCHS growth charts	Ambidirectional longitudinal Assessment at age 6 y

Evidence Table 7. Studies associating cognitive & neurological development with Failure to Thrive patients compared to healthy control subjects in developed countries

Part II

Author, Year	Development measures	Instruments utilized & criteria	Associations found
Mitchell, 1980 80166667	General cognitive index FTT: 87.5 Ctrl: 92.5	McCarthy scale	Though there was a trend for lower GCI scores for FTT group, there was no statistical difference between the two groups.
Hack, 1982 82227864	Gp1Sub*: 99(18) Gp2Sub1†: 89(22) Gp2Sub2‡: 93(17) Ctrl§: 108	Bayley	At 8 months, infants from both groups had similar developmental quotients if catch-up growth is achieved. Subnormal wts at 8 months experienced by subset of both groups is associated with lower DQ scores ($p < .005$) and higher rate of neurological impairment.
	Neurosensory impairment 6(32%) 6(46%) 8(27%) 13(10%) * SGA-subnormal wt at 40 wk & 8 m (n=19), † AGA-subnormal wt at 8 m (n=13), ‡ AGA-subnormal wt at 40 wk & 8 m (n=30), § 4 subgroups - appropriate for age (n=130)	Neurological examine	
Singer, 1984 85057547	Cognitive & sensorimotor development 8 m assessment / 20 m assessment / Placed outside home* / Home placement* NOFTT 77.6(20.5) / 80.5 / 70.2 / 67.4 OFTT 67.7(13.8) / 75.4 / 90 / 83.3 Ctrl 120.2(10.7) / ND / ND / ND * 20 mo assessment, sample size unknown	Bayley MDI/Kent Scoring Adaptation	At initial 8 month assessment, there was main effect of group ($F = 23.98$, $p < .001$). Both FTT groups showed a significant delay in sensorimotor skills compared to control group ($F=46.45$, $p < .001$). At 20 months, it was also reported that there was a main effect of group ($F = 21.3$, $p < .001$). Home placement or placement outside the home affected the MDI scores with mean MDI home scores higher regardless of group status (87.5 vs. 68.8).
	Visual recognition memory (8 m assessment) NOFTT: 68%(9.1) OFTT: 52.6(8.5) Ctrl: 62.5(9.2)	Recognition memory tasks - fixation of familiar vs. novel	At 8 month assessment, the OFTT showed a significant delay in visual perceptual-cognitive abilities compared to NOFTT vs. controls where there were no significant differences ($F = 19.88$, $p < .001$).
Haynes, 1984 84233543	Cognitive & motor development FTT*(%) / Ctrl(%) Intake† ≥ 90: 19(38) / 21(81) < 70-89: 31(62) / 5(19) Fwup‡ ≥ 90: 15(40.5) / 17(81) < 70-89: 22(59.5) / 4(19) * intervention & non-intervention combined, † FTT=50 Ctrl=25, ‡ FTT=37 Ctrl=21	Bayley Scale of Infant Development	There were no differences for the FTT groups after 6 mo for development except for a few cases. Approximately 60% FT were developmentally delayed or retarded vs. 5 Ctrls as delayed. Intervention, or home vs. foster care had no effect.

Evidence Table 7. Studies associating cognitive & neurological development with Failure to Thrive patients compared to healthy control subjects in developed countries

Part II

Author, Year	Development measures			Instruments utilized & criteria	Associations found
Drotar, 1992 92372721	Intelligence quotient	FTT	Ctrl	Stanford Binet Intelligence Scale	---
		86.3(15.34)	88.74(14.32)		
Kelleher, 1993 93234174		FTT	Ctrl	Bayley MDI & PDI	LBW & premature infants were followed & subjects who developed FTT scored significantly lower in cognitive & motor development at 12 and 24 months ($p < 0.005$).
	Mental	103.7 / 92.6	109.5 / 98.1		
	Psychomotor	90.9 / 90.1	98.2 / 95.8		
	age 12 m / age 24 m				
Skuse, 1994 94253258		FTT	Ctrl	Bayley MDI & PDI	At 15 months of age, FTT had lower cognitive & motor development scores than controls ($F = 8.07$, $p = .007$). Model predicted lowering wt up to 6 months of age to lower MDI & PDI scores at 15 months. Increased oral motor score was negative correlated with FTT MDI score ($r = -.38$, $p = .008$).
	Mental	98.2(19.0)	108.5(14.4)		
	Psychomotor	96.7(17.3)	103.6(14.4)		
Reif, 1995 95362505		FTT	Ctrl	Reporting/survey	FTT had reported developmental delays and none were for Controls ($p < .005$). Academic performance was lower for the FTT compared to Controls ($p < .01$).
	Developmental delay	7(11.5%)	0		
	Learning difficulties	11(18%)	2(3.1%)		
Puckering, 1995 95378341	General cognitive index	FTT	Ctrl	McCarthy scale	The FTT children had significantly lower DQ scores ($t = -3.93$, $p = .001$) & had few positive & more negative mother – child interactions than the controls. MANOVA performed on calculated mean GCI & BSQ scores vs. unconditional & conditional interactions grouped by high or low (above & below overall mean value for interaction) – results indicate that parenting style does not account for GCI or BSQ differences between FTT & Ctrl.
		77.1(17.6)	97.7(15.2)		
Corbett, 1996 97113595	Intelligence quotient	FTT	Ctrl	WPPSI-R omitting optional animal pegs & sentences subtests	Though not statistically significant, there was a trend for lower IQ score for FTT group with correlation to the severity of FTT ($p = .160$).
		83.6(11.5)	87.0(11.9)		

Evidence Table 7. Studies associating cognitive & neurological development with Failure to Thrive patients compared to healthy control subjects in developed countries

Part II

Author, Year	Development measures					Instruments utilized & criteria	Associations found
Wilensky, 1996 97022837		FTT	Ctrl			Bayley MDI	At 20 months, the FTT group mental development lagged behind the control group ($p < .05$). In addition, an assessment showed the home environment to be less stimulating. 2/5th of infants diagnosed as FTT no longer fit the criteria at 20 mo fwup, yet had positive association on Bayley MDI.
	Mental	99.7	107.2				
Mackner,[a] 1997 97381196		Gp1	Gp2	Ctrl1	Ctrl2	Bayley MDI	Main effect for grouping ($F = 4.899$, $p < .01$). The Neglect & FTT group scored significantly lower than FTT only or Neglect only group, both of which scored lower than the group with neither risk factors in cognitive development, ($p < .01$). Maternal IQ & child age as covariates –significant relationship with Bayley MDI, $F = 4.90$, $p < .01$
	Mental*	85.45 (13.62)	97.38 (13.79)	97.72 (12.25)	100.81 (16.4)		
	* Adjusted score						
Drewett, 1999 99284054		FTT	Ctrl				The IQs & reading scores from the FTT to the controls were not significantly different, but there was a significant relationship between the child's IQ & their mother's IQ ($\beta = 0.76 \pm 0.06$, $t = 12.09$, $p < .0001$). Also a significant relationship between the child's reading score & their mother's IQ ($\beta = 0.56 \pm 0.07$, $t = 8.21$ $p < .0001$). There was a relationship between reading scores & FTT cases (n=9) with possible organic causes ($\beta = -11.91 \pm 4.49$, $t = 2.65$, $p < .01$).
	Mean IQ*	87.6(17.4)	90.6(17.1)			WISC-III	
	Mean Reading†	93.5(162)	94.5(15.6)			WORD test	
	* FTT n = 105, Ctrl n = 117 † FTT n = 105, Ctrl n = 116						
Kerr,[a] 2000 20277217	Gp1	Gp2	Ctrl1	Ctrl2		WPPSI-R: scores standardized score with mean of 100 ± 15	In all four outcome measures were consistent for main effect from risk status (FTT, FTT & maltreatment, maltreatment alone) as being associated with worse scores in cognitive & adaptive performance, school & home behavior ($F = 2.930$, $p < .01$). In addition, there was a significant difference between the FTT & maltreatment group vs. the group with no risk factors for cognitive & adaptive development, and school performance ($p < .05$).
	81.98 (12.8)	77.98 (13.8)	83.58 (12.4)	83.95 (12.5)			

Evidence Table 7. Studies associating cognitive & neurological development with Failure to Thrive patients compared to healthy control subjects in developed countries
Part III

Author, Year	Potential biases	Comments
Mitchell, 1980 80166667	Physical exams & growth status by PI not blinded	Government & privately funded
Hack, 1982 82227864	8 LTF, 4 incomplete data	SGA mothers incr % pregnancy HTN ($p < .05$) & multiple births ($p < .05$) than AGA, also incr antepartum risk score ($p < .005$) & greater gestational age ($p < .005$); privately funded
Singer, 1984 85057547	Recognition memory tasks differed based on age; etiology for OFTT includes primary neurological disease, methadone addiction, cerebral palsy, congenital heart disease, pulmonary stenosis, cyanotic heart disease, polycystic renal disease, necrotizing enterocolitis, & Aarskoog syndrome	Government funded
Haynes, 1984 84233543	"…because of scheduling, few admissions were not evaluated", 2 refused participation; 10 Gp1 & 3 Gp2 premature – overall similar from FTT vs. Ctrl; at 6 mo fwup: for FTT1 & FTT2 each-3 cases refused reevaluation & from1 dissolution of pair, 1Gp1 died SIDS, 1 Gp2 mother gave up child	Block assignment to Gp1 & Gp2 for hospital convenience & case load requirements; government funded
Drotar, 1992 92372721	---	No difference for attrition group vs. group evaluated, index gp hospitalized avg 14 d for dx & nutritional intervention; government funded
Kelleher, 1993 93234174	Of 985 enrolled, 71 LTF, 12%(20) OFTT, 16%(28) were both OFTT & NOFTT	21% of babies develop FTT by 36 wks; ND on funding source
Skuse, 1994 94253258	2 cases & 3 controls didn't complete assessments & were excluded from analyses, 1 case had microcephaly, hypotonia, & an action tremor or ataxia of unknown origin	Researchers blinded to patient's status in measures except anthropometry; government & privately funded
Reif, 1995 95362505	25 cases not re-evaluated because not located or refused participation; inpatient enrollment of FTT-48 & Ctrl-42; outpatient enrollment of FTT-13 & Ctrl-23(ER)	ND on funding source

Evidence Table 7. Studies associating cognitive & neurological development with Failure to Thrive patients compared to healthy control subjects in developed countries

Part III

Author, Year	Potential biases	Comments
Puckering, 1995 95378341	---	Other than clinic anthropometric measures, home visits by assessors blinded to child's group status; The FTT children were significantly smaller than the controls; government funded
Corbett, 1996 97113595	3 from each group refused consent at follow-up, LTF or moved - 2 cases, 3 controls, 1 case not originally studied participated for follow-up study, 4 of those cases were the slowest growing 5% - also removed from home, all controls stayed with parents. Edward's diagnostic criteria for growth measure considered limited.	Additional aubgroup analyses for FTT cases showed significant association between full-scale IQ and cases with lowest Thrive Index values, p = 0.03; ND on funding source.
Wilensky, 1996 97022837	Feeding behaviors and HOME environment are causal factors given time dissociation as FTT was established at 15 months, where as, maternal interview/home assessment at 25 months.	Reported associations for FTT without specific data: paternal age (p<.01), maternal education, & behavioral observations of lower sociability (p<.05) & fear of examiner (p<.05); ND on funding source
Mackner,[a] 1997 97381196	By group sex data not given, unknown whether Bayley tester was blinded to subject's group assignment	Government funded
Drewett, 1999 99284054	Of 136 cases, 1 died, 9 LTF, 15 declined psychological testing, 4 moved; of 136 controls, 2 were preterm, 5 LTF, 12 declined psychological testing, 14 moved & were replaced. 2 FTT cases & 1 control with medical condition affecting growth, & 9 FTT cases & 2 controls with possible medical conditions	Testers blinded to child's status; privately funded
Kerr,[a] 2000 20277217	Hx of maltreatment not part of original recruitment criteria; unknown number of original sample, also in Mackner 1997 sample (n=177) is reported to be a subsample; maltreatment group may not include all because of definition of a CPS report filed	At 6 year, most FTT children had recovered & 3% had weight for height < 5th percentile; government funded

[a] Overlapping sample for Mackner 1997 & Kerr 2000.

Evidence Table 8. Studies associating cognitive & neurological development with malnourished patients compared to well-nourished control subjects in developing countries

Part I

Author, Year	Demographics	Maternal / household demographics	Inclusion criteria	Exclusion criteria	Definition of malnutrition	Study design
Bartel, 1978, 1979 78180773 79162492	Country: South Africa Setting: Outpatient Age: ND Wt/age: ND Ht/length: ND Enrolled* / Eval* / Race Gp 31/30 31/30 Black Ctrll1 31/30 31/30 Black Ctrll2 31/30 31/30 Black Ctrll3† NA/90 NA/90 White % Male: ND * Bartel 1978 / Bartel 1979 † reported in Bartel 1979	ND	Bk 6 – 12 yr olds hospitalized during first 27 months of life for kwashiorkor, 5 – 10 yrs prior to commencement of study Controls close in age, no hx of PCM: Ctrl1-Siblings close in age Ctrl2-Yardmates of cases Ctrl3-High SES Whites	Neurological involvement, brain damage, fits, birth trauma, hospital coma, hypoglycemia	Wellcome criteria for kwashiorkor: <3rd percentile, edematous, and dermatitis and/or nutritional hair changes	Ambidirectional longitudinal Assessment at 4 – 12 y after hospitalization
Evans, 1980 81008912	Country: South Africa Setting: Outpatient clinic Wt/age: See Cognitive development measures column Ht/length: See Cognitive development measures column Gp1 / Ctrl1 / Gp2 / Ctrl2 Mean age(SD) 8.9 (0.5) 10.7 (1.0) 13 (1.9) 12 (2.1) Enrolled 14 14 14 14 Evaluated 14 13 14 13 % Male 64 54 100 77 Race: “Cape coloured”	ND	Gp1 – newborns of families with hx of undernutrition Ctrl1 – siblings with hx of undernourishment, record of `< 3rd percentile for ht & wt Gp2 – at least 1 hospitalization for kwashiorkor Ctrl2 – siblings closet in age Gp2 w/no hx of kwashiorkor but underweight	ND	ND	Prospective longitudinal Fwup 6 ½ y after intervention

Evidence Table 8. Studies associating cognitive & neurological development with malnourished patients compared to well-nourished control subjects in developing countries

Part I

Author, Year	Demographics	Maternal / household demographics	Inclusion criteria	Exclusion criteria	Definition of malnutrition	Study design
Galler, 1983a, 1985b 83136873 85241833	Country: Barbados Setting: Outpatient Age(y): 5-11 (1983) 9-15 (1985) Gp / Ctrl Wt/age: ND / ND Ht/length: ND / ND Enrolled: 141 / 129 Eval 1983a: 129 / 129 1985b: 109 / 107 % Male 1983a: 60 / ND 1985b: 58 / 60 Race: 100% Black	Maternal educ: Universal education, 95% population literate Income: lower for cases compared to Ctrl Health insur: ND	5 – 11 yr olds with hx at age 1 yr of hospitalization for PEM Grade II-III, BW > 5 lbs Controls without PEM, matched for age, gender, handedness, & same school / neighborhood	Pre- or peri-natal complications, edema, seizures, head trauma, loss of consciousness, high fever	Gomez Scale PEM: Grade II- 61-75% or Grade III- ≤ 60% standard wt for age on Harvard Standard Scale	Ambidirectional longitudinal Fwup 4 – 10 y after D/C
Grantham-McGregor, 1987, 1978, 1980, 1982, 1983 87117313 79086701 81051042 82236679 83246270	Country: Jamaica Setting-Recruitment: hospital Follow-up: hospital & home Gp1* / Gp2† / Ctrl† Age(m): 12.8 (2.9) / 13.4 (4.5) / 12.2 (4.4) Ht/age‡: 89.0 (4.5) / 88.4 (4.4) / 101.3 (3.5) HC/age‡: 91.3 (3.7 / 91.2 (3.3) / 99.0 (3.8) Wt/ht‡: 74.9 (9.2) / 72.4 (10.2) / 89.0 (10.1) Enrolled: 21 / 18 / 21 Evaluated: 18 / 16 / 20 % Male: 67 / 38 / 60 Race: ND, assumed Black Mean (SD) for evaluated cases; * Intervention, † Standard care, ‡ % of expected value	Maternal educ: HS not completed Income: housing 'below certain defined standards' Health insur: ND Maternal PPVT Gp1: 62.3(14.7) Gp2: 59.7(15) Ctrl: 67.4(9.3)	PEM, age 6 – 24 mo, attempt for SES of mothers who had not completed secondary education, substandard housing, residence in city of Kingston Controls, included above criteria but adequately nourished, hospitalized with diseases other than malnutrition	Physical handicap, disease that might affect mental development (other than malnutrition)	Severe PEM based on Wellcome classification	Prospective longitudinal 6 fwups from 6 to 72 m after D/C

Evidence Table 8. Studies associating cognitive & neurological development with malnourished patients compared to well-nourished control subjects in developing countries

Part I

Author, Year	Demographics	Maternal / household demographics	Inclusion criteria	Exclusion criteria	Definition of malnutrition	Study design
Agarwal, 1992 92372206	Country: India Setting: Outpatient Age: NA Wt/age: ND Ht/age: ND Enrolled: 650 Gpl* Gp2† Ctrl Evaluated: 245 324 64 % Male: ND Race: ND (assumed Indians) * Grade I, † Grade II/III	Maternal educ: < 4% > grade school, 31.9% overall women's literacy Income: 40% household per capita < Rs.60 p.m. Health insur: ND	Newborns between 11/1981 – 31983; see Definition of malnutrition Controls > 80% of 50th % wt for age,	ND	Malnutrition based on NCHS 50th centile wt for age as reference pt: wt ≥ 80% of 50th% = normal, Grade I < 80-70%, Grade II < 70-60%, Grade III < 60%	Prospective longitudinal Assessments at age 18, 24, 30, 36 m
Drewett, 2001 21174599	Country: Ethiopia Setting: Outpatient Gp1* Gp2† Ctrl Age‡ ND ND ND Wt§ ? 8.3(1.6) 8.9(1.0) 10.4(1.0) ? 8.5(1.1) 9.4(1.0) 10.6(1.1) Lngth§? 72.6 (5.0) 75.2 (4.4) 79.6 (3.2) ? 74.9 (2.5) 76.2 (3.6) 80.4 (3.9) Enrolled 27 70 100 Evaluated 27 70 100 % Male 33 70 55 Race: ND * Early growth faltering, † Late growth faltering, ‡ criteria < 16 d, § age 2 y, (SD), wt in kg, length in cm	Maternal educ* In-come† Health insur Gp1 37 37 ND Gp2 51 41 ND Ctrl 41 35 ND * % > 3 y, † % > 2 key possessions	All subjects: < 2 y on Nov 1, 1994, recorded initial (< 16 d) wt ≥ 2500 g, recorded 7th visit (alive at 1 yr) Gp1: wt < 3rd centile at visits 2 or 3(2 & 4 mo) Gp2: wt < 3rd centile at visits 6 or 7(10 & 12 mo), & not visits 2 or 3 Control: wt ≥ 3rd centile at visit 2, 3, 6, & 7	ND	Centiles based on NCHS	Ambidirectional longitudinal Assessment at age 2 y (22-24 m) See Comments section

Evidence table 8. Studies associating cognitive & neurological development with malnourished patients compared to well-nourished control subjects in developing countries

Part II

Author, Year	Development measures					Instrument	Associations found
Bartel, 1978, 1979 78180773 79162492	Psychomotor development					LOMDS	There were no significant difference (F=1.50) between the children with history of kwashiorkor, siblings, & yardmates on motor skills except for intergroup comparisons for 2 of 93 items tested of LOMDS. The groups did not differ significantly on grip strength (F=1.45) or finger tapping tests (F=1.43).
		Gp	Ctrl1	Ctrl2			
	Motor development	80.73	91.16	82.55			
	Grip strength*	14.80 (5.24)	16.59 (6.22)	15.15 (5.41)		Smedley hand dynamometer	
	Finger-tapping / fine motor speed*	34.47 (6.35)	37.25 (8.22)	35.21 (5.17)		Reitan Indiana & Halstead neuropsychological test batteries	
	Mean(SD), * Dominant hand scores						
Evans, 1980 81008912		Gp1	Ctrl1	Gp2	Ctrl2	New S. African Individual Intelligence scale Bender-Gestalt test/Koppitz scoring	6-7 years after early infant supplements, the Gp1 full scale intelligence score was significantly higher than Ctrl1 (older siblings), p < .05; or Gp2 (kwashiorkor), p < .01; or Ctrl2 (siblings of kwashiorkor), p < .05. There were higher trends for verbal & performance scores with Gp1 verbal score higher than Ctrl1, p < 05; and Gp 1 higher than Gp2, p < .05; or Ctrl2, p < .01. Bender-Gestalt test reported NS findings.
	Full scale	82.0 (13.0)	71.9 (12.5)	70.0 (13.5)	72.0 (14.6)		
	Verbal	81.3 (13.0)	70.6 (13.3)	74.3 (16.1)	75.0 (17.3)		
	Performance	86.3 (10.4)	80.5 (11.2)	71.3 (8.8)	74.4 (9.2)		
	mean(SD)						
Galler, 1983a, 1985b 83136873 85241833		Gp?	Ctrl?	Gp ?	Ctrl?	WISC	**1983 -** From ages 5-11, the index group scored significantly lower than the controls by sex, p < .05; the mean score for the index group was 12 points lower than the controls. There was no effect on Full IQ by sex, age, or SES. **1985 -** At ages 9-14The index group had statistically significant deficits in fine motor coordination of the dominant hand compared to controls (F = 2.85 , p < .05) with significant effect by age (F = 6.3, p < .001).
	Full scale IQ	91.3 (14.3)	100.1 (13.0)	90.5 (16.7)	107.7 (12.1)		
	Motor coordination deficiency –					Purdue pegboard tasks, Neuman-Keuls	
		8-10 yr	11-13 yr	14-15 yr			
	Dominant hand performance						
	Gp	11.24(2.22)	13.1(2.38)	12.81(2.07)			
	Ctrl	12.41(0.94)	13.53(1.72)	12.73(2.02)			
	Assembly tests						
	Gp	23.94(4.08)	29.40(4.51)	30.27(5.66)			
	Ctrl	23.00(4.21)	26.77(6.00)	29.81(7.21)			

Evidence table 8. Studies associating cognitive & neurological development with malnourished patients compared to well-nourished control subjects in developing countries

Part II

Author, Year	Development measures				Instrument	Associations found
		Gp1	Gp2	Ctrl		
Grantham-McGregor, 1987, 1978, 1980, 1982, 1983 87117313 79086701 81051042 82236679 83246270	DQ at D/C	86(12.7)	77(12.0)	98(14.8)	Griffith's Mental Development Scales for Babies and Young Children including subscales – hand & eye coord, hearing & speech, performance, practical reasoning, & locomotor	Development assessment taken at D/C, 6, 12, 18, 24 months, and annual thereafter showed consistently the nonintervention group (Gp2) was significantly behind the control group with intervention group (Gp1) scoring higher than the nonintervention group, but still behind the control group. At 6 months, the Gp1 was significantly behind the Gp2, ($F = 4.43$, $p < 0001$), but NS vs. Ctrl ($F = 1.85$). Gp2 was significantly behind the Ctrl ($F = 5.83$, $p < .0001$). PPVT at 36 months, showed effect by group, $p < .005$. At 60 months after D/C, (2 yr post intervention) both Gp1 & Gp2 were statistically behind the control group, $p < 0.01$. At 60 months, the results of Stanford-Binet Test showed that the "relative positions of groups maintained".
	DQ at 6 m	96(11.3)	82(12.1)	105(11.2)		
	DQ at 60 m	86.1(8.2)	78.1(9.7)	93.2(11.2)		
	PPVT at 36 m	26.9(10.6)	18.3(7.5)	26.2(12.2)	Peabody Picture Vocabulary Test	
	IQ at 60 m	71.5(8.7)	63.3(7.8)	75.2(10.5)	Stanford-Binet Test	
Agarwal, 1992 92372206		Gp1	Gp2	Ctrl	Binet Kulshrestha Intelligence Scale Developmental Quotient calculated for Binet Kulshrestha intelligence subsets Caldwell Inventory	At 36 month assessment, there were differences in scores between the normal, Grade I, and Grade II/III for cognitive ($F = 13.27$, $p < .001$) & language ($F = 9.308$, $p < .001$) development, motor coordination ($F = 10.52$, $p < .001$), concept formation ($F = 6.235$, $p < .01$), and reasoning ($F = 7.774$, $p < .001$). The mean scores decreased with increasing degrees of malnutrition. Home environment was most important variable in predicting IQ, accounting for 26.22% of total variance in IQ, $p < .001$
	Cognitive	91.9(8.6)	86.8(7.7)	95.5(7.9)		
	Motor coordination	1.13(.22)	0.97(.27)	1.16(.19)		
	Language	0.85(.14)	0.78(.11)	0.90(.14)		
	Concept formation	1.32(.43)	1.07(.54)	1.38(.37)		
	Reasoning	1.15(.79)	0.75(.79)	1.43(.89)		

Evidence table 8. Studies associating cognitive & neurological development with malnourished patients compared to well-nourished control subjects in developing countries

Part II

Author, Year	Development measures				Instrument	Associations found
		Gp1	Gp2	Ctrl		
Drewett, 2001 21174599	Psychomotor	6.6*(4.2)	8.5*(4.3)	10.2(3.7)	Bayley PDI & MDI – nonstandard scoring based on number of items passed	Group status was correlated to psychomotor development (F = 9.3, p < .001; Gp1&Gp2 vs. Ctrl, t = 3.8, p < .001; Gp1 vs .Gp2, t = 2.0, p < .05) with early growth faltering group scoring lower than the late growth faltering group who in turn scored lower than the controls. Similar pattern for mental development scores (Group effect, F = 12.7, p < .001; Gp1 vs. Gp2, t = 4.0, p < .01; Gp1 vs. Gp2, t = 3.0, p < .01). Child's wt at 2 years was related to both scores (PDI: r = .53, MDI: r = .49, p < .001), & maternal education related to mental development (MDI: t = 2.1, p < .05). No relationship between households with greater than 2 key possessions and psychomotor &mental scores. The difference in initial weights of the 3 groups were statistically significant (F = 21.4, p < .01).
	Mental	22.6(6.2)	26.6(6.1)	28.9(5.8)		
	Initial wt (g)	2819(323)	3141(351)	3368(430)		
	* Gp1 n= 25, Gp2 n=66					

Evidence table 8. Studies associating cognitive & neurological development with malnourished patients compared to well-nourished control subjects in developing countries

Part III

uthor, Year	Potential biases	Comments
Bartel, 1978, 1979 78180773 79162492	No data on difference of number of children between two reports	Single tester blinded to child's group assignment for Bartel 1978; partially funded by African Medical Research Council
Evans, 1980 81008912	1 child died in each of the controls, sex unkn	Gp1 received supplements until mean 28 months, one examiner blinded to subject's group status, testing 6-7 years after cessation of supplements; US government & South African Medical Research Council
Galler, 1983a, 1985b 83136873 85241833	Withdraws/non-participation – 4 refused consent, 7 LTF, 1 cerebral palsy; Severe PEM	Relevant WISC subtests utilized & some items altered for cultural setting; findings of dominant hand performance of fine motor skill tasks deficient in formerly malnourished children correlates or co-varies with IQ & other soft neurologic signs; private & hospital funded
Grantham-McGregor, 1987, 1978, 1980, 1982, 1983 87117313 79086701 81051042 82236679 83246270	Controls had better housing than other 2 groups in spite of attempts to match; 2 died & 1 WD from intervention group, 1 from nonintervention moved & 1 was adopted by middle-class family, 1 from control WD; 10 of 21 Gp1 had edema, 4 of 18 in Gp2, & none in the control group	Tester blinded to subjects' group, controls hospitalized mainly for gastroenteritis & respiratory infections; government & private funding
Agarwal, 1992 92372206	ND on 17 of 650 in cohort; 5.5% of population were normal for growth at 24 months corresponding to 5.9% for 1989-90.	Funded by Indian Council of Medical Research
Drewett, 2001 21174599	Initial weight a proxy for birth weight as most births at home; 27 of 40 early wt faltering group recruited & tested; significant higher proportion of males in Gp2 vs. Gp1, $\chi^2 = 5.56$, $p < .05$; 6 cases (Gp1-2 & Gp2-4) with lower limb disabilities could not participate in psychomotor test	Sample subset of Jimma Birth Cohort study; Gp2 & Controls selected at random from sampling frame; systematic method for selection of broad comparisons for Control group; testers blinded to child's status; Private & hospital funded

Evidence Table 9. Studies associating other correlates / outcomes with Failure to Thrive patients compared to healthy control subjects in developed countries

Part I

Author, Year, UI	Demographics	Maternal / household demographics	Inclusion criteria	Exclusion criteria	Definition of FTT	Study design
Pollitt, 1976 76109110	Country: US Setting: Outpatient FTT / Ctrl Mean age(SD)* Male 33(14) 34(13) Female 39(14) 39(15) Mean ht† Male 93(2) 101(1) Female 90(2) 102(3) Enrolled/Eval 19 19 % Male 47 47 Race: ND * months, † centimeters	FTT / Ctrl Maternal educ 11 (2) / 12 (1) Income Gross annual 6943 (3444) / 9541 (4768) Per capita 1557 (725) / 2648 (1517) Health Insur: ND	Outpatient clinic, 12-60 mo, ht & wt < 3%, bw = 2500 gm, GA = 36 wks, nl birth, nonorganic, singleton, maternal ht = 154.5 cm & English-speaking ability Controls matched for age (± 3 mo), sex, race, ht & wt = 25%	Birth complications, physical disability, genetic or organic retardation, brain damage, organic growth retardation	Boston Growth Standards – ht & wt = 3rd percentile	Prospective cross-sectional Weekly interviews for 7-11 sessions
Mitchell, 1980 80166667	Country: US Setting: Outpatient clinic FTT / Ctrl Age(y) 2-5 / 2-5 Wt/age ND / ND Ht/length ND / ND Enrolled : cohort of 312 Evaluated 30 / 282 % Male 36.7 / 51.8 % Black 70 / 70	Maternal educ: ND Income: ND Health insur: FTT-53% Medicaid Ctrl-49% Medicaid	See Definition of FTT Controls: wt = 80% of nl, matched for age, sex, mother's age / marital status & family problems	Organic cause of FTT, single anomalous low wt recorded, clinic registration by age 6 mo, < 3 visits	Wt for age < 80% of nl up to age 24 mo	Ambidirectional longitudinal 1 fwup at age 3 – 6 y

Evidence Table 9. Studies associating other correlates / outcomes with Failure to Thrive patients compared to healthy control subjects in developed countries

Part I

Author, Year, UI	Demographics	Maternal / household demographics	Inclusion criteria	Exclusion criteria	Definition of FTT	Study design
Hack, 1982 82227864	Country: US Setting-Recruitment: Hospital Follow-up: hospital/clinic Gp1* Gp2† Mean age‡ 32(2.8) 29(1.9) Wt/age(g) 1141(285) 1197(206) Length(cm) 37.9(3.8) 38(2.7) Enrolled|| ND ND Evaluated 38 154 % Male 47 47 % Black 52 63 * SGA, † AGA, ‡ wks gestation, || n = 204	Gp1 Gp2 Maternal educ <HS 12 32 Income* 28 99 Health Insur ND ND * Hollingshead Social Class 4 & 5	VLBW, < 1500g, divided into two groups: SGA < 2 SD or AGA	ND	Wt < 2 SD below mean for age @ term and/or @ 8 mo of age	Prospective longitudinal Assessments at age 40 wk & 8 mo
Haynes, 1984 84233543	Country: US Setting: In & Out-patient Age: ND Wt/age: ND Ht/length: ND FTT1* FTT2† Ctrl Enrolled/Eval 25 25 25 % Race Sp-Am? 44 44 44 Sp-Am? 40 52 52 White? 36 44 36 White? 36 24 28 Black? 20 12 20 Black? 24 24 20 % Male: ND * std care & lay health visitor intervention, † std care only	Maternal educ Income* Gp1 10 379(0-750) Gp2 11 372(0-950) Ctrl 10 362(0-1100) Health insur: ND * @ mo	Consecutive admissions for NOFTT Controls - thriving non-hospitalized patients matched for age, sex, birth wt, & mother's age, ethnicity, number of living children	ND	< 5 percentile or significant decline from birth wt percentiles	Prospective longitudinal 1 assessment 6 mo after intake

Evidence Table 9. Studies associating other correlates / outcomes with Failure to Thrive patients compared to healthy control subjects in developed countries

Part I

Author, Year, UI	Demographics	Maternal / household demographics	Inclusion criteria	Exclusion criteria	Definition of FTT	Study design
Sherrod, 1984 85026403	Country: US Setting-Recruitment: Prenatal clinic Follow-up: Pediatric clinic NOFTT / Ctrl Birthwt(g) 3031 / 3054 Enrolled/ Eval* 31 / 24 Race-White 10 / ND Black 21 / ND % Male: ND * 4 arm study – Data for FTT & Ctrl only; abused or neglected cases excluded	NOFTT / Ctrl Maternal educ 10.3 / 11.2 Income* 13 / 13 Health Insur† ND / ND * # employed, † p < .05, ‡ p < .01	NOFTT, abused, or neglected Controls – no hx of abuse, FTT, or neglect	ND	Wt gain fallen below 2/3 of Harvard 50th percentile on growth curve	Retrospective longitudinal 3 annual assessments
Casey, 1985 84206364	Country: US Setting: Outpatient clinic or home FTT / Ctrl Age(mo)* 16.4 / 16.9 Wt/age* 72.5% / 94.5% Ht/length* 93.9% / 98.5% Enrolled/Eval 23 / 23 % Male 57 / 57 Race: % White 26 / 26 * At diagnosis	FTT / Ctrl Maternal educ 11.3 / 10.9 Income 5,451 / 6,188 Health insur: ND	All pts referred for FTT evaluation, > 12 wks age, FTT as defined or wt % decreased > 2 SD over time, residence ≤ 30 miles of clinic Control with normal growth, matched for age, race, sex, maternal education, household income, marital status, & crowdedness	Organic illness	Weight < 3rd percentile for corrected age	Prospective cross-sectional 3 wk assessment from time of diagnosis

Evidence Table 9. Studies associating other correlates / outcomes with Failure to Thrive patients compared to healthy control subjects in developed countries

Part I

Author, Year, UI	Demographics	Maternal / household demographics	Inclusion criteria	Exclusion criteria	Definition of FTT	Study design
Hutcheson, 1993 94015754	Country: US Setting: Primary care clinic FTT / Ctrl Age(mo) 15.1(5.2) / 14.9(5.1) Wt/age 2.83 / 63.17 Ht/age 23 / 63 Enrolled/Eval 34 / 34 % Male 62 / 62 Race: Black 32 / 32	FTT / Ctrl Maternal educ* 38 / 70 Income† 64 / 70 Health insur ND / ND * % HS graduate † % receiving AFDC	Age 8 – 24 mo, NOFTT Controls matched for age, sex, race	Congenital disorder, chronic disease, < 37 wk gestation, SGA	Wt for age ≤ 5th percentile, or wt for ht ≤ 10th percentile, based on NCHS	Prospective cross-sectional
Kelleher, 1993 93234174	Country: US Setting: Primary care clinic FTT / Ctrl GA(wk)* 33.0 / 33.1 Wt(g)* 1679 / 1845 Enrolled: 842* Evaluated 180 / 591 % Male 52.2 / 47.9 Race: % Black 50 / 53.8 * At birth	FTT / Ctrl Maternal educ* <HS 40.6 / 38.1 HS 30.0 / 29.3 Some col 14.4 / 20.8 ≥col grad 15.0 / 11.8 Income <10K 38.6 / 34.5 10-20K 19.9 / 23.9 >20K 38.1 / 37.4 Health insur ND / ND * % HS graduate	Gestation age ≤ 37 wks, birth wt ≤ 2500 g, FTT Controls matched for – birth wt +/- 250 g, maternal education, maternal race, & infant sex	Live outside catchment area, D/C outside recruitment period, D/C or died within 48 hr, hospitalized > 60 d, oxygen support > 90 d, twin, triplet or quadruplet of ineligible child, maternal drug/ alcohol abuse, insufficient Eng skills, psychiatric hosp	< 5th percentile for gestation corrected age based on NCHS, growth status on "wt curve below that recorded at last regular assessment visit."	Prospective longitudinal Fwup at ages 12, 24, 36 mo

Evidence Table 9. Studies associating other correlates / outcomes with Failure to Thrive patients compared to healthy control subjects in developed countries

Part I

Author, Year, UI	Demographics	Maternal / household demographics	Inclusion criteria	Exclusion criteria	Definition of FTT	Study design
Drotar, 1994 94308313	Country: US Setting: Inpatient with outpatient follow-up FTT / Ctrl Age(mo)* 4.7(2.8) / 5.0(2.7) Wt/age: ND / ND Ht/length: ND / ND Enrolled 48 / 52 Evaluated 31 / 39 Male 23(74%) / 25(64%) Race: Black 17(55%) / 28(72%) White 14(45%) / 11(28%) *Mean (SD), at enrollment	FTT / Ctrl Maternal educ 10.9 (2.0) / 11.3 (1.4) Income 6414 (6669) / 7495 (10721) Health insur: ND Mean (SD)	Hospitalized for NOFTT, ages 1-9 m Controls matched for age at intake, sex, race, birth order, gestational age, maternal educ & age, family income & size	Physical abuse, residence > 1 hr from hospital, bw < 1500 gm	Wt = 5th percentile based on NCHS, absence of disease, wt gain with inpatient tx, poor wt velocity	Prospective longitudinal 1 follow-up at 3 yrs
Skuse, 1994, 1995 94253258 96091265	Country: UK Setting: Outpatient FTT / Ctrl Mean age(SD)* 14.6(1.4) / 14.2(1.4) Wt/age† -2.07(.44) / .10(.96) Ht/length† -1.27(.94) / .18(.73) Enrolled 49 / 50 Evaluated 47 / 47 % Male 49 / 49 % Non-white 43 / 34 * Age in months † z score, p < .001	Maternal education: ND Income: income/welfare support FTT-16, Ctrl-11 Health insur: National healthcare	District-centered until 12 mo of age, singleton deliveries of 38-41 wks gestation Control matched for sex, age, ethnic origin, bw within 300 g, ordinal position, SES	≤ 3rd centile, no wt data	Wt for age ≥ -1.88 by 12 mo of age & sustained 3 mo (based on NCHS)	Prospective longitudinal Assessments at age 15 mo & 4y

Evidence Table 9. Studies associating other correlates / outcomes with Failure to Thrive patients compared to healthy control subjects in developed countries

Part I

Author, Year, UI	Demographics	Maternal / household demographics	Inclusion criteria	Exclusion criteria	Definition of FTT	Study design
Puckering, 1995 95378341	Country: UK Setting: Outpatient FTT / Ctrl Age(mo) 48.9(1.8) / 48.2(0.8) Wt/age* -2.01(0.6) / -0.32(1.1) Ht/length* -2.24(0.5) / -0.6(0.9) Enrolled/Eval 23 / 23 % Male 48 / 48 Race: 100% White * SDS, based on NCHS, p < .001	FTT / Ctrl Maternal educ* 15.6 (1.4) / 15.6 (1.4) Income† 11 / 7 48% / 30% Health insur: Socialized medicine * Age leaving full-time education † Income support/welfare	From inner city population sample - Caucasian born in 1980 with longitudinal growth data from birth to 4 years Controls matched for sex, gestational age ≥ 38 wks, & ethnic origin	Prematurity, congenital defects/ diseases affecting growth, no perinatal insults	Ht & wt < 10% based on Tanner & Whitehouse growth charts	Ambidirectional cross-sectional
Wilensky, 1996 97022837	Country: Israel Setting: Community pediatric clinic FTT / Ctrl Mean age(mo)* 15/20 / 15/20 Wt/age ND / ND Ht/length ND / ND Enrolled† 55 / 1352 Evaluated 50 / 50 % Male ND / ND Race: ND; Maternal country of birth – 68% Israel, 25% Europe/America, 5% N Africa, 2% Asia * At entry / assessment	FTT / Ctrl Maternal educ* 13.8 (1.62) / 13.4 (1.44) Income: AFDC 76% Health insur: ND * Mean (SD), based on record review of potential subjects	FTT infants by review of records who have reached 15 months born in 1991 Controls from same maternal & child health clinic matched for birth month, maternal educ, maternal age, parity, and infants' birth wt	Birth wt < 2500 gm, < 37 weeks, wt/ht ratio > 10 %, organic cause of FTT	Wt < 3% by NCHS for = 3 months prior to age 15 months	Ambidirectional cross-sectional

Evidence Table 9. Studies associating other correlates / outcomes with Failure to Thrive patients compared to healthy control subjects in developed countries

Part I

Author, Year, UI	Demographics	Maternal / household demographics	Inclusion criteria	Exclusion criteria	Definition of FTT	Study design
Drewett, 1999 99284054	Country: UK Setting: Clinic / home visits FTT / Ctrl Age(y) 8.12(0.62) / 8.10(0.57) Wt(kg)* 23.8 / 27.9 BMI* 14.9 / 16.3 Enrolled 136 / 136 Evaluated† 107/111 / 117/122 % Male‡ 40 / 38 %White‡ 91 / 91 * Median, † Psychological / anthropometric evaluation, ‡ FTT = 107, Ctrl = 117	FTT / Ctrl Maternal educ* 72 / 66 Income: NA Health insur: National healthcare * % left school at 16 y	At least 1 wt at age 0-2 mo & 2 subsequent wts, thrive index < 5th centile = 2 occasions between 3-18 mo Controls - at least 1 wt at age 0–2 mo & 2 subsequent wts, no thrive index < 10th centile, age ± 1 mo, similar/same residential area or GP practice	ND	Lowest 5% for change of SD score; avg taken of SD scores for all wt bet 0-2 mo, expected wt from 3-18 mo calculated for "thrive index"	Ambidirectional longitudinal Five years from enrollment of 1 y old cases
Wright, 2000 20161504	Country: UK Setting: Outpatient FTT / Ctrl Median age* 15.1 / ND range (7-28 m) / (16-18 m) Wt/age -2.00(.93) / ND Ht/length -1.06(.96) / ND Enrolled 120 / 40 Evaluated 97 / 28 % Male 54 / 61 % Nonwhite 9 / 0	Maternal educ: ND Income: ND FTT* / Ctrl* Unemployed parent 39 / 13 Nonhome-owner 54.7 / 53.6 No car 48.3 / 50 Health insur: National healthcare * Percent	Baseline wt at 6-8 wk & 2nd wt at 9-18 mo Controls from 3 "generally representative" of Newcastle	2nd twin sibling	Weight decline of 1.26 SD from age 6-8 wks to 2nd weighing at 9-18 months	Prospective cross-sectional

Evidence Table 9. Studies associating other correlates / outcomes with Failure to Thrive patients compared to healthy control subjects in developed countries

Part II

Author, Year	Correlates / outcomes & measures			Associations found	Potential biases	Comments
Pollitt, 1976 76109110		FTT*	Ctrl *	The FTT mothers had less education (t = 1.88, p = 0.05) and the FTT household per capita income levels were also lower than the controls' (t = 2.77, p = .01).	4 cases with FTT hx within ht 3rd & 10th percentiles included in study	Government & privately funded
	Maternal educ	11(2) y	12(1) y			
	Income					
	Gross annual	6943(3444)	9541(4768)			
	Per capita	1557(725)	2648(1517)			
	* Mean (SD)					
Mitchell, 1980 80166667		FTT(%)	Ctrl(%)	The FTT had significantly more neonatal problems (p < .05) such as jaundice, poor suckling, & possible sepsis, and family problems (p < .01) compared to controls. NS but FTT group had higher incidence of prematurity and physical abuse. There were no differences in occurrences of illness, or "problems noted on physical examination".	Physical exams & growth status by PI not blinded; significantly fewer cases had completed immunizations, p < .01	Government & privately funded
	Neonatal abnormalities	30	15			
	Prematurity (<37 wk)	16.7	9.2			
	Family problems	36.7	11			
	Physical abuse	3.3	2.1			
	Acute or chronic illness	ND	ND			
Hack, 1982 82227864	Neonatal risk score Extended hospital stay Chronic disease			Subnormal wts at 8 months experienced by subset of both groups is associated with lower neonatal period (r = 0.28, p < .001), extended hospital stay (r = 0.30, p < .001) and increased illness severity (r = 0.32, p < .005).	8 LTF, 4 incomplete data	SGA mothers incr % pregnancy HTN (p < .05) & multiple births (p < .05) than AGA, also incr antepartum risk score (p < .005) & greater gestational age (p < .005); privately funded

Evidence Table 9. Studies associating other correlates / outcomes with Failure to Thrive patients compared to healthy control subjects in developed countries

Part II

Author, Year	Correlates / outcomes & measures	Associations found	Potential biases	Comments
Haynes, 1984 84233543	Catch-up growth ADL FTT(%)* Ctrl(%) Prematurity 13(26) 5(20) LBW 11(22) 5(20) Re-hospitalization 13(26) 0 * intervention & non-intervention combined	All FTT had some wt gain during hospitalization, at reeval-some minor wt gain, 8 FTT gain > 20 percentile pts or within 5 percentile of birth wt percentile At reeval, only minor improvement in mother's response to child's needs, majority of mothers hostile or incoordination Though NS as a risk factor, FTT had higher trend for prematurity and LBW 26% of FTT were re-hospitalized, 0% for Ctrl	"…because of scheduling, few admissions were not evaluated", 2 refused participation; 10 Gp1 & 3 Gp2 premature – overall similar from FTT vs. Ctrl; at 6 mo fwup: for FTT1 & FTT2 each-3 cases refused reevaluation & from1 dissolution of pair, 1Gp1 died SIDS, 1 Gp2 mother gave up child	Block assignment to Gp1 & Gp2 for hospital convenience & case load requirements; government funded
Sherrod, 1985 85026403	Anatomical defects – FTT Ctrl 1y .13 .08 2y .06 .04 3y .13 .00 Family dysfunction (ND due to low frequencies)	Compared to controls, NOFTT group revealed more anatomical abnormalities such as hernias and heart disease during the 1st year ($\chi^2 = 4.23$, $p < .05$) and during all 3 years ($\chi^2 = 5.44$, $p < .025$); and more family dysfunction during the 1st year or during all 3 years ($\chi^2 = 9.29$, $p < .01$; $\chi^2 = 5.32$, $p < .025$) accounting for clinic visits or identified at clinic visits.	Attending physicians alerted to give special treatment to children suffering from maltreatment, analysis showed no increase in outcome variability; study design to identify relationship of illness to abuse, not NOFTT to illness	Data collectors blind to child group assignment; government & privately funded

Evidence Table 9. Studies associating other correlates / outcomes with Failure to Thrive patients compared to healthy control subjects in developed countries

Part II

Author, Year	Correlates / outcomes & measures	Associations found	Potential biases	Comments
Casey, 1985 84206364	HOME environment FTT / Ctrl Total score 29.2(7.7) / 33.0(6.1) Maternal responsivity 7.7(2.3) / 8.9(1.9) Maternal acceptance 5.1(1.6) / 6.2(1.1) Organization of environment 4.7(1.2) / 5.3(0.7)	There is an association between the lower HOME total ($p < .04$)& subset scores in maternal responsiveness ($p < .03$), maternal acceptance ($p < .01$), home organization $p < .02$), and FTT group. Coddington Life Events showed no difference between groups.	---	All FTT pts referred to Growth & Development Clinic at hospital, all SES represented-majority low SES, assessor blinded to subject's group; government & privately funded
Hutcheson, 1993 94015754	FTT1* / FTT2† / Ctrl1* / Ctrl2† Maternal psychological functioning - Negativity affectivity 0.38 / 0.20 / 0.28 / -0.11 Family stress/support - • Parenting stress 0.53 / 0.57 / 0.70 / 0.67 • Informal support 1.12 / 1.19 / 1.26 / 1.46 • Life events 11.29 / 7.32 / 9.31 / 10.13 Mother-child interaction – Maternal affective tone 4.26 / 3.51 / 3.96 / 4.05 Z scores given * Infants: 8 – 13.4 m † Toddlers: 13.5 – 24 m	Though there were no age or group differences found on perceived life stresses, parenting stresses, informal support, and negative affectivity, the FTT infants had fewer life events than FTT toddlers, whereas the reverse was true for the comparison group. Controlling for maternal education, wt for age, & ht for age - significant group by age interaction for maternal factors ($F=4.98$, $p = 0.02$) due to maternal affective tone ($F=9.33$, $p = 0.005$). The maternal affect was less positive toward FTT toddlers than FTT infants.	76% of index group met both criteria for NOFTT (wt for age, & ht for age), 24% met one criterion; unknown n for age by group comparisons	Government & privately funded

Evidence Table 9. Studies associating other correlates / outcomes with Failure to Thrive patients compared to healthy control subjects in developed countries

Part II

Author, Year	Correlates / outcomes & measures			Associations found	Potential biases	Comments
Kelleher, 1993 93234174		FTT(%)	Ctrl(%)	Sample of LBW or premature infants were followed. Infants who developed FTT were more likely to have congenital heart disease, bronchopulmonary dysplasia, and cerebral palsy. General health status was lower for FTT as measured by Stein Total health Score (p < .003) and by the Rand General Health Ratings (p < .0001). For GI disorders, NS for vomiting & diarrhea. There were significant differences in environmental variables between the two gps (p < 0.03).	Of 985 enrolled, 71 LTF, 12%(20) OFTT, 16%(28) were both OFTT & NOFTT	21% of babies develop FTT by 36 wks; ND on funding source
	Prematurity	100	100			
	LBW	100	100			
	Bronchopulmonary dysplasia	13.9	9.6			
	Congenital heart disease	7.2	.3			
	Neurological – cerebral palsy	8.9	4.6			
	Environmental variables*	32.6	33.9			
	General health ratings	ND	ND			
	Gastrointestinal disorders	ND	ND			
	* HOME Inventory - total score					
Drotar, 1994 94308313	Family Relationship Index			Patients with NOFTT had poor family relationships at time of diagnosis which persisted for 3.6 years despite various interventions compared to the control group (F = 8.11, p < .01). There was an effect of time in the scores for both groups (F = 5.13, p < .05).	---	Government & privately funded
		FTT	Ctrl			
	Intake	47.9 (0.8)	53.7 (5.6)			
	Follow-up	51.2 (8.2)	56.0 (9.4)			
Skuse, 1994, 1995 94253258 96091265	15 month assessment –			At 15 month assessment, NS but the cases had a trend for anemia & lower maternal IQ. At 4 year fwup, FTT at high risk for child abuse or neglect (RR = 4.43).	1994: 2 cases & 3 controls didn't complete assessments & were excluded from analyses, 1 case had microcephaly, hypotonia, & an action tremor or ataxia of unknown origin	Researchers blinded to patient's status in measures except anthropometry, 1994 noted 1554 potential subjects in population sample vs. 2609 in 1995; privately funded
		FTT	Ctrl			
	Mother's IQ	83.4(17.1)	86.4(16.2)			
	Maternal/child interaction	ND	ND			
	Oral-motor function	ND	ND			
	Anemia	25.5%	23.9%			
	Abuse/neglect - 6 FTT & 90 nonFTT from sampling frame 2609					

Evidence Table 9. Studies associating other correlates / outcomes with Failure to Thrive patients compared to healthy control subjects in developed countries

Part II

Author, Year	Correlates / outcomes & measures			Associations found	Potential biases	Comments
Puckering, 1995 95378341	Maternal interactions	FTT	Ctrl	FTT signf less positive mother-child interactions compared to Ctrls dyads (combined unconditional measures, t = -2.69, p = .01); FTT signf less positive interactions (combined conditional measures), t = -0.88, p = 0.4 NS but trend for more negative mother-child interactions (combined unconditional measures, t = 1.22, p = 0.2) NS (combined conditional measures), t = 0.12, p = 0.8	---	Other than clinic anthropometric measures, home visits by assessors blinded to child's group status; The FTT children were significantly smaller than the controls; government funded
	Positive –					
	Unconditional	-1.37	1.37			
	Conditional	-0.16	0.16			
	Negative –					
	Unconditional	1.16	-1.16			
	Conditional	0.04	-0.12			
Wilensky, 1996 97022837		FTT	Ctrl	The FTT group was found to have lower birth weight ($p < .05$), and were more likely to be hypotonic than the control population ($p < .05$). They were twice as likely to be admitted in the hospital during their first year ($\chi^2 = 5.10$, $p < .05$). In addition, an assessment showed the home environment to be less stimulating ($p < .05$).	Feeding behaviors and HOME environment are causal factors given time dissociation as FTT was established at 15 months, where as, maternal interview/home assessment at 25 months.	2/5th of infants diagnosed as FTT no longer fit the criteria at 20-month follow-up, yet had positive association on Bayley MDI. Reported associations for FTT without specific data: paternal age (p<.01), maternal education, & behavioral observations of lower sociability (p<.05) & fear of examiner (p<.05); ND on funding source
	Birthweight*	3074	3230			
	Hypotonia*	7.27%	2.27%			
	Hospitalization	33.9%	16.9%			
	HOME environment					
	• Active stimulation	.84 (.17)	.92 (.11)			
	• Family encouraging development	.55 (.31)	.71 (.24)			
	• Verbal & emotional reactivity	.85 (.20)	.93 (.14)			
	* Record review of 55 FTT & 1352 Ctrl					

Evidence Table 9. Studies associating other correlates / outcomes with Failure to Thrive patients compared to healthy control subjects in developed countries

Part II

Author, Year	Correlates / outcomes & measures			Associations found	Potential biases	Comments
Drewett, 1999 99284054		FTT	Ctrl	FTT children were significantly more likely to visit the hospital or outpatient clinic than the controls ($\chi^2 = 4.54$, $p = .033$). Paternal ht of FTT were significantly shorter than controls ($t = 2.69$, $p < .01$). 9% of cases vs. 3% of controls had relevant medical conditions that may have affected growth. FTT children had significantly more feeding problems than the controls ($\chi^2 = 12.1$, $p < .01$)	Of 136 cases, 1 died, 9 LTF, 15 declined psychological testing, 4 moved; of 136 controls, 2 were preterm, 5 LTF, 12 declined psychological testing, 14 moved & were replaced. 2 FTT cases & 1 control with medical condition affecting growth, & 9 FTT cases & 2 controls with possible medical conditions	Testers blinded to child's status; privately funded
	Hx hospital admission / hospital outpatient clinic	66(62%)	56(48%)			
	Father's height	174.2(7.8)	177.0(7.2)			
	Medical condition affecting growth – "definitely" / "possibly"	2/9	½			
	Feeding problems	49(46%)	28(24%)			
Wright, 2000 20161504		FTT	Ctrl	22% of cases received social work input of which 4% were registered as at risk for abuse or neglect vs. none for the controls. 3 or 4 FTT registered placed in foster care. FTT significantly later start in eating solids ($p = .003$) & finger foods ($p = .005$) compared to control group.	Of 120 cases, 23 recovered above screening threshold & had no subsequent data, 21 families received social work input of which, 4 cases registered at risk of abuse or neglect, 17 cases had "relevant organic conditions"…but only 4 said to be main explanation for their FTT", age difference between groups	Government & privately funded
	Social work input	21/97	0/28			
	Abuse/neglect risk	4/97	0/28			
	Started solids*	3.89	3.04			
	Started finger foods*	7.15	6.14			
	* age (mo)					
	(Belongs in Developmental table)					

Evidence Table 10. Studies associating other correlates / outcomes with malnourished patients compared to well-nourished control subjects in developing countries

Part I

Author, Year	Demographics	Maternal / household demographics	Inclusion criteria	Exclusion criteria	Definition of malnutrition	Study design
Ghosh, 1979 80028795	Country: India Setting: Inpatient Gp1* / Gp2† / Ctrl Age(mo): 6-36 / 6-48 / 6-48 Wt/age: ND / ND / ND Ht/age: ND / ND / ND Enrolled/Eval: 28 / 39 / 60 % Male: 64 / 54 / 67 Race: ND (assumed Indians) * Mild-moderately malnourished, † Severe malnutrition	ND	6 – 48 months, children with PEM, see Definition of FTT Control matched for age, > 80% of 50% weight for age	ND	Based on 50th percentile by Harvard scale: Grade 1-mild 71-80%, Grade 2-malnutrition 61-70%, Grades 3 & 4 severe ≤ 60%	Prospective cross-sectional
Bartel, 1978, 1979 78180773 79162492	Country: South Africa Setting: Outpatient Age: ND Wt/age: ND Ht/length: ND Enrolled* / Eval* / Race Gp: 31/30 / 31/30 / Black Ctrll1: 31/30 / 31/30 / Black Ctrll2: 31/30 / 31/30 / Black Ctrll3†: 90 / 90 / White % Male: ND * Bartel 1978 / Bartel 1979, † reported in Bartel 1979	ND	Bk 6 – 12 yr olds hospitalized during first 27 months of life for kwashiorkor, 5 – 10 yrs prior to commencement of study Controls close in age, no hx of PCM: Ctrl1-Siblings close in age Ctrl2-Yardmates of FTT Ctrl3-High SES Whites	Neurological involvement, brain damage, fits, birth trauma, hospital coma, hypoglycemia	Wellcome criteria for kwashiorkor: <3rd percentile, edematous, and dermatitis and/or nutritional hair changes	Ambidirectional longitudinal Assessment at 4 – 12 y after hospitalization

Evidence Table 10. Studies associating other correlates / outcomes with malnourished patients compared to well-nourished control subjects in developing countries

Part I

Author, Year	Demographics	Maternal / household demographics	Inclusion criteria	Exclusion criteria	Definition of malnutrition	Study design
Kothari, 1992 92225733	Country: India (Developing) Setting: Inpatient FTT / Ctrl Mean age(y) 2.65±0.88 / ND Enrolled 25 / 26 Evaluated 25* / 26 % Male 52 / 50 Race: ND (assumed Indians) * Marasmus – 15, marasmic kwashiorkor - 10	ND	Ages 1-5 yr with severe PEM Controls matched for age & sex with normal nutritional status	Controls without anemia, infection, or cardiac disease	Grade IV malnutrition < 50th percent of body wt based on 50th percentile by Harvard scale	Prospective cross-sectional
Bénéfice, 1992 92296639	Country: Senegal Setting: Outpatient Age: ND Enrolled: 100 Evaluated: FTT 64, Control 34 % Male: 46 Race: ND	ND	Age 9 – 14 y from 2 villages with per capita caloric intake of 2200 & 2400	Recent serious illness, clinical signs of malnutrition or anemia	Wt/age < -1 SD median WHO/NCHS	Prospective cross-sectional

Evidence Table 10. Studies associating other correlates / outcomes with malnourished patients compared to well-nourished control subjects in developing countries

Part II

Author, Year	Correlates / outcome & measures	Associations found	Potential biases	Comments
Ghosh, 1979 80028795	Nerve conduction – ulnar, median, peroneal nerves	Highly significant results with lower nerve conduction velocities in all age groups in the severe malnutrition group compared to controls ($p < .001$). No difference between mild/moderate group and controls. Specific n not given, however significant delay in nerve conduction in each nerve in infants with onset PEM < 12 mo vs. cases onset > 12 mo, $p < .001$	---	ND on funding source
Bartel, 1978, 1979 78180773 79162492	Cardiovascular – Avg EEG freq • freq-R 8.17 8.63 8.44 8.70 • freq-L 8.19 8.67 8.54 8.75 Incidence of EEG activity of specified freq bands • theta-R 15.59 9.49 11.76 9.12 • alpha-R 43.96 55.54 51.78 56.41 Mean(SD), * Dominant hand scores	EEG frequency results were significant for group effect for both hemisphere ($p < 0.01$). Also there was group effect for the incidence of a & d bands in the right & a, d, & ? in the left hemisphere ($p < 0.01$). The kwashiorkor consistently scored higher in the d and lower in the a bands vs. the other groups ($p < 0.05$).	No data on difference of number of children between two reports	Single tester blinded to child's group assignment for Bartel 1978; partially funded by African Medical Research Council
Kothari, 1992 92225733	Cases / Ctrl Left ventricular mass 25.75(8.09) 32.44(11.64) Left ventricular mass / body wt 4.44(1.45) 2.42(0.87) Cardiac index* 5.95(1.95) 4.97(1.41) Ejection fraction 62.4(10.7) 67.0(7.8) Anemia – Mean hemoglobin – 7.16±1.78 g/dl * $l/min/m^2$	Left ventricular mass was less in the cases vs controls ($p < 0.05$, CI 2.08-11.30), but left ventricular mass/body wt was higher in the cases ($p < 0.001$, CI 1.28-2.76) which is associated with poorer prognosis. Cardiac index increased in the cases vs. controls ($p < 0.05$, 0.04-1.92) Relative cardiac sparing in most cases, although there was atrophy. No difference between groups in EJ, but there were EF < 50% in 5 cases, 2 of 5 died within 3 wks.	---	ND on funding source

Evidence Table 10. Studies associating other correlates / outcomes with malnourished patients compared to well-nourished control subjects in developing countries

Part II

Author, Year	Correlates / outcome & measures			Associations found	Potential biases	Comments
Bénéfice, 1992 92296639		FTT	Ctrl	Children with malnutrition scored lower in areas of physical activity (p < .05), had less work capacity (t = 3.2, p < .001), had lower pulmonary function (p < .001), arm muscle compared to nourished controls. There was no difference in HR (t =0.37) or level of physical activity.	Child's age determined by recall, no records available; no explanation on missing case from each group not in analyses	ND on funding source
	Power work capacity	60.9(2.8)	75.1(4.4)			
	FVC, < 132 months	1.33(0.04)	1.61(0.04)			
	FVC, > 132 months	1.73(0.03)	2.23(0.09)			
	33 m dash (sec)	7.22(0.10)	6.60(0.15)			
	Jumping (m)	1.34(0.02)	1.43(0.03)			
	Throwing (m)	13.4(0.4)	15.7(0.6)			
	Hand grip (kPa)	47.5(2.0)	54.6(2.9)			
	HR (%) > 125	8.85(1.45)	7.85(2.06)			
	Adjusted mean (SD)					