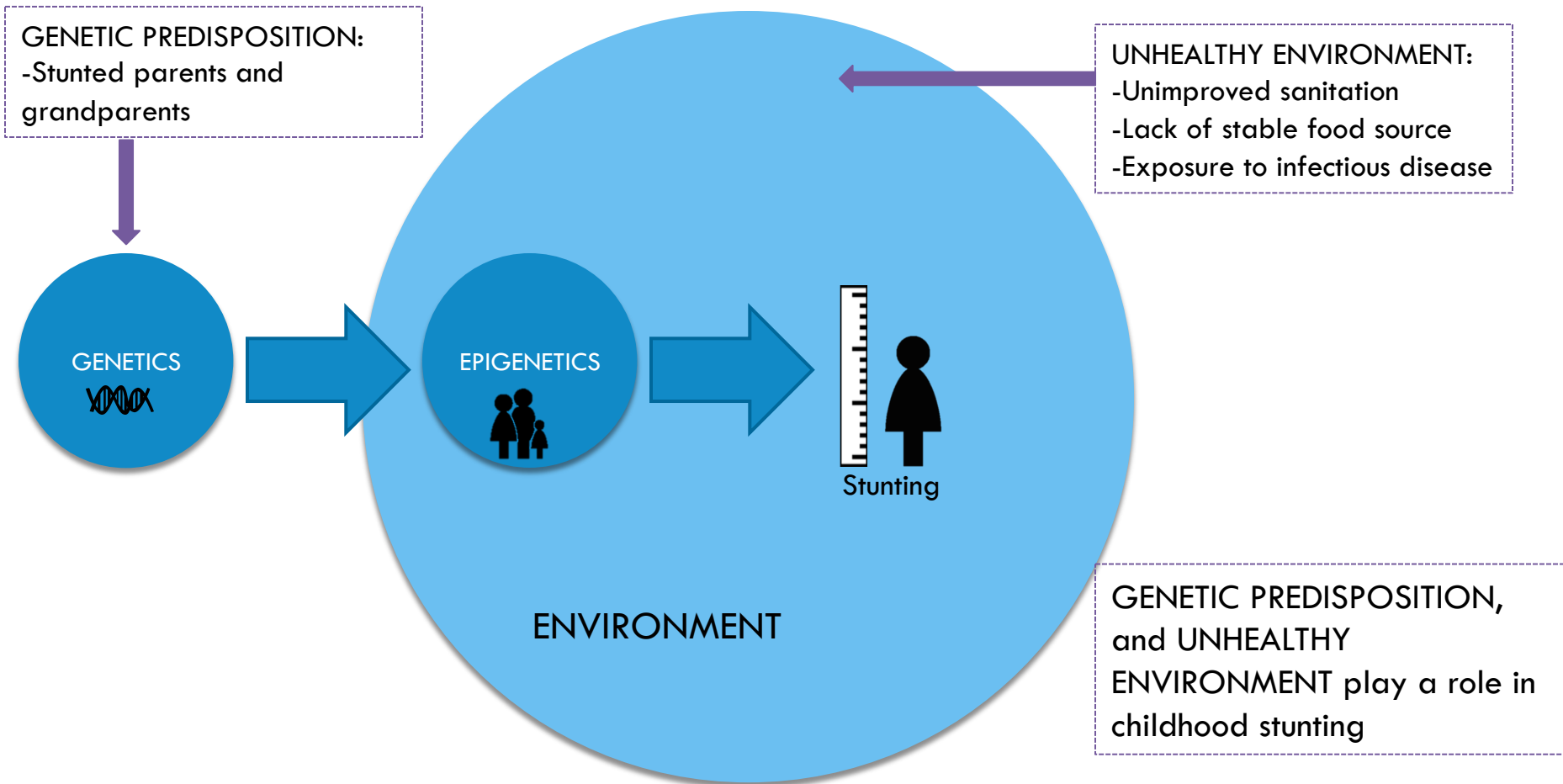


NATURE VS NURTURE IN HEALTHY BIRTH, GROWTH, AND DEVELOPMENT

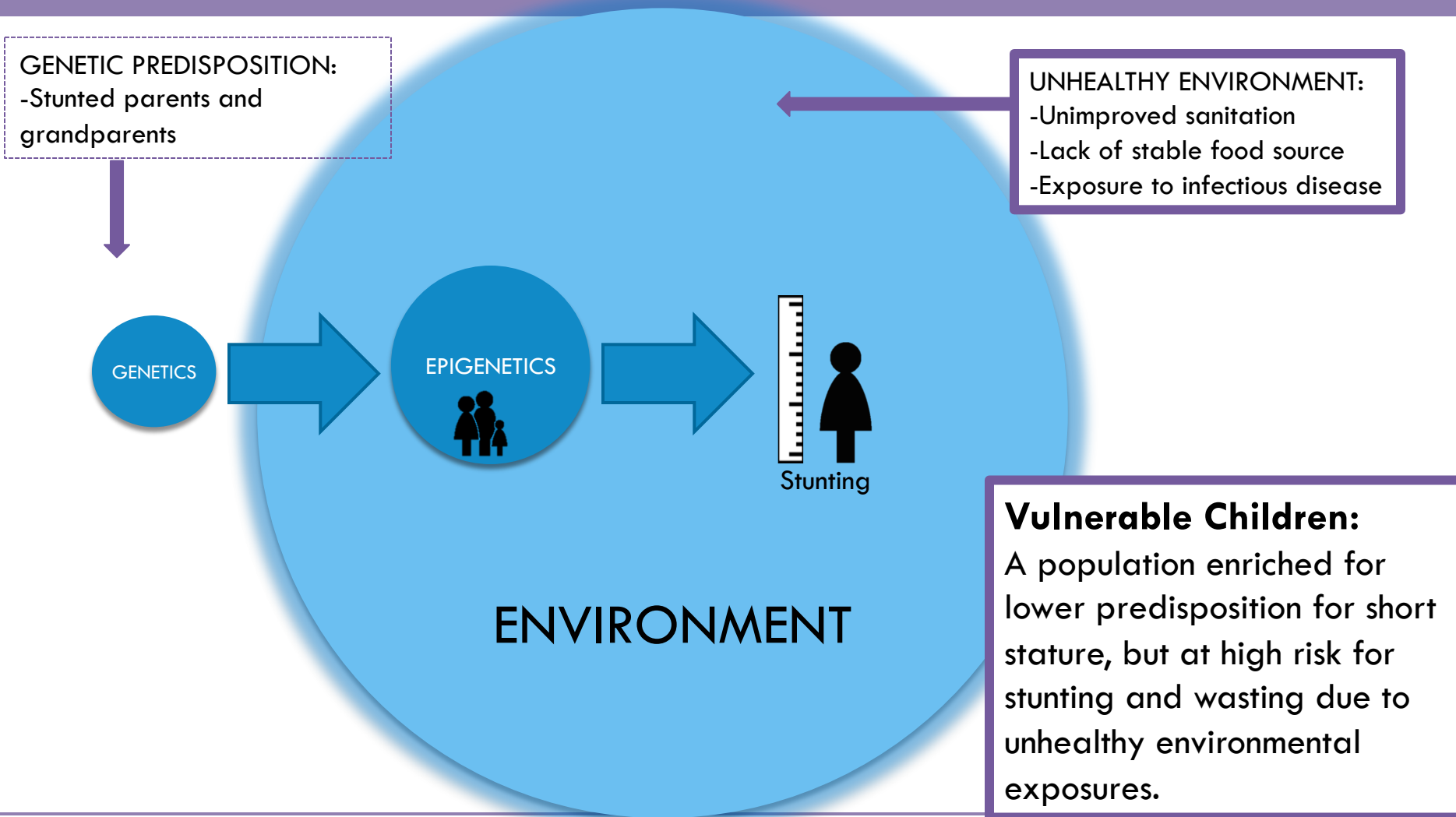
Produced by: Deichsel E, Long J, Kwan-Gett T, Walson J



Purpose



Purpose



Purpose

Project Aim

- Understand a counterfactual view of how the environment influences growth when minimizing the role of genetic risk.
- Gain insight into what role environment plays in growth patterns.



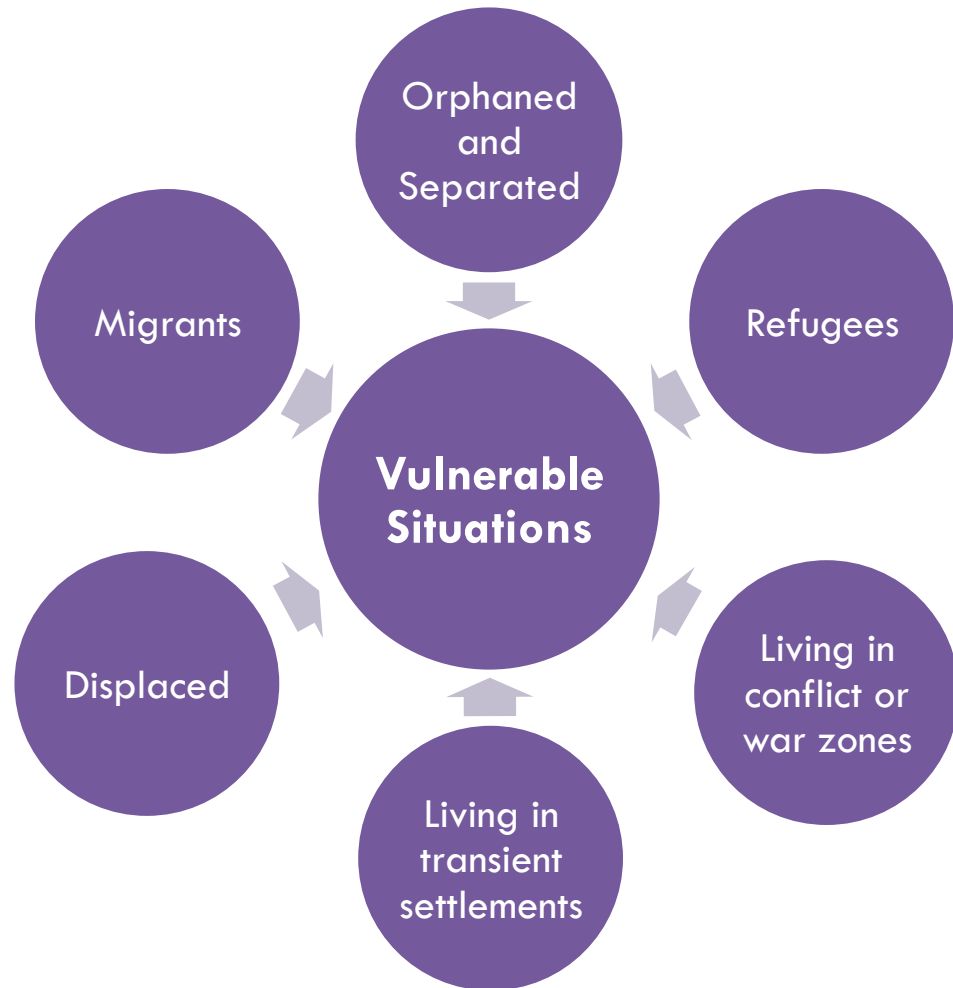
Methods



Identifying the target population

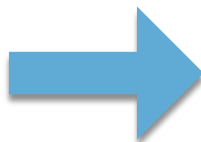
Target Population

- **Children introduced to a vulnerable situation before or at 5 years old**
- **Globally representative with a focus on low and middle income countries**



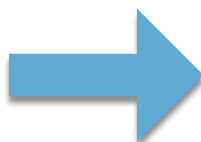
Performed literature searches to answer the following questions:

Growth



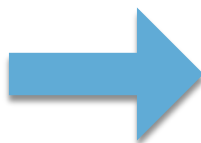
Are children in vulnerable situations more prone to stunting and wasting than children in the general population?

Cognitive
Development



Are children in vulnerable situations at greater risk for delayed cognitive development, and can interventions improve or mitigate this risk?

Resettlement



If children are removed from vulnerable situations (via resettlement or international adoption), can they experience catch up growth or development recovery?

Growth in vulnerable children



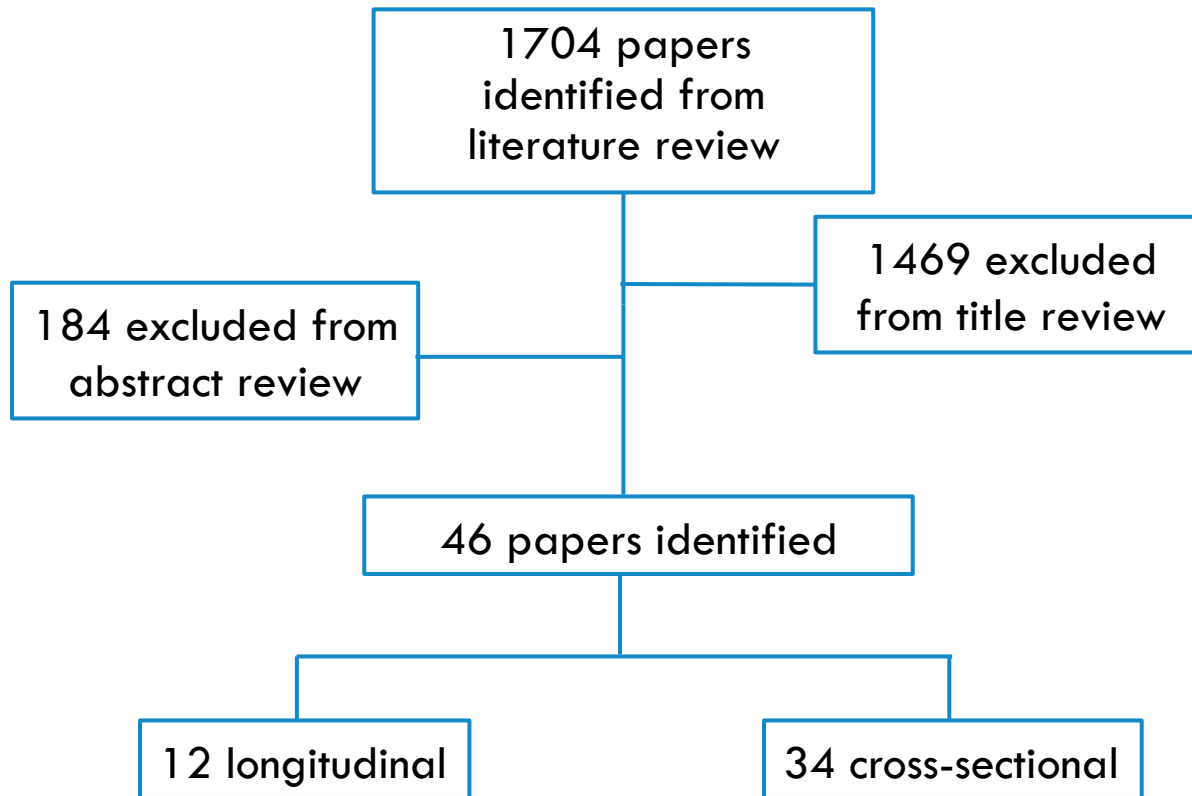
Methods of literature review

- Developed several iterations of search terms
- Utilized MeSH terminology and Boolean operators to best capture all applicable resources in the US National Library of Medicine ontology
- Did not filter by date or language to capture full range of available research

Growth Terms	
growth	weight
height	stunting
Vulnerability Terms	
vulnerable	war
displaced	orphan
conflict	orphanage
ethnic conflict	refugee
Age Terms	
newborn	toddler
infant	schoolchild
child	pre-school
young person	boy/girl



Results of PubMed literature review



Inclusion Criteria

- ▣ Included at least one growth measure
- ▣ Includes children ≤ 5 years

Exclusion criteria

- ▣ Exclusively HIV-infected population
- ▣ Source population is a developed country not involved in conflict
- ▣ Resettlement in developed countries*

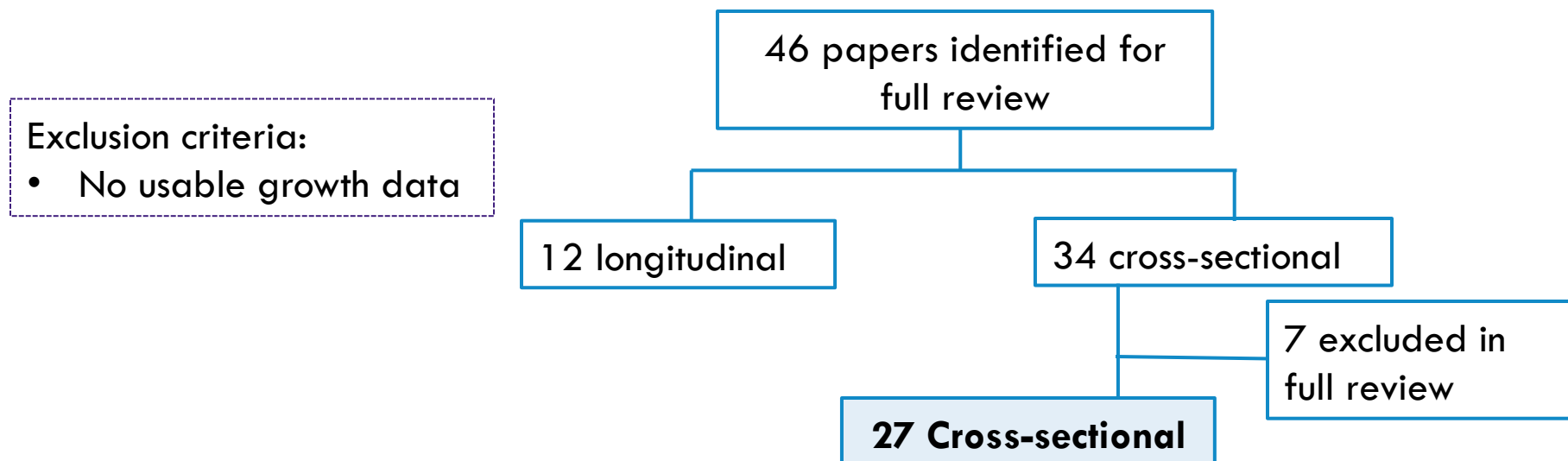
*Resettlement explored separately



Comparing study findings to country means

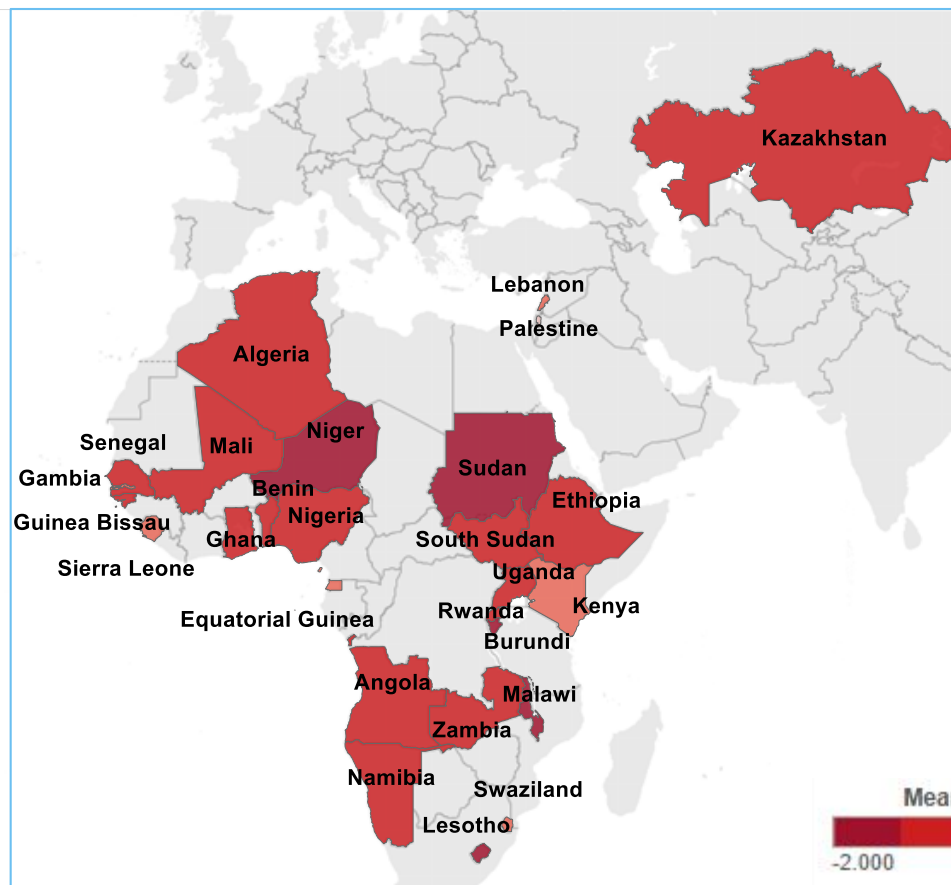
Are children in vulnerable situations more prone to stunting and wasting than children in the general population, and does this differ by country?

- ❑ To examine this, we collected data from cross-sectional studies that observed stunting and wasting among vulnerable children.
- ❑ This was compared to the most recent DHS data collected for each country.

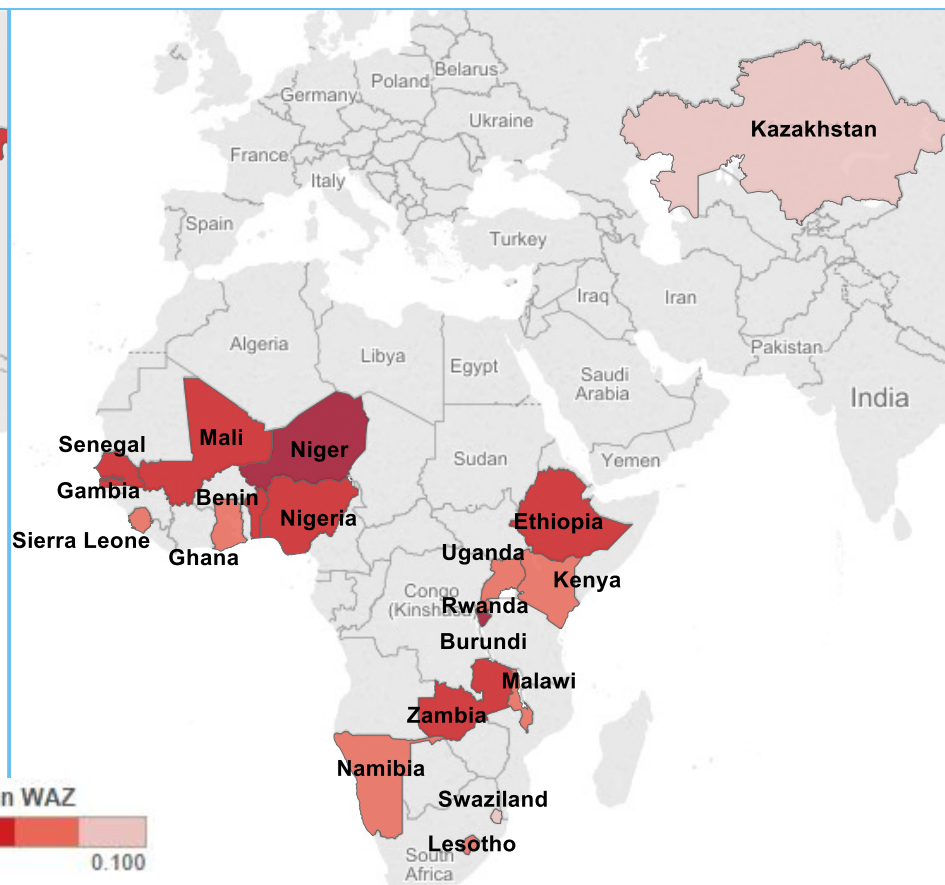


Comparing mean WAZ among vulnerable children to country means

Studies among vulnerable children



DHS country means



Comparing percent wasted among vulnerable children to country means

Studies among vulnerable children

DHS country means



*Data collected on Mexico and El Salvador excluded from map



Comparing mean HAZ among vulnerable children to country means

Studies among vulnerable children



DHS country means

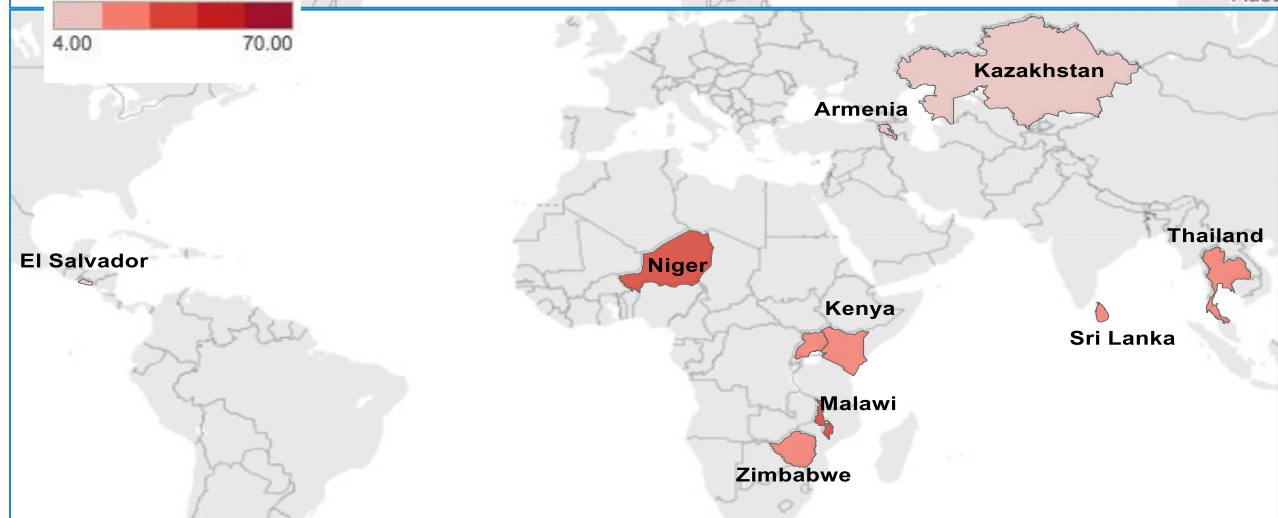


Comparing percent stunted among vulnerable children to country means

Studies among
vulnerable children



DHS country means



Conclusion

- ❖ Cross-sectional studies of children in vulnerable situations report high prevalence of stunting and wasting, but provide little context to how this compares to the general population.
- ❖ In some countries, such as Kazakhstan and Armenia, children in vulnerable situations appear to be more growth restricted than the general population, and appear to be similar to the countries with the highest prevalence of stunting and wasting.
- ❖ In countries where wasting is highly prevalent, all children may be at high risk, making it difficult to assess the effects of vulnerable situations.
- ❖ Stunting appears more prevalent in children in vulnerable situations than in the general population



Cognitive Development in Vulnerable Children



Methods of literature review

Formal literature Search:

- Used papers identified from the original literature search to determine appropriate terms
- Built search terms to find papers on cognitive outcomes among vulnerable children
- Included migrant populations in vulnerable search
- Did not filter by date or language to capture full range of available research
- Performed finalized PubMed literature search on 8/11/2015

Informal Literature Search:

- Literature identified from other searchers
- Used meta-analyses and reviews to identify additional papers

Cognition Terms

cognition	Socio-epidemiological
Socio-emotional	neurodevelopment
Early child development	

Vulnerability Terms

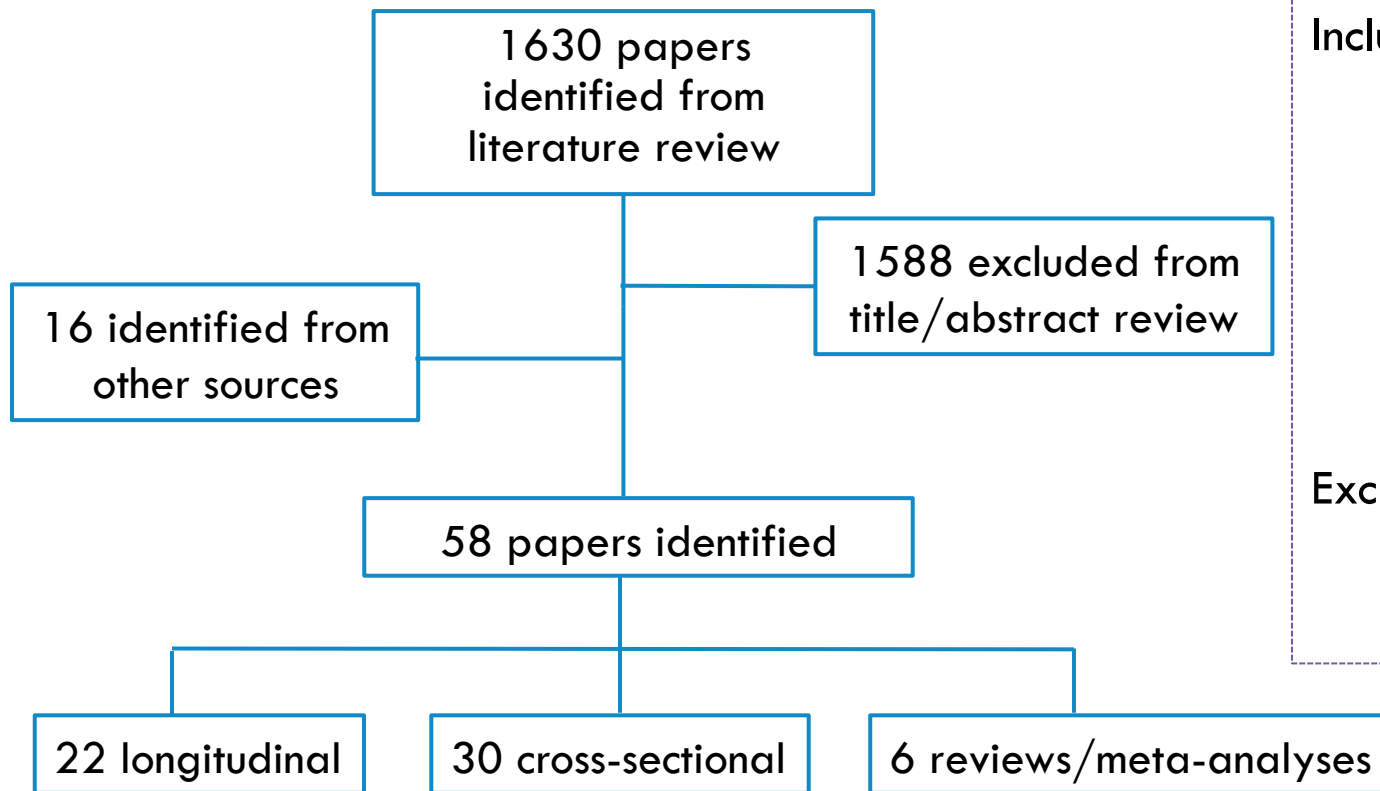
vulnerable	war
displaced	orphan
conflict	orphanage
ethnic conflict	refugee
migrant	

Age Terms

newborn	toddler
infant	schoolchild
child	pre-school
young person	boy/girl



Results of PubMed literature review: Cognitive Outcomes



Inclusion Criteria

- ▣ Included at least one cognitive measure
- ▣ Includes children who had exposure to vulnerable situation ≤ 5 years

Exclusion criteria

- ▣ Exclusively HIV infected populations



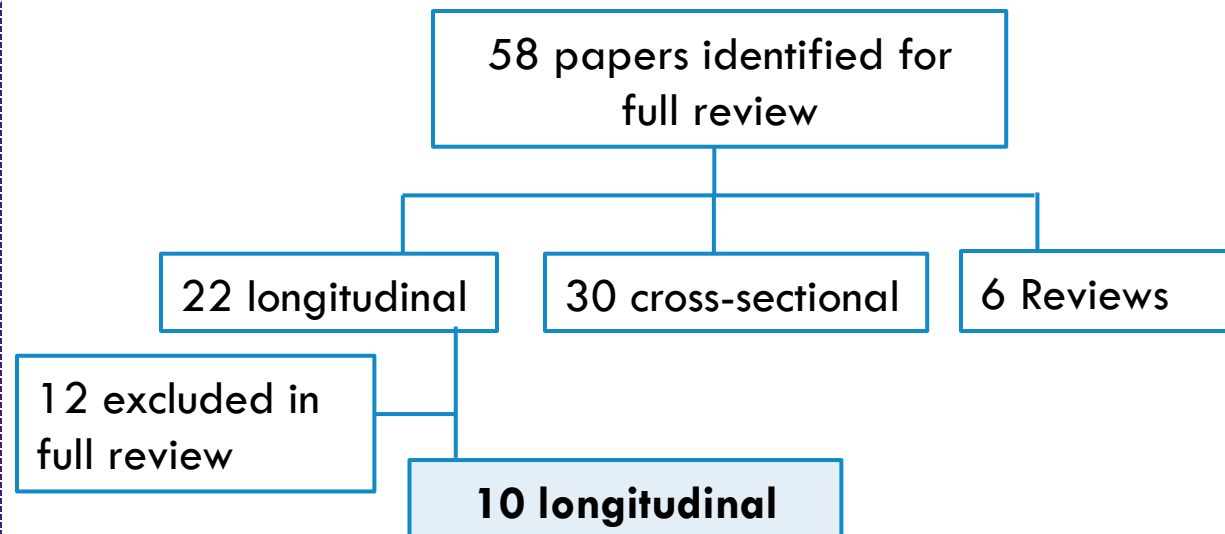
Longitudinal outcomes in cognitive development

Are children in vulnerable situations at greater risk for delayed cognitive development, and can interventions improve or mitigate this risk?

- ❑ To examine this, we collected data from the longitudinal studies identified in the literature search.

Exclusion criteria:

- Exposure happened in later childhood
- Outcomes examined outside the scope of this analysis
- Did not report results on outcomes of interest
- Multiple papers reporting data from the same study



Longitudinal outcomes in cognitive development

Cognitive Domains Included	
Language	Global
Cognition	Fine Motor
Socio-emotional	Gross Motor

Limitations of cognitive development analysis:

- No consistency in *domains examined*
- No consistency in *developmental assessment tools employed*
- Many studies had small sample sizes and heterogeneous populations
- Unable to pool estimates due to heterogeneity of results



Cognitive development: Studies at baseline

**Baseline measures among vulnerable children compared controls or comparison group:
Number of tests by cognitive development domain**

STUDY RESULTS	DOMAIN				TOTAL
	Cognitive	Language	Motor	Socio-emotional	
No difference	2	1	N/A	N/A	3
Worse	3	3	3	1	10
TOTAL	5	4	3	1	



Cognitive development: Studies at baseline

**Baseline measures among vulnerable children compared controls or comparison group:
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No difference	2	1	N/A	N/A	3
Worse	3	3	3	1	10
TOTAL	5	4	3	1	

Most studies found that children in vulnerable situations appear to test lower on cognitive development tests across domains than comparison groups selected from the general population.



Resettlement: International adoption as an intervention



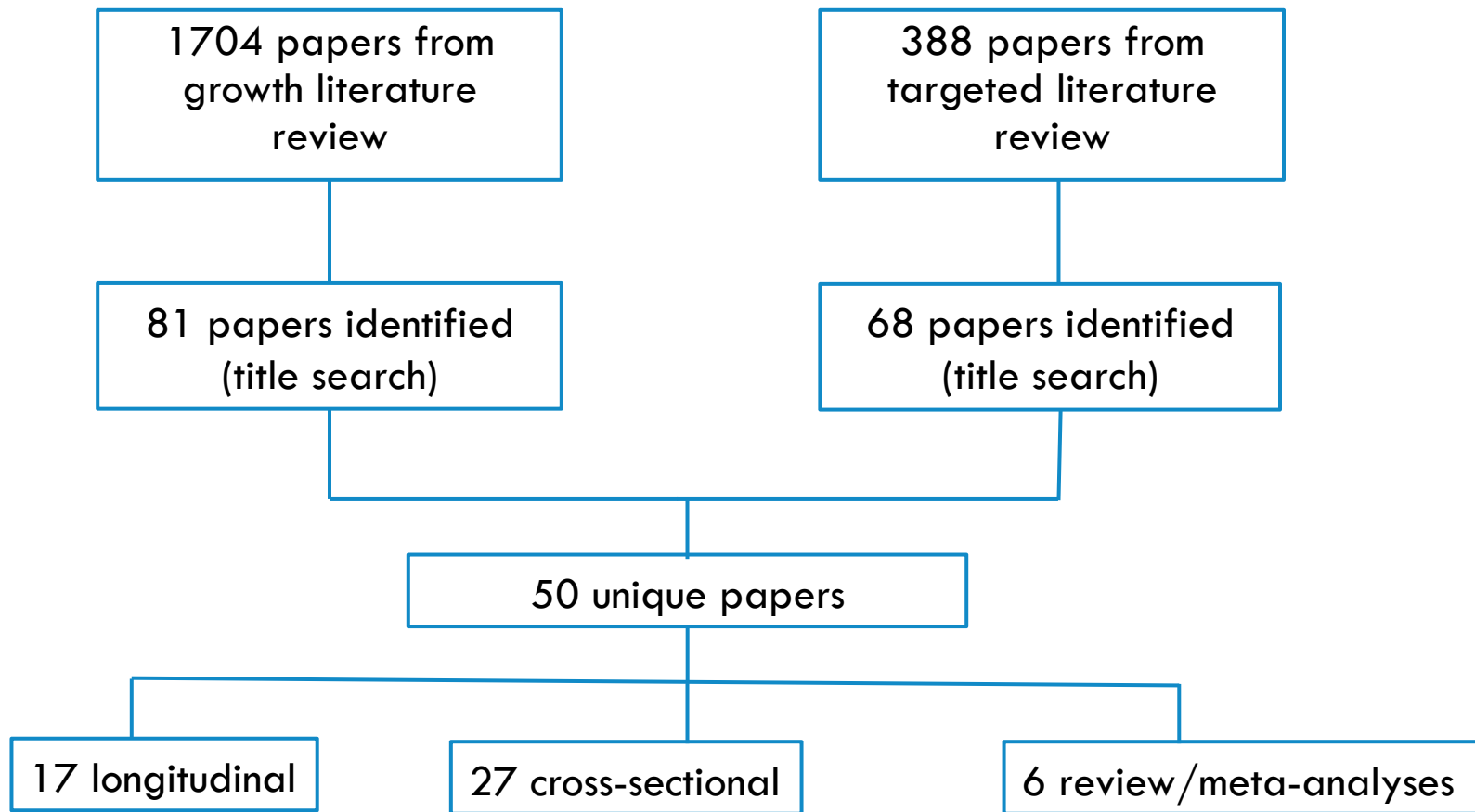
Methods of literature review

- Pulled all resettlement papers from the original search
- Built new search specifically to find resettlement papers, using both growth and cognition terms. Completed on 8/17/2015
- Combined results of both searches to identify unique papers
- Snowball approach to identify additional papers from other literature searches and meta-analyses

Growth and Cognition Terms	
growth	weight
height	stunting
cognition	Socio-epidemiological
Socio-emotional	neurodevelopment
Vulnerability Terms	
resettled	asylum
International adoptees	Post institutionalized
migrant	relocated
Age Terms	
newborn	toddler
infant	schoolchild
child	pre-school
young person	boy/girl



Results of PubMed literature review: Resettlement and growth



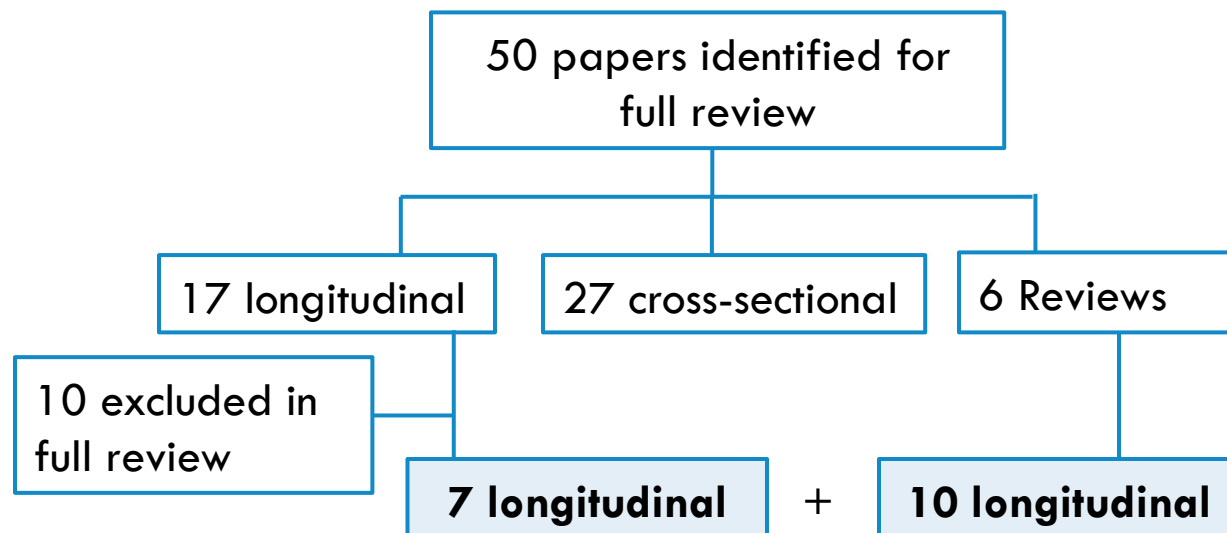
Comparing study findings

If children in vulnerable situations are resettled to more secure environment do they experience growth recovery?

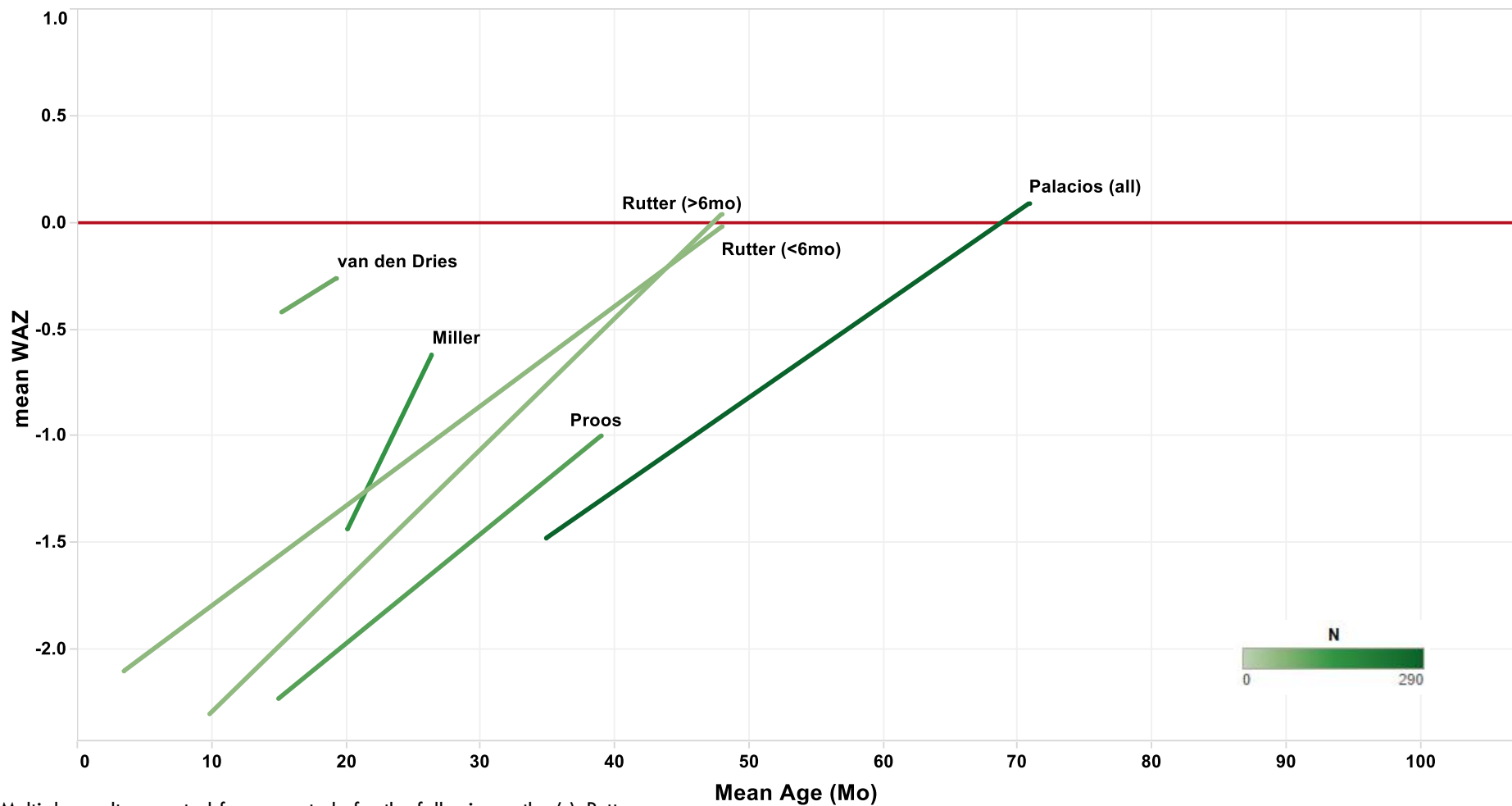
- ❑ To examine this, we collected data from longitudinal studies that assessed resettlement as an intervention for growth identified in the literature.
- ❑ Anthropometric measures were compared at adoption and after adoption.

Exclusion criteria:

- No usable growth data
- Could not separate data for appropriate age group
- Follow-up on different populations



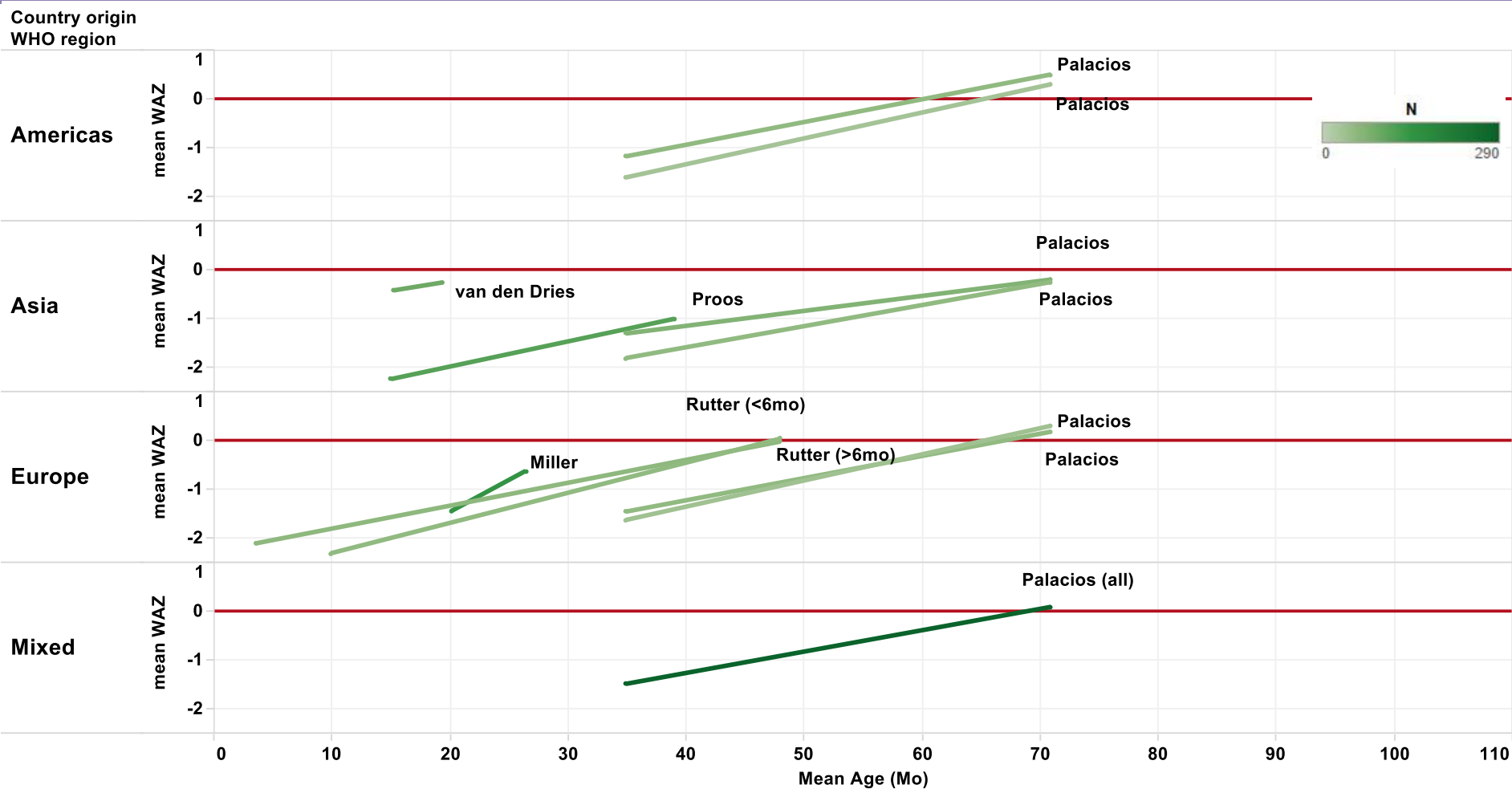
Resettlement: mean WAZ*



*Multiple results reported from one study for the following author(s): Rutter

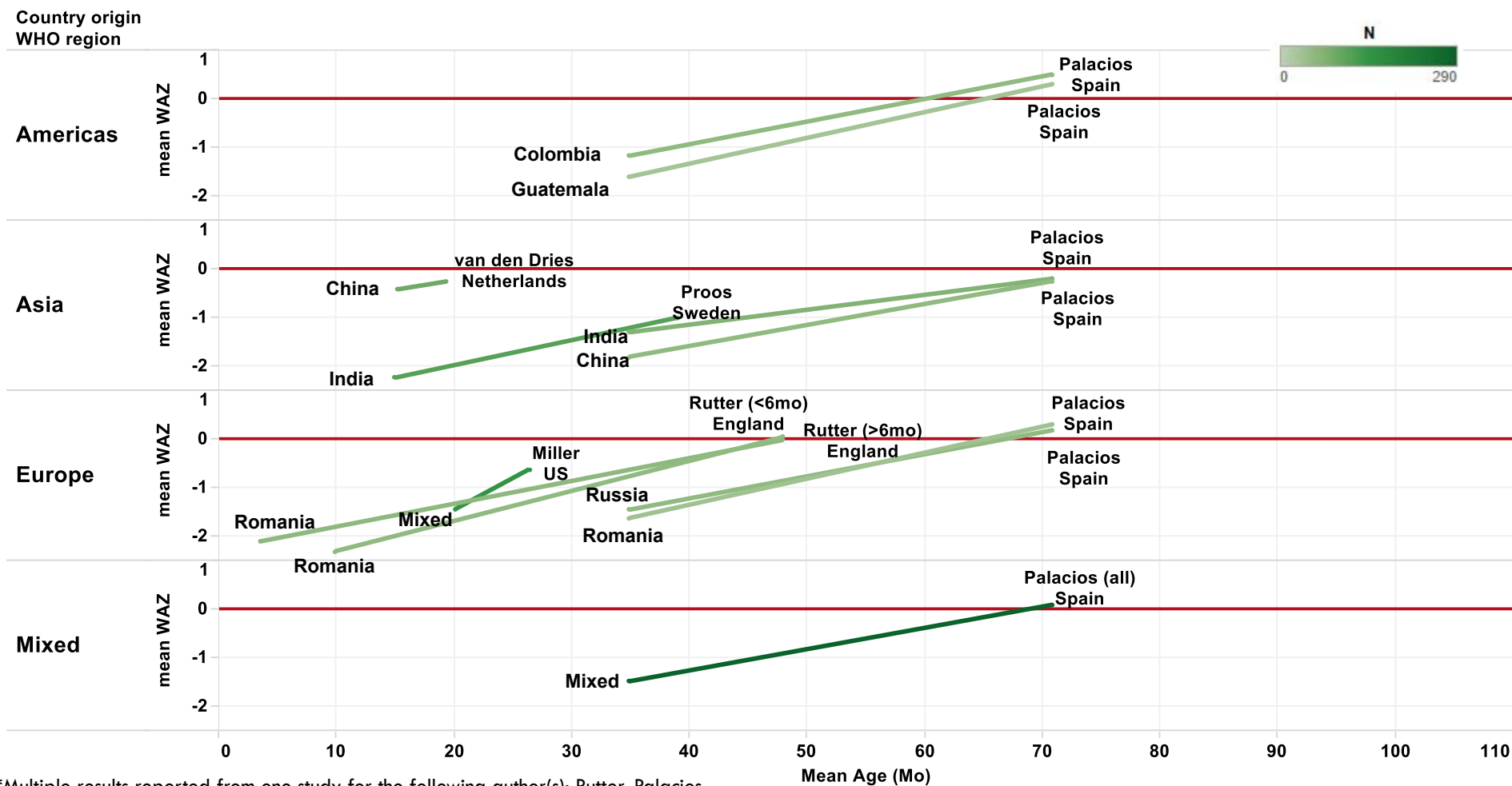


Resettlement: mean WAZ*



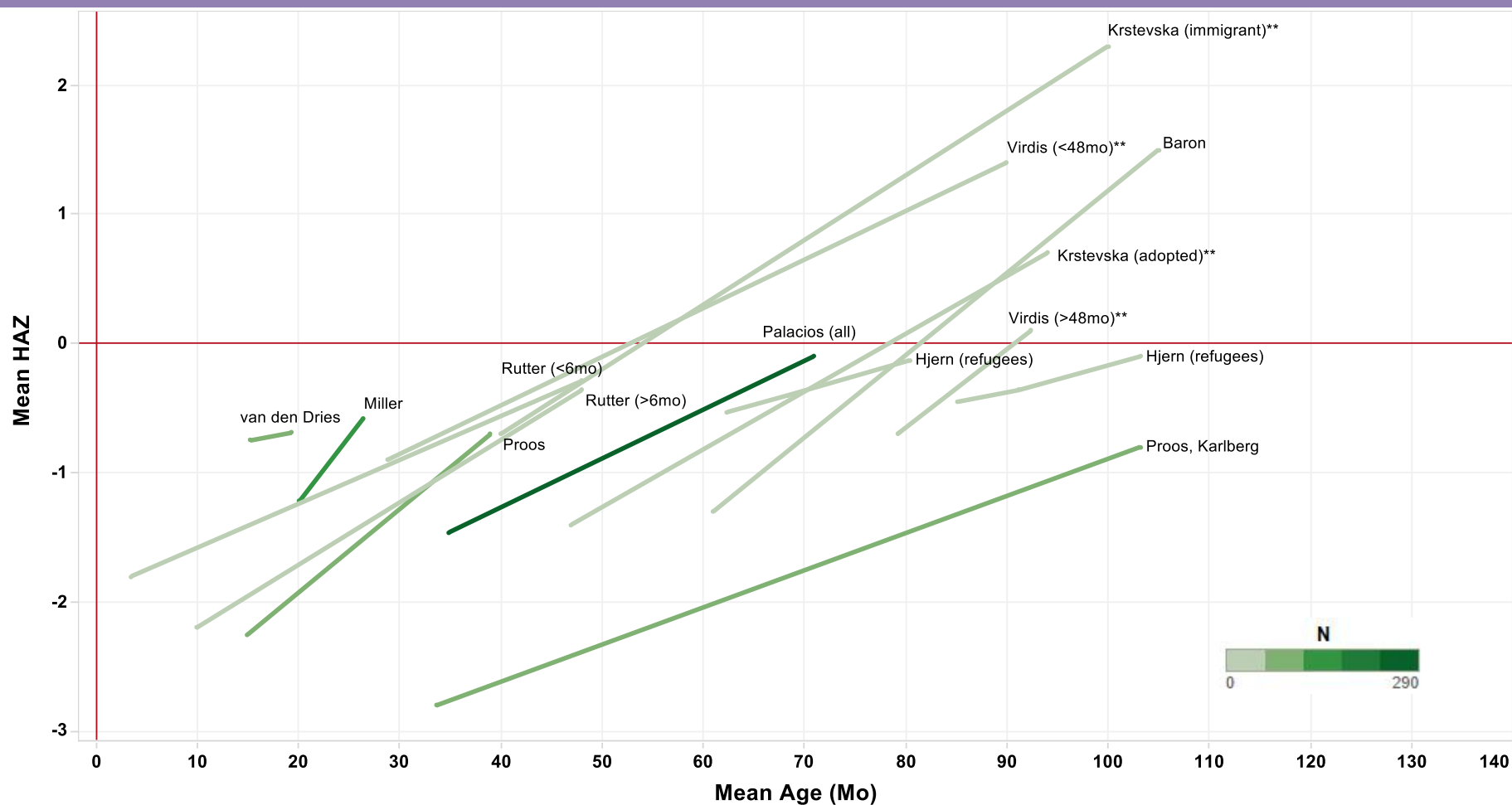
*Multiple results reported from one study for the following author(s): Rutter, Palacios

Resettlement: mean WAZ by origin and resettlement country*



*Multiple results reported from one study for the following author(s): Rutter, Palacios

Resettlement: mean HAZ*

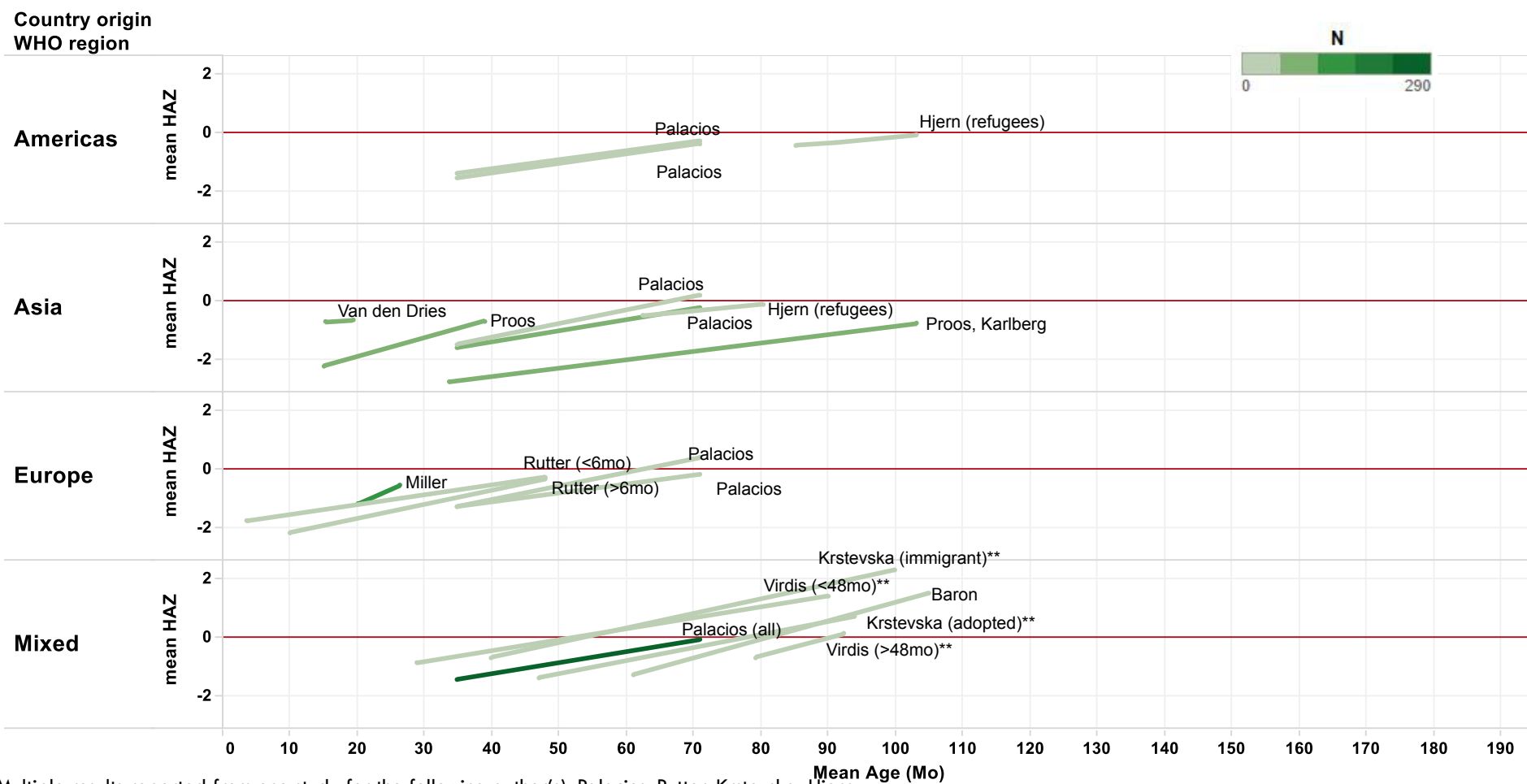


*Multiple results reported from one study for the following author(s): Rutter, Krstevska, Hjern

** Study conducted in special population: precocious puberty



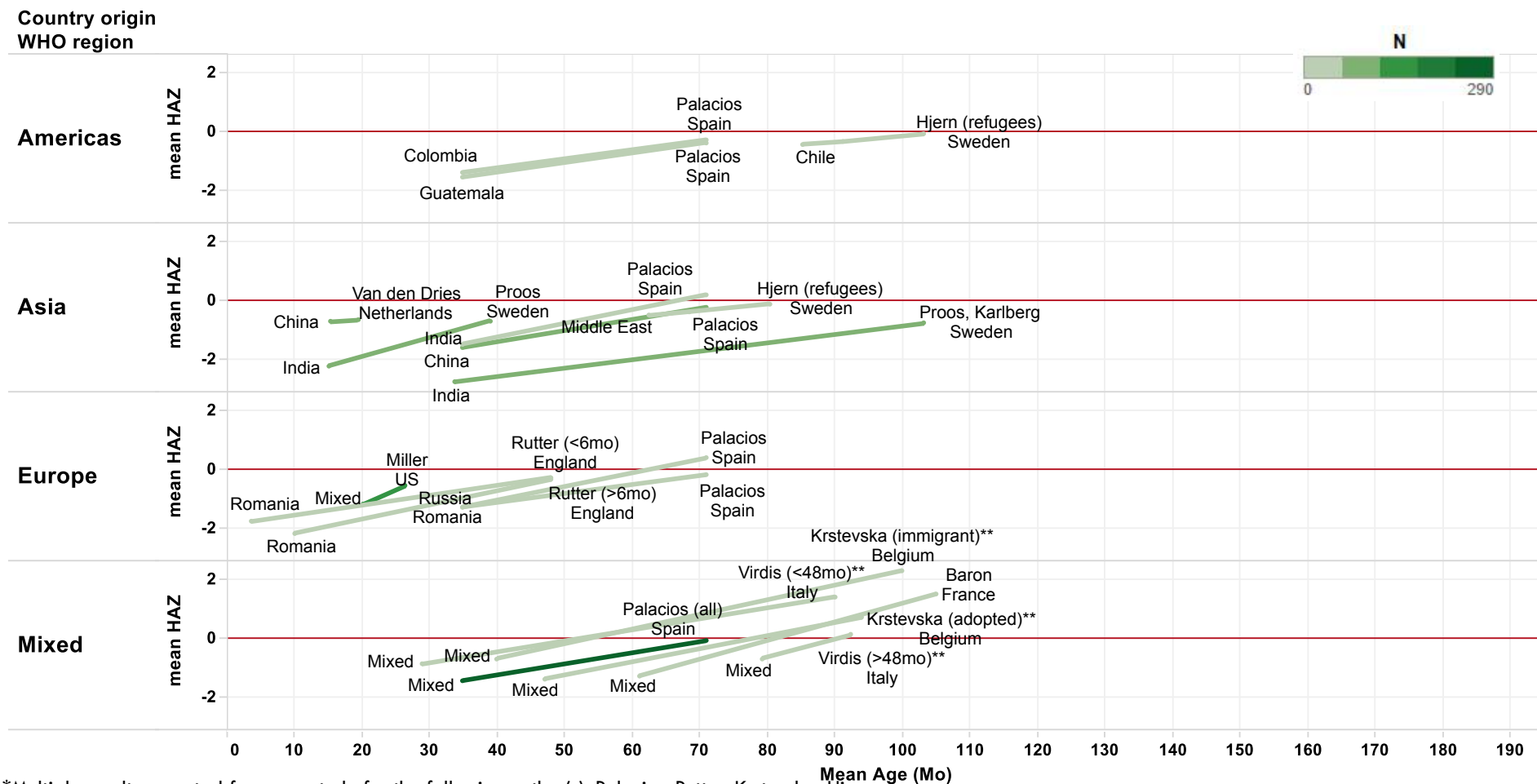
Resettlement: mean HAZ*



*Multiple results reported from one study for the following author(s): Palacios, Rutter, Krstevska, Hjern

**** Study conducted in special population: precocious puberty**

Resettlement: mean HAZ by origin and resettlement country*



*Multiple results reported from one study for the following author(s): Palacios, Rutter, Krstevska, Hjern

** Study conducted in special population: precocious puberty



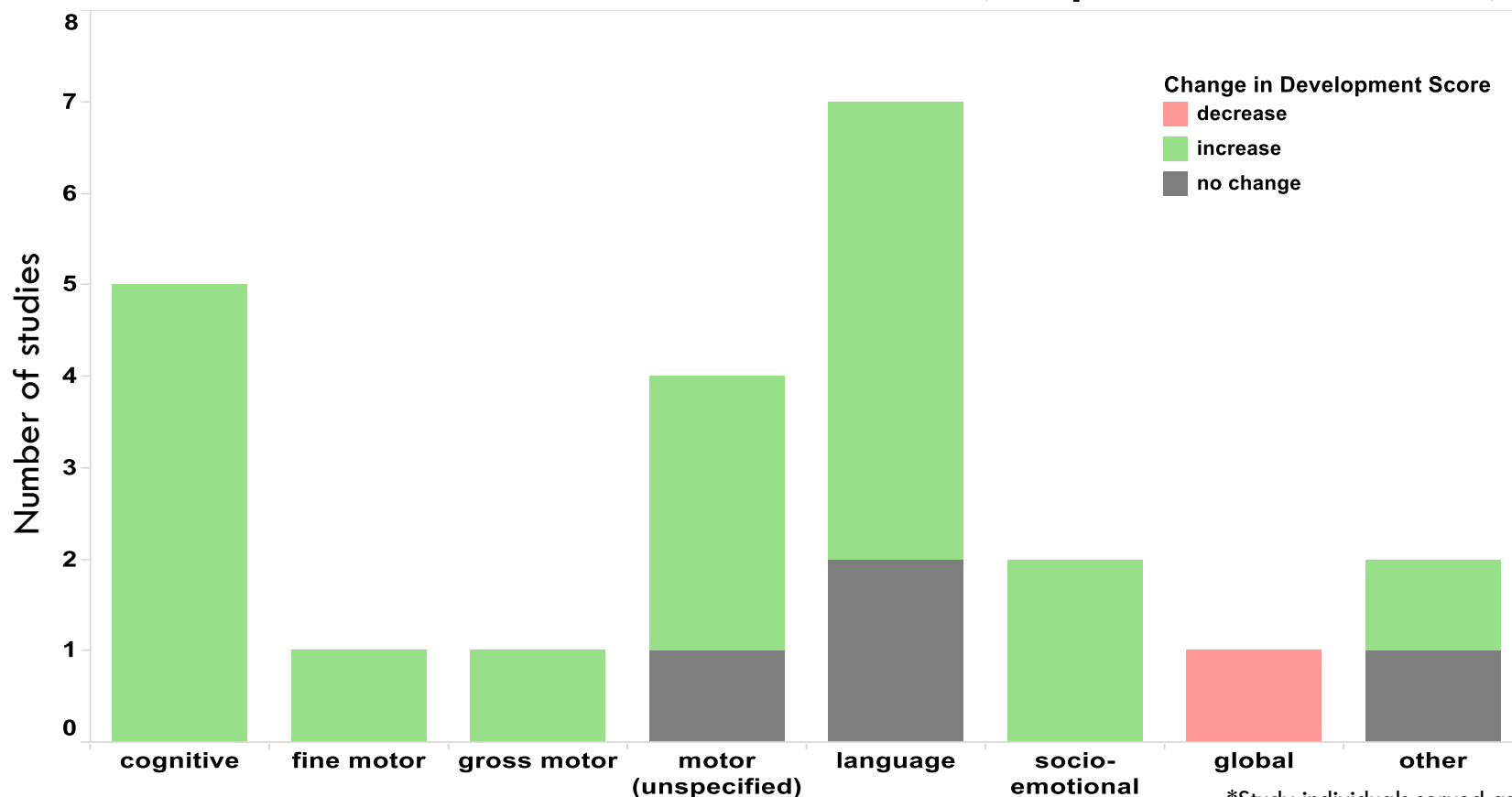
Conclusion

- ❖ Resettlement (including international adoption) from low or middle income countries to high income countries appear to be a very effective intervention to improve both WAZ and HAZ, and in many cases may actually result in normalized growth.
- ❖ Catch up growth appears largest in the youngest children, although improvement occurs across a broad range of ages.



Cognitive development: improvement over time

Number of studies documenting improvement in cognitive outcomes among children removed from the vulnerable situation (adoption or resettlement)*

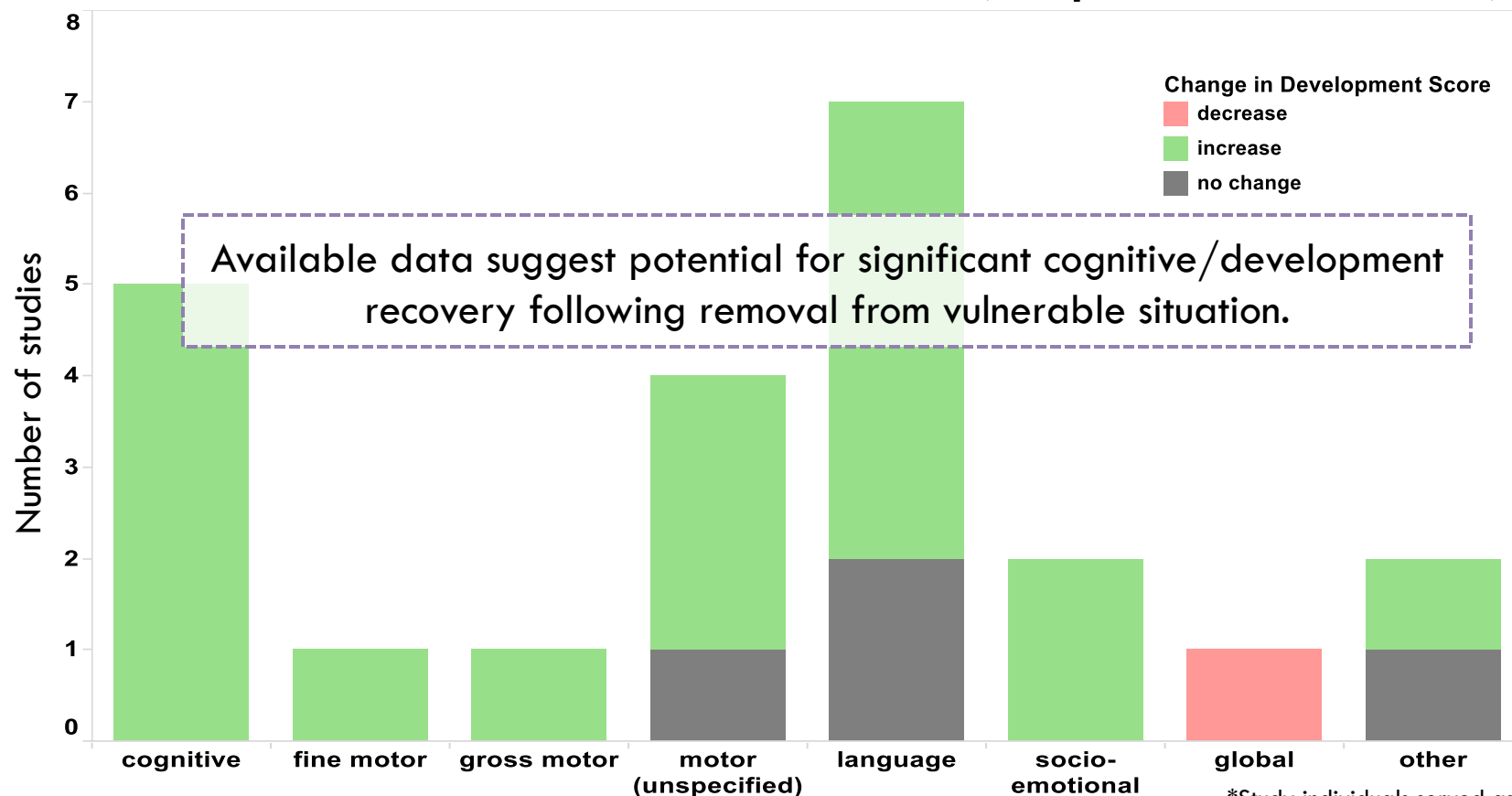


*Study individuals served as their own controls



Cognitive development: improvement over time

Number of studies documenting improvement in cognitive outcomes among children removed from the vulnerable situation (adoption or resettlement)*



*Study individuals served as their own controls



Conclusion

- ❖ Removal from vulnerable situation may lead to improvement in scores across domains, although full catch up is infrequently reported. More evidence may be needed, particularly in assessment of global cognition/executive function.
- ❖ Age at adoption may be associated with catch up: 7 studies reported younger age at adoption associated with better outcomes.



Major limitations

Heterogeneity in data

- Each study used in the analysis reported mean results for children of varying age, background, and socio-economic status

Incomplete background information

- Many studies were unable to obtain information on birth parents of orphan children, so samples may include children at risk for stunting from other causes

Paucity of longitudinal data

- Results represent the information we found with reported longitudinal results. Our findings are limited and may not represent all available data



Overall Conclusions

- Using populations of children in vulnerable situations as an example of the impact of environmental change on growth and cognitive potential, these findings suggest that changes in environmental exposures may have profound impact on both growth and cognitive recovery.
- Age appears to be an important determinant of catch up growth and cognitive development potential.
- Future research needed to explore optimal age window where an intervention can result in the optimal catch up growth and cognitive development.



Resources



Vulnerable children and Growth Contacts

Potential Existing data sets

- Beth Dawson-Hahn—Seattle Children's eed@uw.edu
 - ▣ Research collecting longitudinal growth and nutritional information on child refugees in Seattle
- Suzinne Pak-Gorstein—Seattle Children's spakgor@uw.edu
 - ▣ Research on cognitive development in child refugees in Seattle
- Janine Young—Denver Health Refugee Clinic janine.young@dhha.org
 - ▣ Medical Director; collecting cross-sectional growth data on refugees in Denver
- SMART nutrition surveys data on refugees
 - ▣ <http://twine.unhcr.org/app/>
- United Nations Office for the Coordination of Humanitarian Affairs
 - ▣ Collects data on refugees



Experts with experience working with vulnerable children

START contacted experts

- Amy Hagopian—UW Global Health hagopian@uw.edu
 - ▣ International health workforce issues and the effects of war on global health
- David Townes—UW Global Health townesd@uw.edu
 - ▣ Senior Public Health and Medical Technical Advisor to the Office of Foreign Disaster Assistance at USAID.
- J. Carey Jackson—UW Global Health jacksonc@uw.edu
 - ▣ Medical Director of the International Medicine Clinic, Refugee and Immigrant Health Promotion Program at Harborview
- William Stauffer—University of Minnesota zuhar001@umn.edu
 - ▣ Technical advisor to the CDC on refugee and immigrant health
- Kurt Tjossem—International Rescue Committee (IRC) kurt.tjossem@rescue.org
 - ▣ Regional Director
- Katie Murphy—International Rescue Committee (IRC) katie.murphy@rescue.org
 - ▣ Technical Advisor, Early Childhood Development
- Casie Tesfal—International Rescue Committee (IRC) casie.tesfai@rescue.org
 - ▣ Nutrition Advisor
- Katherine Yun—The Children's Hospital of Philadelphia yunk@email.chop.edu
 - ▣ Research on refugee and immigrant health specifically immigrant families in the US
- Leisel Talley—CDC International Emergency and Refugee Health Branch lre0@cdc.gov
 - ▣ Nutrition expert; operational research is conducted in partnership with other agencies



Experts with experience working with vulnerable children (cont)

Additional Contacts

- Paul Spiegel—United Nations High Commissioner for Refugees
spiegel@unhcr.org
 - ▣ Deputy Director of the Division of Programme Support and Management
- Anne Melvin—Seattle Children's
 - ▣ Director of the Pediatric HIV Program; Research on internationally adopted children in Seattle
- Paula Braitstein—University of Toronto paula.braitstein@utoronto.ca
 - ▣ PI on a 10 year long cohort study of orphans collecting physical and mental health outcomes
- Theresa Betancourt—Harvard School of Public Health
theresa_betancourt@harvard.edu
 - ▣ Research cognitive development in children experiencing humanitarian emergencies
- Julie Bledsoe—University of Washington jbledsoe@uw.edu
 - ▣ Primary care physician that specializes in adoption medicine



Appendix



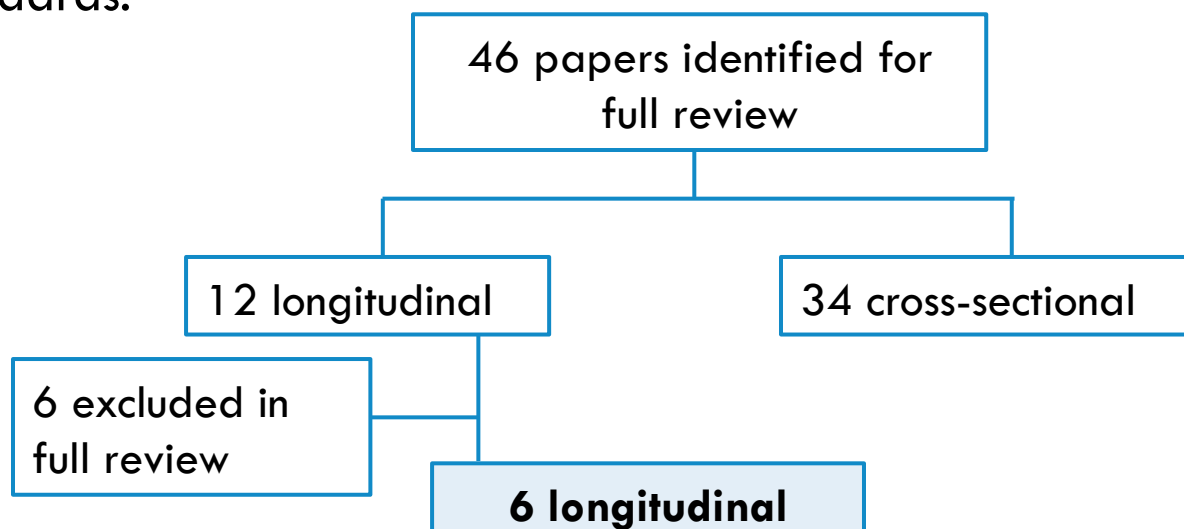
Compare study results to country averages/standards

Do vulnerable children experience different changes in anthropometric measures over a defined time compared to the general population?

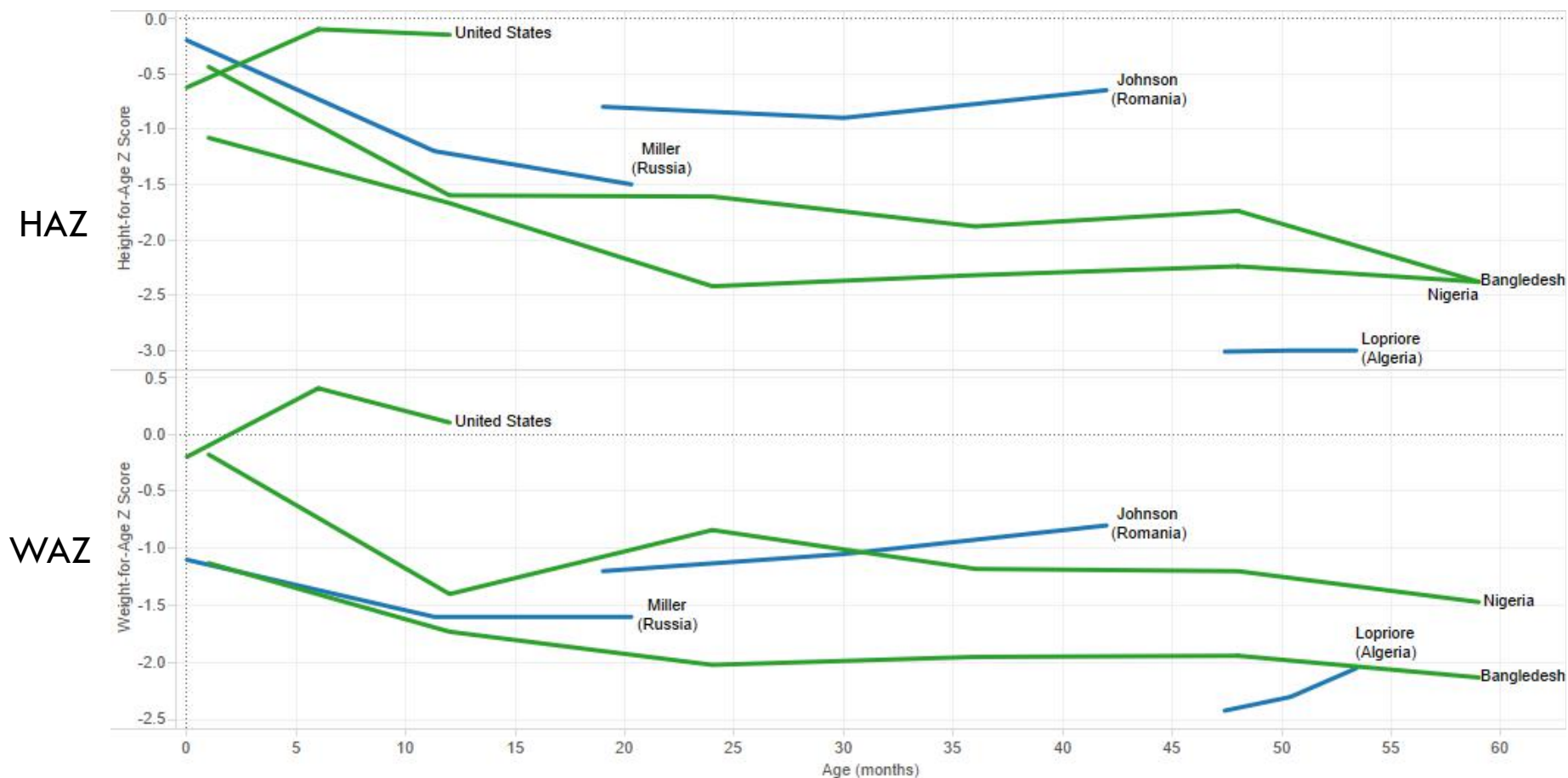
- To examine this, we collected data from longitudinal studies examining change in WAZ, HAZ, weight or height over a time among vulnerable children.
- We compared WAZ and HAZ to DHS country averages, weight and height to WHO growth standards.

Exclusion criteria:

- No usable growth data
- Could not separate data for appropriate age group
- Follow-up on different populations



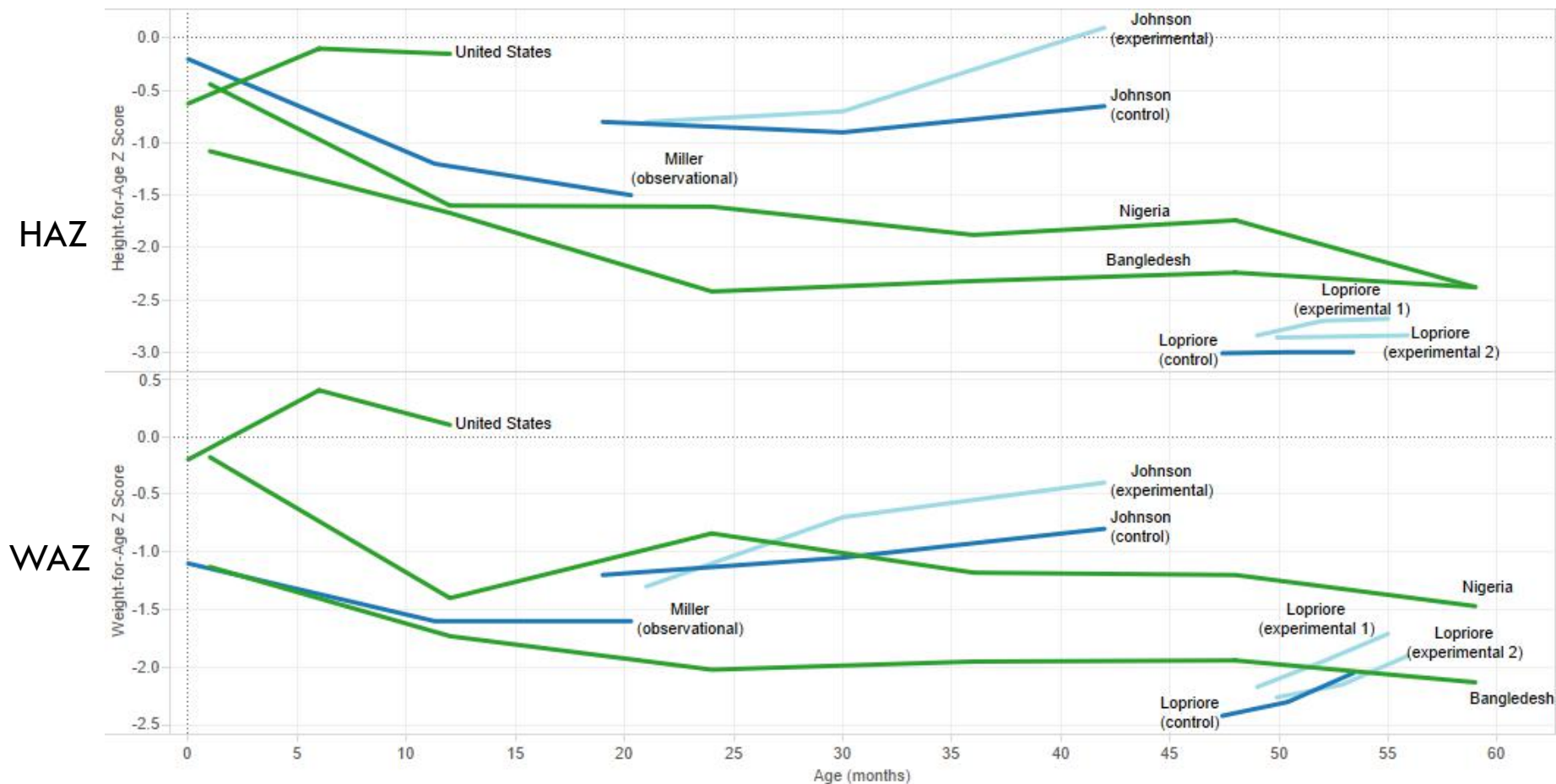
WAZ and HAZ among three studies (control group)



Green=Country average growth Blue=3 studies from VC review



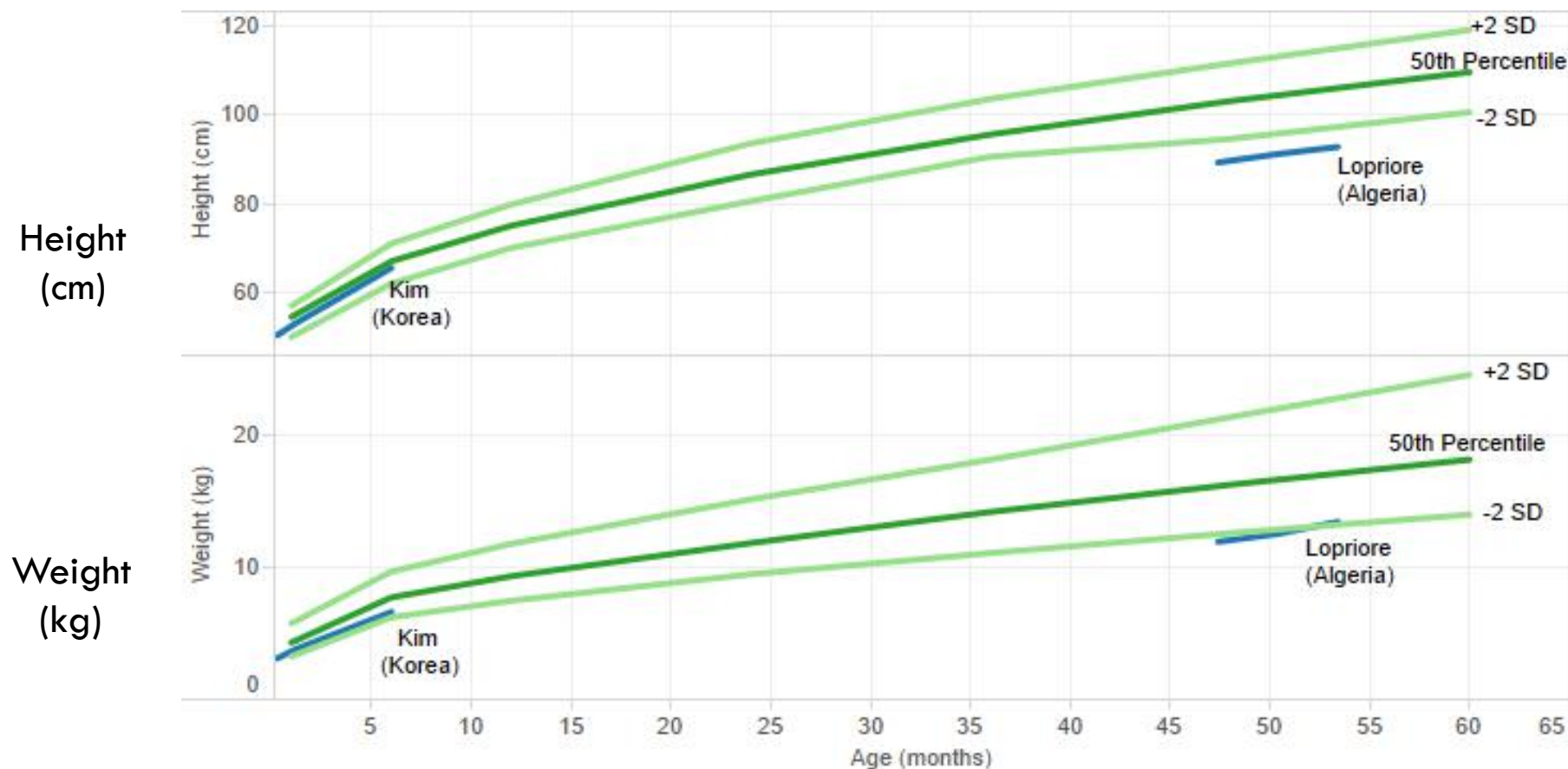
WAZ and HAZ among three studies by treatment group



Green=Country average growth Blue=3 studies from VC review



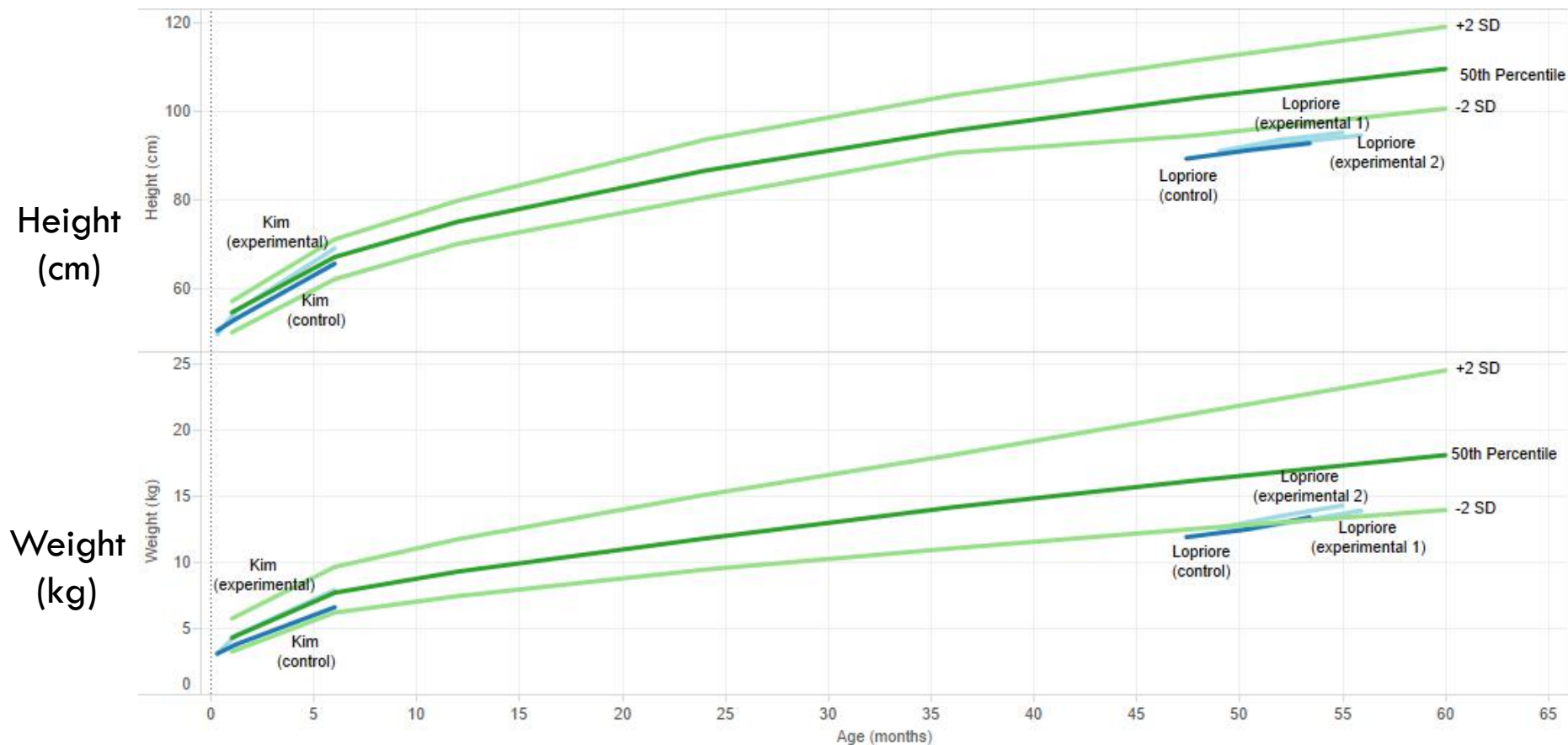
Height and weight for age among two studies (control group)



Green=WHO growth standard Blue=2 studies from VC review



Height and weight for age among two studies by treatment group

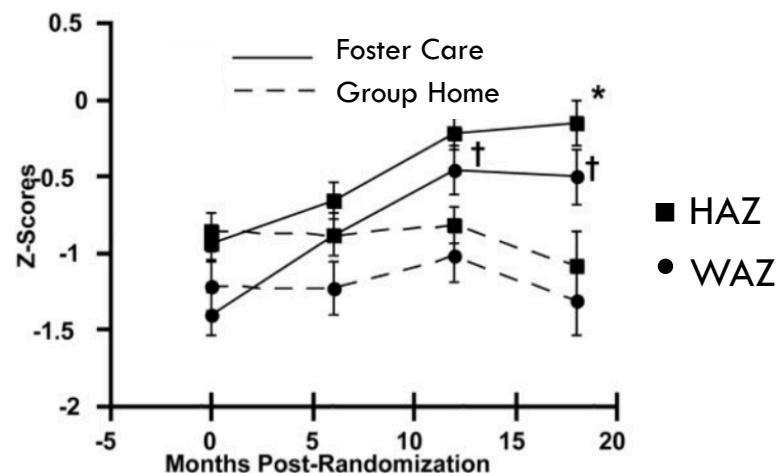


Green=WHO growth standard Blue=2 studies from VC review



Take home messages from vulnerable children studies

- There are few longitudinal growth studies on vulnerable children
 - ▣ Studies report different growth metrics at different ages
- Growth metrics in vulnerable children associated with similar predictors as non-vulnerable children (Johnson, Glew, Miller)
 - ▣ Low birth weight, sex, age, baseline delayed growth
- Variation among orphans depends on living environment
 - ▣ Children in homes seem to achieve better growth than those institutionalized



Johnson 2000



Growth- Cross-sectional studies (1-33)

1. Abdeen Z, Greenough PG, Chandran A, Qasrawi R. Assessment of the nutritional status of preschool-age children during the Second Intifada in Palestine. *Food Nutr Bull.* 2007;28(3):274–82.
2. Akresh R, Lucchetti L, Thirumuthy H. Wars and Child Health: Evidence from the Eritrean-Ethiopian conflict. *J Dev Econ.* 2012;99(2):330–40.
3. Al-Adili N, Shaheen M, Bergstrom S, Johansson a. Survival, family conditions and nutritional status of motherless orphans in the West Bank, Palestine. *Scand J Public Health [Internet].* 2008;36(3):292–7. Available from: <http://sjp.sagepub.com/cgi/doi/10.1177/1403494807086985>
4. Assefa F, Jabarkhil MZ, Salama P, Spiegel P. Malnutrition and Mortality in Kohistan District, Afghanistan, April 2001. *JAMA.* 2001;286(21):2723–8.
5. Ayuku D, Embleton L, Koech J, Atwoli L, Hu L, Ayaya S, et al. The government of Kenya cash transfer for orphaned and vulnerable children: cross-sectional comparison of household and individual characteristics of those with and without. *BMC Int Health Hum Rights [Internet].* 2014;14:25. Available from: <http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=4175501&tool=pmcentrez&rendertype=abstract>
6. Brentlinger PE, Hernan M a, Hernandez-Diaz S, Azaroff LS, McCall M. Childhood malnutrition and postwar reconstruction in rural El Salvador. A community-based survey. *J Am Med Assoc [Internet].* 1999;281(2):184–90. Available from: <http://www.scopus.com/inward/record.url?eid=2-s2.0-0033550498&partnerID=40&md5=bb12db758bd7bafaea8236bf3fc82720> \n<http://jama.ama-assn.org/content/281/2/184.full.pdf>
7. Brown B, Oladokun R. Health status of children in institutionalised homes in South West Nigeria. *Niger Postgrad Med J.* 2013;20(3):168–73.
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- 10.. Gordon NH, Halileh S. An Analysis of Cross Sectional Survey Data of Stunting Among Palestinian Children Less Than Five Years of Age. *Matern Child Health J [Internet].* 2013;17(7):1288–96. Available from: <http://link.springer.com/10.1007/s10995-012-1126-4>
11. Grandesso F, Sanderson F, Kruijt J, Koene T, Brown V. Mortality and malnutrition among populations living in South Darfur, Sudan: results of 3 surveys, September 2004. *Jama [Internet].* 2005;293(12):1490–4. Available from: <http://jama.jamanetwork.com/article.aspx?articleid=200561>



Growth: Cross-sectional studies -- Continued (1-33)

12. Grijalva-Eternod CS, Wells JCK, Cortina-Borja M, Salse-Ubach N, Tondeur MC, Dolan C, et al. The Double Burden of Obesity and Malnutrition in a Protracted Emergency Setting: A Cross-Sectional Study of Western Sahara Refugees. *PLoS Med* [Internet]. 2012;9(10):e1001320. Available from: <http://dx.plos.org/10.1371/journal.pmed.1001320>
13. Guerrier G, Zounoun M, Delarosa O, Defourny I, Lacharite M, Brown V, et al. Malnutrition and Mortality Patterns among Internally Displaced and Non-Displaced Population Living in a Camp, a Village or a Town in Eastern Chad. *PLoS One* [Internet]. 2009;4(11):e8077. Available from: <http://dx.plos.org/10.1371/journal.pone.0008077>
14. Hammami M, Hammad A, Koo WWK. Anthropometric status in Palestinian children living in refugee camps in Lebanon. *Ethn Dis*. 2006;16(2):510–3.
15. Hearst MO, Himes JH, The Spoon Foundation, Johnson DE, Kroupina M, Syzdykova A, et al. Growth, Nutritional, and Developmental Status of Young Children Living in Orphanages in Kazakhstan. *Infant Ment Health J*. 2014;35(2):940101.
16. Janevic T, Petrovic O, Bjelic I, Kubera A. Risk factors for childhood malnutrition in Roma settlements in Serbia. *BMC Public Health*. 2010;10:509.
17. Jeharsae R, Rassamee S, Chongsuvivatwong V. Journal of Medical Association of Thailand. *J Med Assoc Thai*. 2011;94(9):1104–8.
18. Jeharsae R, Sangthong R, Wichaidit W, Chongsuvivatwong V. Growth and development of children aged 1–5 years in low-intensity armed conflict areas in Southern Thailand: a community-based survey. *Confl Health* [Internet]. Conflict and Health; 2013;7(1):8. Available from: <http://www.conflictandhealth.com/content/7/1/8>
19. Nwaneri DU, Omuemu VO. Intestinal helminthiasis and nutritional status of children living in orphanages in Benin City, Nigeria. *Niger J Clin Pract*. 2013;16(2):243–8.
20. Olwedo MA, Mworozi E, Bachou H, Orach CG. Factors associated with malnutrition among children in internally displaced person's camps, northern Uganda. *Afr Health Sci*. 2008;8(4):244–52.
21. Otieno P, Nduati R, Musoke R, Wasunna A. Growth and development of abandoned babies in institutional care in Nairobi. *East Afr Med J*. 1999;76(8):430–5.
22. Panpanich R, Brabin B, Gonani a, Graham S. Are orphans at increased risk of malnutrition in Malawi? *Ann Trop Paediatr* [Internet]. 1999;19(3):279–85. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/10715715>



Growth: Cross-sectional studies – Continued (1-33)

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