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# Childhood growth and education migration among ethnic Tibetan children from Nepal

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## Abstract

**Background:** Ethnographic work among high altitude populations has shown that children are highly mobile—the most recent expression of this is the educational migration of children born at high altitude to boarding schools at lower altitudes. The impact of these patterns of migration on size for age are unknown.

**Aim:** We investigated the association between growth in weight and height and educational migration in ethnic Tibetan children living in and out of their natal communities.

**Subjects and methods:** Five hundred and fifty eight children ages three to sixteen from the Nubri Valley, Nepal participated in this study. Three hundred children were living in natal villages and 258 were attending boarding schools in Kathmandu. Height, weight, and skinfold thicknesses were collected and matched to demographic data from the community.

**Results:** There was no association between altitude of family residence and size for age z-scores. Males had lower z-scores than females; z-scores for both groups declined with age. Differences in size for age among children in boarding schools were associated with two factors: sex and type of boarding school (individual sponsor or group funded). Individuals attending individually sponsored schools had greater size for age compared to children in group funded schools or in their natal villages; younger children in collectively funded schools were smaller than village peers.

**Conclusions:** Despite popular perceptions, educational outmigration in Himalayan communities may not be associated with improved child growth outcomes and investment in community level schools may be a practical solution for improving child growth and physical and mental health.

## KEYWORDS

child growth, educational migration, high altitude

## 1 | INTRODUCTION

A typical sponsor directed advertisement for a boarding school in Kathmandu contrasts village children dressed in tattered clothing with kids sporting crisp school uniforms implying that one can rescue a child from the grinding poverty of village life by providing a scholarship to attend an urban boarding school. Images such as these used to

recruit primarily donors for the boarding schools, construct very specific narratives of poverty, suffering, and ignorance for children who remain in their natal high-altitude communities compared to those who are able to migrate elsewhere for education. Success with obtaining funding and support for educating children from high-altitude Himalayan communities in boarding schools in Kathmandu has become increasingly widespread, resulting in dramatic changes in

children's migration since the practice first began in the 1980s. Prior to the 2020 SARS-CoV-2 pandemic, the majority of children from many Tibetan communities in the Himalayas resided in religious and secular educational institutions outside of the children's natal communities (Childs et al., 2014; Childs & Choedup, 2018).

However, while these educational programs have largely focused on education as a mechanism for escaping poverty, minimal research has looked at the physical and psychological consequences that educational migration may have on children's growth and wellbeing in the context of the Himalayas and similar high-altitude communities.

In a broader context, there is limited research on the health and growth impacts of educational migration from rural to urban on all children, not just children from high-altitude communities. While the public—and fundraising—emphasis of this migration may focus on the removal of children from rural poverty, much less is understood about how the complexities of navigating boarding schools, familial loss, and community/language loss may impact children's health, growth, and well-being, although these topics have been central to discussions about both the historical context of boarding schools and the contemporary practice, especially for rural and/or Indigenous communities, as stated in a 2009 report by the United Nations (Smith, 2009). In a historical context, the physical, mental, and sexual abuse that characterized many residential schools, especially those that focused on cultural and religious assimilation of Indigenous or minority communities, are increasingly well-known but often framed as historical issues, and not practices that continue to this day (Schilling, 2020). The boarding schools studied in this project however, are religiously oriented toward Buddhism, with each school connected to a *Rinpoche* (reincarnated, older, respected, notable, learned and/or an accomplished Lama) and including Buddhist teachings and Tibetan language alongside the Nepali and English curriculum, however considerable evidence suggests that language and cultural loss is still common among Himalayan boarding school attendees (Childs & Choedup, 2018; Craig, 2011; Burack et al., 2023).

In general, a growing body of evidence suggests that although boarding schools are often presented as a panacea for rural educational and health disparities, the evidence supporting this is decidedly less robust than advertisements and global initiatives would suggest (Smith, 2009). For example, several studies have reported increased rates of anemia, infectious disease, and malnutrition among young children attending rural boarding schools in China (Luo et al., 2009; Wang, Liu, et al., 2016). Among ethnic Tamahumara children from rural Mexico, Monárrez-Espino et al. (2004) found no differences in body size between children boarding and children not boarding at schools. However, both these studies were conducted in rural boarding schools, not among rural migrants residing in urban schools. Further, in many of these studies, the children were short term educational migrants, returning to families at frequent intervals.

Patterns of educational migration across the Himalayas are starkly different; research among adults who migrated for education as children show very few have frequent returns to their natal villages during childhood (Burack et al., 2023; Childs & Choedup, 2018). As such, in addition to the literature on boarding schools and child health, investigations in the biosocial ecology of educational migration among high-altitude communities can also be informed by existing literature

on the health and growth impacts of institutional care, such as orphanages and children's homes Nelson (2016), although most of the students are not orphans but may go years or decades without seeing parents or natal communities and describe themselves as actively creating new forms of kinship through "second parents" of aunts, uncles, cousins, siblings, teachers, Buddhist monks and nuns, older children from their villages, and foreign sponsors.

In this study we examine childhood growth among ethnic Tibetan children, ages 3–17, from Nubri, Nepal. Nubri is a high-altitude enclave situated in the upper stretch of the Buri Gandakhi River in Gorkha District of Nepal. As of 2015, 75% of all children aged 10–19 were residing in boarding schools outside their natal villages based on household surveys (Craig et al., 2016). Tibetan communities such as Nubri have long histories of educational migration, with sons frequently sent out to monasteries for religious education as monks (Childs & Choedup, 2018) as part of larger strategies of childcare dispersals commonly practiced in high-altitude communities. What has changed in recent decades is both the magnitude of the outmigration, the increasing inclusion of females, and the destinations of the migrant children as well as the opportunities for education within Nubri (Childs & Choedup, 2018). Educational migration in Nubri is not equal, and our earlier research has shown that wealthier families are more likely to send children out for education, likely because of increased access to social networks in monasteries and boarding schools within Kathmandu, as well as the presence of extended family members in Kathmandu who may be able to provide some form of support. Boarding schools in Kathmandu are typically financed either by a direct sponsor (usually a non-Nepali) of the individual child (*jindag*) or by the sponsorship of an entire school and all children who attend it as part of support to a lama (Childs & Choedup, 2018).

Here, we investigated two primary research questions: (1) what is the nature of the association between altitude of current residence and height-for-age (HAZ) or weight-for-age z-score (WAZ) and (2) are there differences in height for age and weight-for age z-scores between children remaining in their natal communities for education and children migrating out for education? Under the first research question, we tested the following hypotheses: 1.1 Children living at higher altitude will have lower WAZ and HAZ compared to children living at lower altitudes; 1.2 the association between altitude and WAZ and HAZ will show an altitude gradient and 1.3 there will be no differences in WAZ or HAZ between male and female children; 2.1 among children ages 5 and up, children who migrated out for education will have higher WAZ and HAZ scores compared to age-matched village peers and 2.2 there will be no differences in children's WAZ or HAZ between boarding school types in Kathmandu.

## 2 | RESEARCH SITES AND METHODS

### 2.1 | Sample

Nubri has a de facto population of roughly 3500 people inhabiting villages ranging in altitude from 2090 m to 3830 m above sea level. The first references to Nubri in historical records date to the late 11th

century (Childs, 2004). The current residents are an admixture of migrants from the Tibetan Plateau and lower valleys to the south who subsist on agriculture (barley, potatoes, maize), animal husbandry (yaks and yak-cow crossbreeds), trade (mainly medicinal plants), and a growing tourism and mountaineering industry. As a remote and marginalized part of Nepal, schools, health care facilities, and other development initiatives did not reach Nubri until the 1980s. In response to a growing need to educate children, parents began sending children to distant monasteries and schools in the 1980s, a trend that gained momentum in the 1990s and accelerated in the 2000s. Childs and Choedup (2018) have written extensively on the social factors and practices surrounding the decisions by families to send children out for migration and the ways in which these decisions and practices have changed from the 1990s.

## 2.2 | Data collection

We recruited families with children between the ages of 3 and 16 living in 11 villages in Nubri to participate in this study ( $n = 300$ ). In each village, we worked closely with community nurses, female community health volunteers (FCHV), women's associations, and local political and religious leaders to identify families with eligible children and explain the study goals. Based on cross-checks with our own household surveys and data from community nurses, we estimate that >90% of children residing in Nubri participated in the study. While most of the children in residence in Nubri lived at home with parents ( $n = 194$ ), a subset resided in boarding schools and monasteries in Nubri ( $n = 106$ ). For analytical purposes, we classify the three uppermost villages as high altitude (above 3000 m/10,000 ft), the middle four villages as intermediate altitude (from 2999 to 2500 m), and the lowermost four villages as low altitude (from 2499 to 1875 m). We obtained human subjects research approval from Washington University in St. Louis and from the Nepal Health Research Council (NHRC). We assigned a random ID number to each village to allow for inter-village comparisons while protecting individual participant privacy.

Immediately after completing the measurements in Nubri, we recruited children from Nubri who were in Kathmandu boarding schools to participate in the study ( $n = 258$ ). This is only a subset of the children being raised in educational institutions outside of the valley, as children from Nubri attend dozens of different schools however the majority of children attend one of these two schools. We obtained permission from the directors of the schools and the same researcher (Elizabeth A. Quinn) did measurements on all children.

Over a one-month period we measured children's height, weight, triceps skinfold thickness and mid-upper arm circumference. Height was measured using a portable stadiometer (Seca 213) to the nearest millimeter with all measurements repeated in triplicate. Weight was measured to the nearest 0.1 kilograms using standard scales (Tanita BF680). Following a common practice for studies of children in cold climates, we measured all children while they were wearing light clothing and made age-specific adjustments for clothing weight (Roche et al., 2015). Mid-upper arm circumference was collected at the midpoint of the upper arm using Seca baby bands to the nearest

millimeter. Triceps skinfold thickness was collected using Lange calipers to the nearest millimeter and done in triplicate. Intra-observer CV was 3.1%, within the range considered acceptable by other studies (Vegelin et al., 2003); all measurements were done by a single researcher (Elizabeth A. Quinn). All measurements (height, weight, triceps skinfold thickness, mid-upper arm circumference) were converted to anthropometric z-scores using z-anthro program in Stata (WHO Multicentre Growth Reference Study Group, 2006).

Child age was calculated from maternal recall and in most instances, we were able to verify reported ages against earlier household and reproductive history surveys. When specific birth dates were unavailable, we calculated child age from the Tibetan calendar using animal years and birth months, a method that has been validated in many studies (Beall, 2013; Craig et al., 2016). The Tibetan calendar is a repeating 60-year cycle of years, each identified by a combination of one of 12 animal signs (hare, dragon, snake, horse, sheep, monkey, bird, dog, pig, mouse, ox, and tiger) and one of five elements (fire, earth, iron, water, and wood). Duration of time in boarding schools (age of migration) was not available for the children as it was not collected prospectively from parents, was not available in household surveys, and children's reports, especially young children's reports of time in boarding schools, was unreliable. In this subset we found nearly equal numbers of males and females which conforms to the finding that there is no current sex bias in children's outmigration for education (Childs & Choedup, 2018), despite a tradition of religious training for young males as monks. Over the next 2 years, we did additional follow-up studies with the children residing in these schools, collecting information on linear growth over time and on children's lived experiences of boarding school life, educational migration, and psychological well-being (Burack et al., 2023) using the narrative drawing technique (Hunleth, 2011). When relevant, additional data from these later studies have been included in the analyses here to better contextualize children's perceptions of their education.

Sample divisions for testing the research questions were as follows: for research question 1, all children, ages 3–16, living in their natal villages (including those attending a local school) were included in the analysis sample. Villages were assigned a random number to protect community privacy. To test research question 2, children ages 3 and 4, too young for boarding school, were excluded from the analysis. We modeled the boarding schools two ways: first as boarding schools in and out of Nubri and second, for the boarding schools in Kathmandu, as two distinct entities—individual student sponsored boarding schools (ISBS), where each attendees must have one or more foreign sponsors covering tuition and boarding for that individual (called *jindag*), and group sponsored boarding schools (GSBS) where support is offered to all Nubri children through a common fund provided by foreign patrons to the lama or religious leader associated with the school.

## 2.3 | Statistical analyses

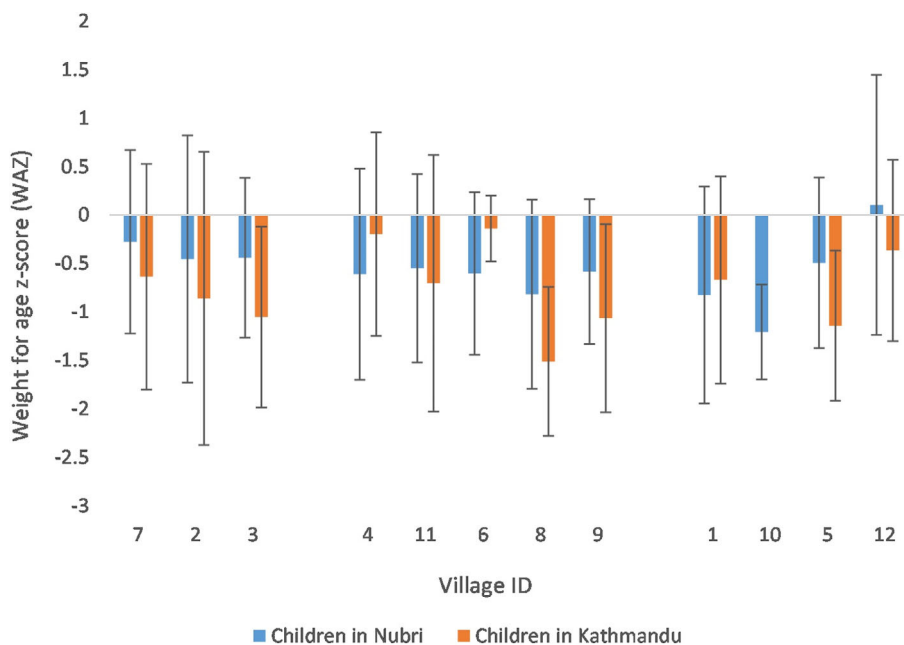
We calculated age-based z-scores for weight, height, weight for height, BMI, triceps, and mid-upper arm circumference using the statistical software Stata 12.0 and the software package Zanthro, with

the 2006 WHO growth standards as the reference population. The WHO reference values truncate at age 10 for WAZ limiting our analysis for WAZ to those children from ages 3 to 10. Weight for height z-scores (WHZ) were limited to those individuals between 45 and 120 cm, the current WHO cut-offs; Canada expanded WAZ data were used for Figures 5 and 6 but not included in Figure 7. In both instances, sample sizes are lower for WAZ and WHZ scores compared to HAZ reflecting the limitations of the available data. There have been some concerns raised, regarding hypsometric bias (sea level bias), about the use of WHO standards as a reference for high-altitude populations as no high-altitude populations were included in the reference populations (Ponce-de-Leon, 2008). As such, the WHO growth standards are used here as reference sample, not as a population standard. We excluded children with biologically implausible WAZ or HAZ ( $n = 2$ ), as well as children with identified developmental disorders ( $n = 4$ ). Basic t-tests were used to test for significant between group differences by individual sex (male vs. female) and between rural and boarding school subgroups by sex.

To test research question 1, we used multivariate linear regression to test for differences between altitude of residence and child WAZ or HAZ; sex-specific models were subsequently tested. These analyses were followed by multi-variate ANOVA, which allowed for villages to be treated independently of altitude. To test research question 2, multivariate ANOVA was used to test for differences between children attending school in Nubri compared to those attending boarding school in Kathmandu and for testing differences by type of boarding school in Kathmandu. All models were adjusted for child age.

### 3 | RESULTS

**Research question 1.** *What is the nature of the association between altitude of current residence and height-for-age (HAZ) or weight-for-age z-score (WAZ).*



**FIGURE 1** Weight for age Z-scores (WAZ) for children over the age of 5 depending on location of current residence (natal village, boarding school). Few children under the age of five attended boarding schools and lived outside their natal villages

We found no association between altitude and child WAZ or HAZ among children ages 3 and over living in villages across a 1800 m altitude gradient.

#### 3.1 | The association between altitude and WAZ and HAZ will show an altitude gradient

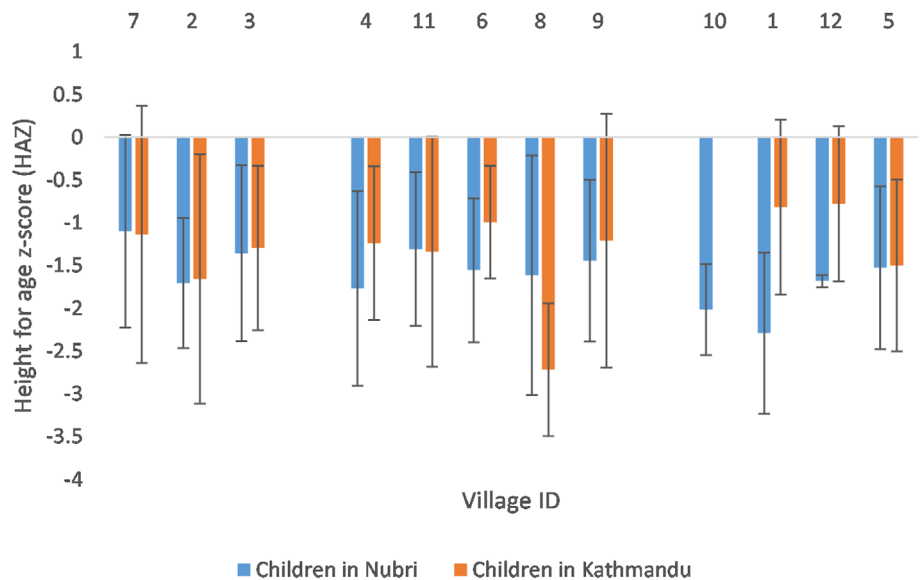
There was no evidence for an altitude gradient in this sample. Intermediate altitude villages (2999–2500 m) had more discordance in mean child weight and height for age than high or low altitude villages. The villages with the lowest average WAZ and HAZ for males were low altitude villages (1875–2499 m); for females, the village with the lowest mean HAZ was intermediate altitude and for WAZ was high altitude. The villages with the highest mean HAZ for males was intermediate altitude, highest mean WAZ for males high altitude, and for females the highest mean WAZ and HAZ were in the same low-altitude village (Figures 1 and 2).

#### 3.2 | There will be no differences in WAZ or HAZ between male and female children

Among all children in survey, females had significantly higher mean weight, MUAC, triceps, and HAZ compared to males (Table 1). In both subgroups of children—those remaining in natal villages and those in boarding schools, females had higher weights, HAZ, and BMIs compared to males (Figures 3–6).

For each 1 year of age added, male children living in Nubri lost  $-0.137$  (0.041) z-scores ( $p < 0.001$ ) for WAZ, with age alone explaining 11% of the variation in WAZ. Males lost  $-0.106$  (0.033) z-scores for HAZ ( $p < 0.000$ ) for each additional year of age, with age explaining 8.1% of the variation. By comparison, female children in Nubri

**FIGURE 2** Height for age Z-scores (HAZ) for children over the age of 5 depending on location of current residence (natal village, boarding school). Few children under the age of five attended boarding schools and lived outside their natal villages



**TABLE 1** Demographic characteristics of the sample by sex

Variable	All males (n = 213)		All females (n = 241)		t-test for difference by sex
	Mean	Std	Mean	STD	
Age (years)	9.3	3.5	8.9	3.2	0.157
Weight (kg)	26.4	9.4	28.4	12.4	0.024
Height (cm)	123.7	16.9	125.8	19.3	0.106
MUAC (cm)	18.9	2.6	19.4	3.1	0.039
Triceps (mm)	11.4	4.3	12.1	4.8	0.045
WAZ*	-0.75	0.88	-0.64	1.03	0.171
HAZ	-1.65	1.12	-1.09	1.28	0
BMI	16.7	2.2	17	2.4	0.056

Abbreviations: HAZ, height-for-age z-scores; WAZ, weight-for-age z-score.

showed only modest declines in WAZ and HAZ associated with age. For each 1 year of age, females lost  $-0.026$  (0.035) z-scores for WAZ and  $-0.053$  (0.028) z-scores for HAZ and neither model reached significance.

**Research question 2.** *Are there differences in height for age and weight-for age z-scores between children remaining in their natal communities for education and children migrating out for education?*

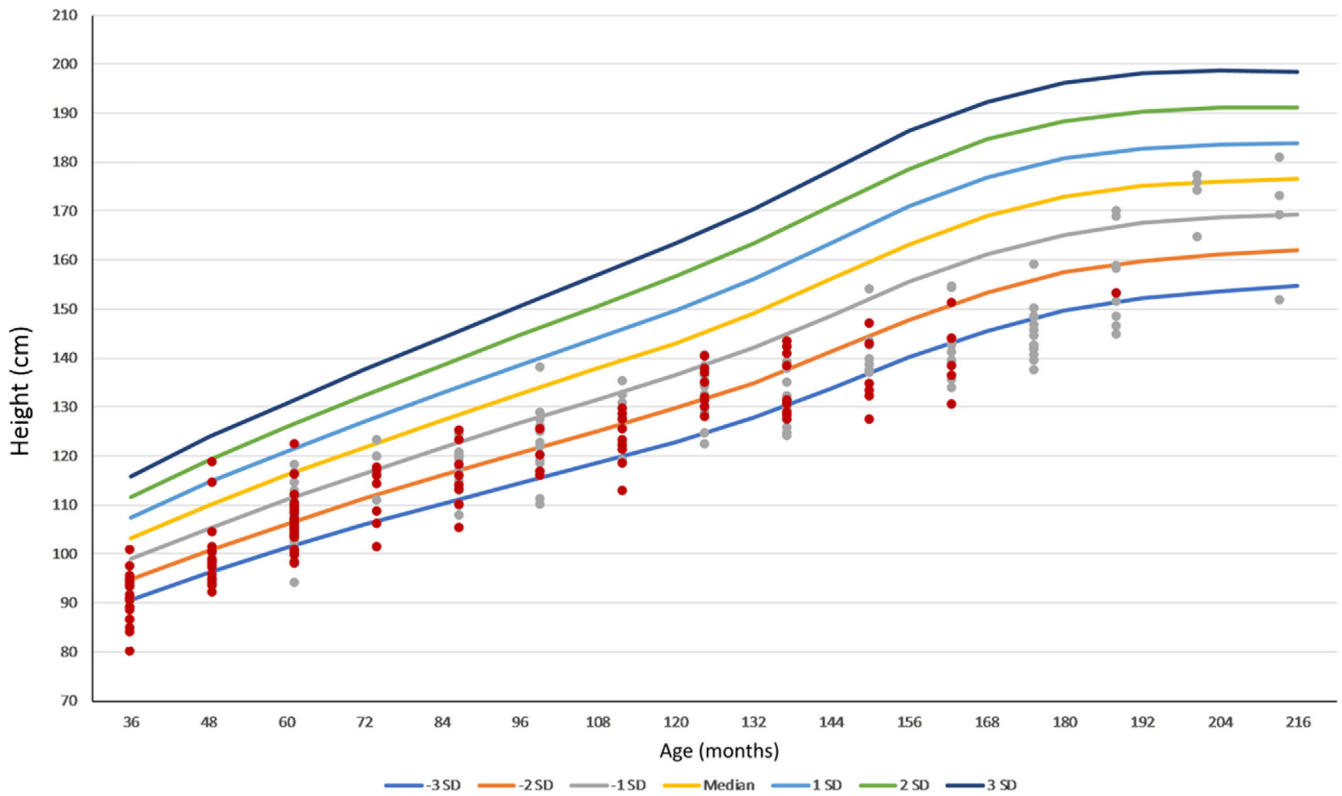
Models testing for the association between outmigration for education and child growth were limited to children ages five and above. We further divided these children into two groups: children ages five to nine and children ages 10–16. The distinction is necessary to model the differences in sample size: between ages 5 and 10 there was an even split between children in Nubri and children who had outmigrated. After age 10, most children were no longer in their natal communities; the boarding schools in Nubri only offer education through grade 4 so children continuing education for grades 5–10

must leave the communities. For clarity, we will refer to the two groups as children (ages 5–10) and adolescents (ages 11–17).

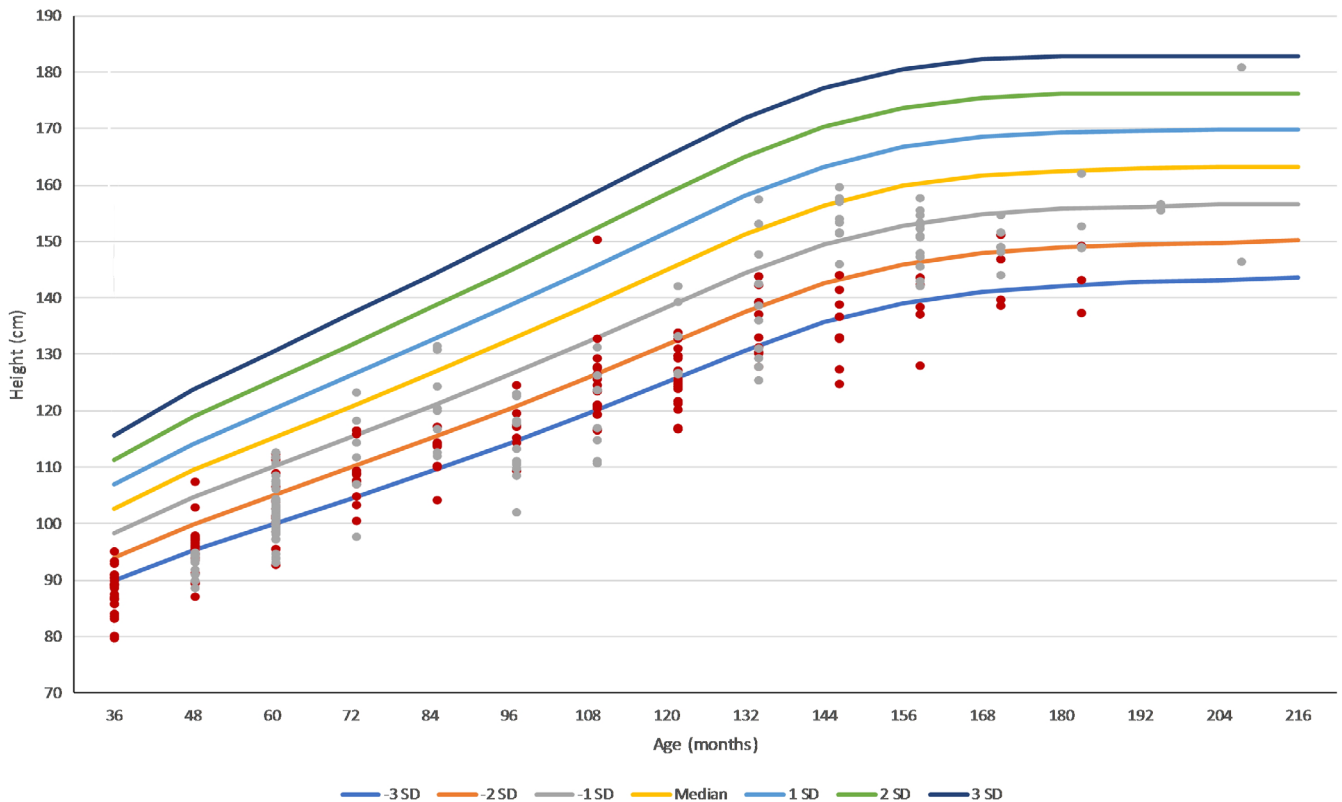
### 3.3 | Among children ages 5 and up, children and adolescents who migrated out for education will have higher WAZ and HAZ scores compared to age-matched village peers

As previously reported, in this sample near equal numbers of male and female children and adolescents had migrated out for education (121 females, 126 males). There were no significant differences in the mean age by sex for children remaining in their natal villages or attending boarding schools in Nubri.

In the full sample, male children had higher mean WAZ and lower mean HAZ compared to village peers although the difference in group means did not reach significance (Table 2). Females attending boarding schools had much higher mean WAZ and HAZ compared to males attending boarding schools (Table 2). Female children attending

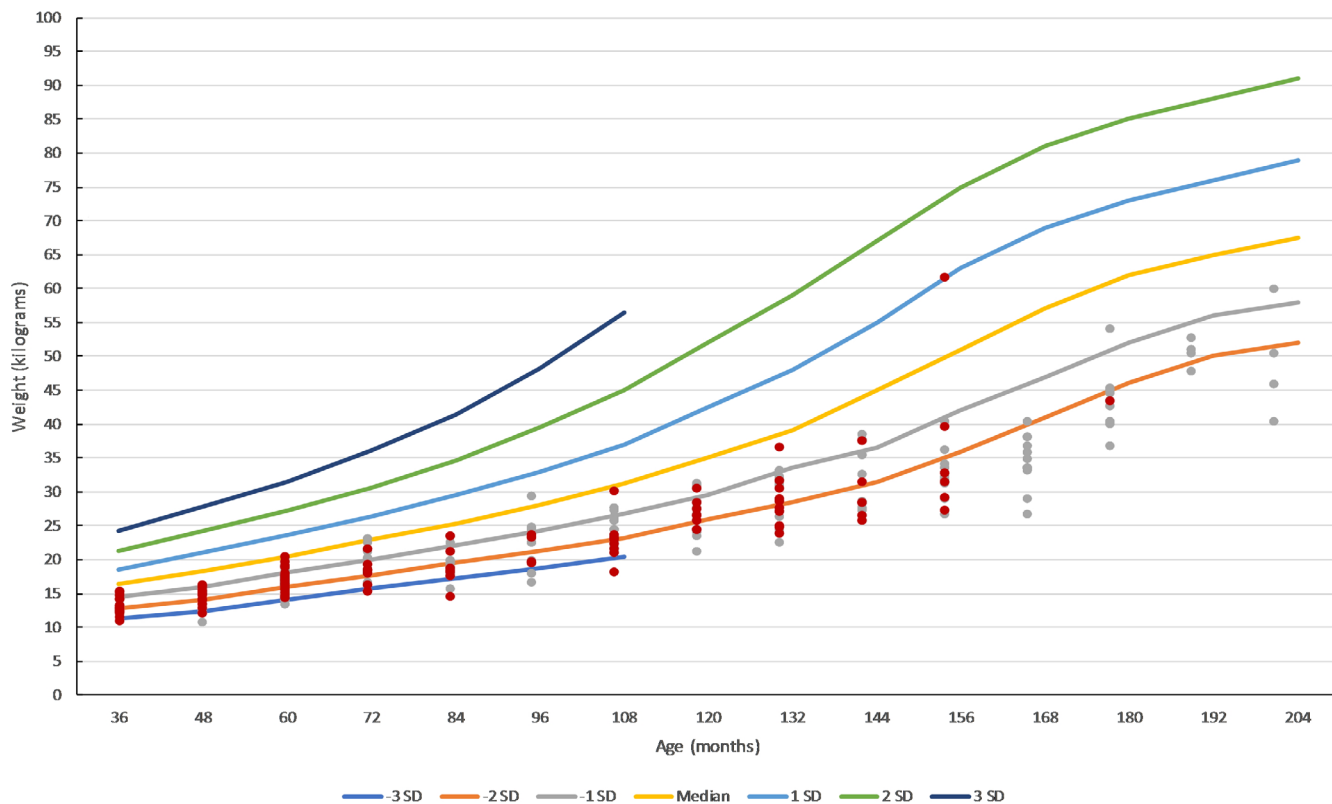


**FIGURE 3** Male heights from children in Nubri (red circles) and children attending boarding schools in Kathmandu (gray circles). Reference lines representing the WHO growth reference standards for  $-3$  to  $+3$  SD are shown for reference

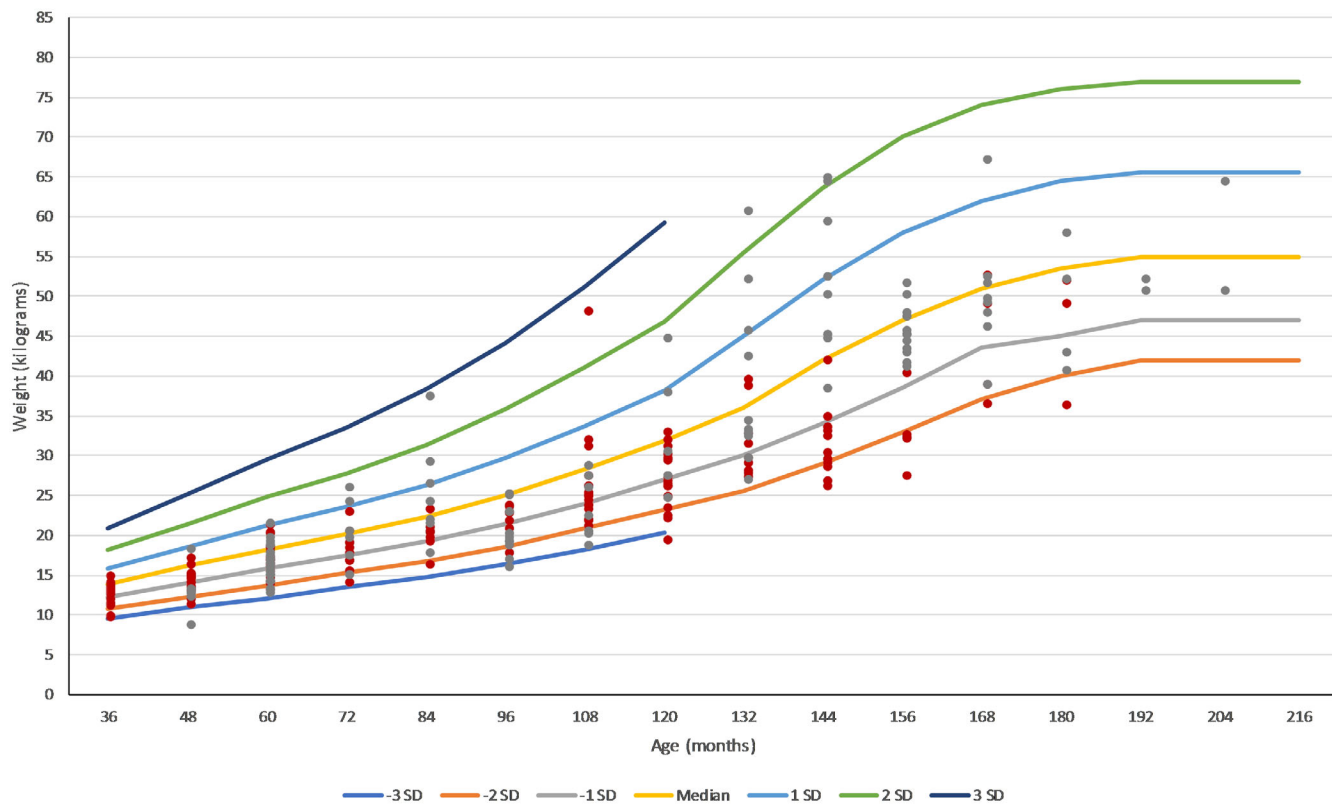


**FIGURE 4** Female heights from children in Nubri (red circles) and children attending boarding schools in Kathmandu (gray circles). Reference lines representing the WHO growth reference standards for  $-3$  to  $+3$  SD are shown for reference





**FIGURE 5** Male weights from children in Nubri (red circles) and children attending boarding schools in Kathmandu (gray circles). Reference lines representing the WHO growth reference standards for  $-3$  to  $+3$  SD are shown for reference

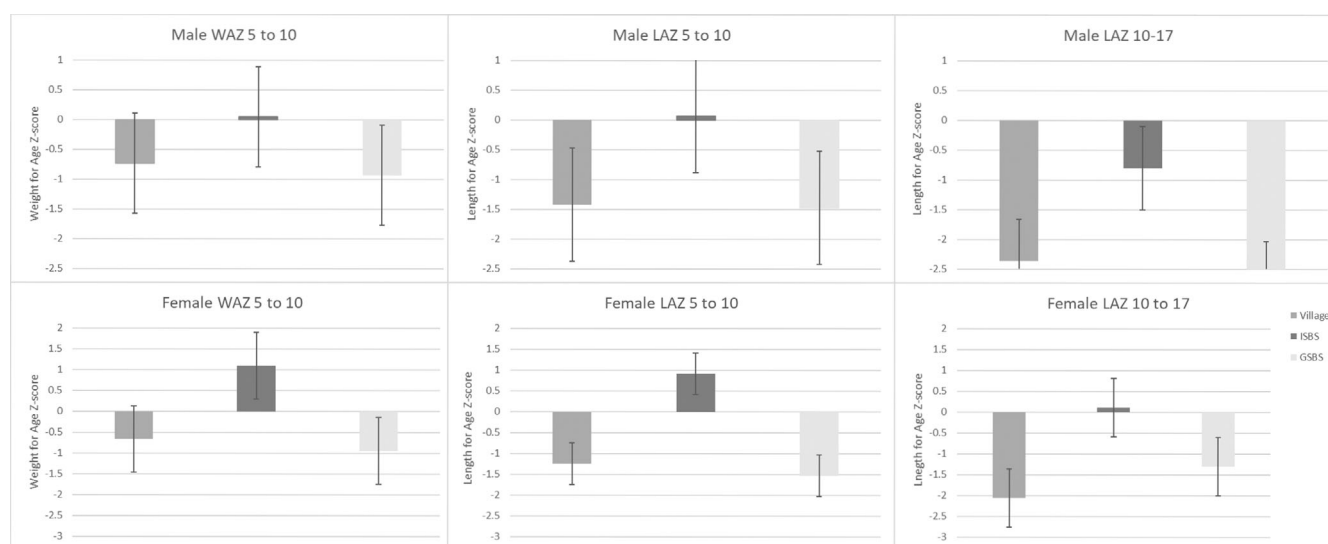


**FIGURE 6** Female weights from children in Nubri (red circles) and children attending boarding schools in Kathmandu (gray circles). Reference lines representing the WHO growth reference standards for  $-3$  to  $+3$  SD are shown for reference

**TABLE 2** Comparisons by sex for children over the age of five living in their natal villages or in boarding schools in Nepal

Variable	Males in village (n = 89)		Males in boarding school (n = 124)		p diff	Females in village n = 119		Females in boarding school n = 122		p diff
	Mean	Std.	Mean	Std.		Mean	Std.	Mean	Std.	
Age (years)	8	2.9	10.15	3.59	0.000	8.8	2.1	9.1	3.6	0.317
Weight (kg)	23.2	7.5	28.6	10	0.000	25.9	8.3	30.9	15.1	0.001
Height (cm)	117.2	14.1	128.3	17.4	0.000	123.5	14.7	128	22.8	0.034
MUAC (cm)	18	2.5	19.5	2.6	0.000	19.3	2.8	19.4	3.5	0.655
Triceps (mm)	9.3	3.6	12.8	4.3	0.000	9.5	3.1	14.7	4.8	0.000
WAZ*	-0.71	0.85	-0.78	0.91	0.321	-0.668	0.885	-0.609	1.178	0.721
HAZ	-1.62	1.06	-1.67	1.16	0.373	-1.394	1.057	-0.797	1.407	0.000
BMI	16.5	2.6	16.8	1.8	0.227	16.5	1.7	17.6	2.9	0.000

Abbreviations: HAZ, height-for-age z-scores; WAZ, weight-for-age z-score.

**FIGURE 7** Comparative graphs for weight for age Z-scores for children age 5–10, and length for age z-scores for ages 5–10 and 10–17 comparing the three educational groups in this study (village, ISBS, GSBS). GSBS, group sponsored boarding schools; ISBS, individual student sponsored boarding schools

boarding schools had significantly higher height, weight and BMI compared to females who remained in the villages (Table 2).

### 3.4 | There will be no differences in children's WAZ or HAZ between boarding school types in Kathmandu

The majority of children in this sample of educational migrants attend a GSBS (73.2%). Slightly more males attended GSBS compared to females; twice as many females as males attended ISBS. Children attending GSBS were significantly younger than children attending ISBS ( $8.54 \pm 3.5$  vs  $11.6 \pm 3.5$  years;  $p < 0.000$ ). Females attending GSBS were significantly younger than males attending GSBS ( $7.1 \pm 3$  vs.  $9.69 \pm 3.4$ ;  $p < 0.000$ ) while there were not significant differences

in ages of children attending ISBS ( $11.6 \pm 3$  females vs.  $11.5 \pm 4.5$  males;  $p < 0.881$ ).

Among males, attending an ISBS was associated with increased HAZ and WAZ compared to village peers—the only category in which males showed any improvement in WAZ or HAZ (Figure 7). Males attending a GSBS had lower HAZ compared to both village and ISBS peers. Among male children living in villages, age explained 13.3% of the variation in HAZ, while for those attending GSBS age explained 35.4% of the variation in HAZ, suggesting that the GSBS was associated with increased risk of lower HAZ compared to village peers. WAZ was not significantly associated with age for males in either type of boarding school.

For females, attending an ISBS was associated with improved HAZ; females attending ISBS had higher HAZ than village or GSBS children. WAZ was also lower in females attending boarding schools



compared to females in villages, although again this was driven by the larger number of children attending GSBS who had reduced WAZ compared to village peers while children attending ISBS had higher WAZ (Figure 7).

Within the two groups of boarding schools, females attending a GSBS had a 0.33 increase in reference HAZ score compared to village peers while those attending an ISBS had an enormous increase in HAZ score compared to village peers. As WHO reference values for WAZ were only available through age 10; WAZ analyses were not available for older children.

## 4 | RESULTS SUMMARY

In the group of children over the age of five, there was no significant difference in size for age between males who migrated out for education compared to males who remained in Nubri. In fact, although the differences were not statistically significant, males attending GSBS had lower average HAZ scores than males who remained in the villages or attended ISBS. For females, educational migrants had greater HAZ scores compared to village peers and females attending ISBS had the highest HAZ scores of any group.

## 5 | DISCUSSION

**Research question 1.** *What is the nature of the association between altitude of current residence and height-for-age or weight-for-age z-score.*

It is likely that the underlying mechanisms contributing to variability in child size have multiple and complex associations with ecological stressors such as infectious disease burden (Beall, 2013; Wiley, 2004) and nutrition (Frisancho, 1970; Leonard, 1989; Leonard et al., 1993). This study did not find significant differences in child size between children living in natal villages or attending group sponsored boarding schools in Kathmandu for age for children over the age of 5. While attending an individual sponsored boarding school was associated with increased size, the inconsistencies in growth improvement between the two schools suggest that the picture of high-altitude child growth is more complicated than simply being about measures of high altitude. It is far more likely that the underlying mechanisms contributing to variability in child size have multiple and complex associations with ecological stressors such as infectious disease burden (Beall et al., 2013; Wiley, 2004) and marginal nutrition (Leonard et al., 1993).

Our own work among children under the age of 3 in these communities (Quinn & Childs, 2020) has also demonstrated a lack of altitude effect when engagement in high-value trade (tourism and medicinal plants) are included. While a few studies have reported associations, these studies fail to adjust for other potential confounders such as nutrition or economics (Dang et al., 2004; Wang, Medina, et al., 2016) or have looked only at one individual component of height, such as leg length. Overall, there is an extensive body of evidence supporting a lack of

altitude with height for age in older children and adolescents. Numerous studies looking at economic development, improvements in infrastructure and healthcare access in high altitude adapted populations have shown secular trends in height (Gonzales et al., 1982; Gonzales et al., 1984; Hoke & Leatherman, 2019; Leonard et al., 2000), including short term fluctuations reflecting periods of political or economic instability (Oths et al., 2018).

Growth at altitude cannot be assessed simply in relation to height above sea level because, in fact, it involves a complex and unique combination of stressors including cold temperatures, chronic under-nutrition, reduced ecological productivity, chronic hypoxia, infectious diseases, and historical processes that may serve to marginalize alpine communities.

Constraints on agricultural production at high altitude settlements in Nepal are also mitigated by a subsistence strategy that relies heavily on trade. Highlanders in the Himalayas and Tibetan Plateau typically link their economies with lower-lying regions through trade. Many settlements in Nepal are positioned between mountain passes through which goods from the Tibetan Plateau, such as wool and salt, were until recently exchanged for lowland products, such as rice. In Nubri's highest villages people acknowledge their agricultural shortfalls through the oft-repeated phrase, "We trade or we starve" (Childs, 2004). High-altitude dwellers in Nubri, and elsewhere augment their food supply by profiting as middle-men in trans-montane trade (Fürer-Haimendorf, 1975; Fisher, 1986). Trade has become especially important to local economies in recent years. Pastures owned by the highest villages in Nubri (and elsewhere in Nepal, Bhutan, and across the Tibetan Plateau) are now prime collection grounds for yartsa gunbu (*Ophiocordyceps sinensis*; a caterpillar fungus complex), a medicinal substance prized in China since the early 2000s for its perceived efficacy in improving longevity and virility (Childs et al., 2014). Income generated by the sale of yartsa gumbu is available only to residents of the highest villages in Nubri; it is now used to purchase food from neighboring markets in the Tibet Autonomous Region of China. In this case, trade can level inter-village nutritional variation. People at the highest elevations do not grow enough food to subsist but can earn more than enough to fulfill their food requirements. People at the lower elevations can produce an agricultural surplus, but their ability to supplement locally grown nutrients is restricted by sparse income opportunities.

### 5.1 | Sex differences in WAZ or HAZ between male and female children

In the absence of clear sex preferences for male children, a recent meta-analysis found that male infants and children were more likely to be malnourished and stunted compared to females (Thurstans et al., 2020), which may explain the lower WAZ and HAZ scores for males in this sample. While historically sons were favored over daughters in many Tibetan societies, this does not appear to be the case in Nubri any longer, as both sexes were equally likely to migrate for education with one exception: eldest daughters.

Elder daughters are more likely to remain in villages than later born daughters or any sons, a practice Childs and Choedup (2018) speculate reflects the necessity of the daughter's labor in the household, especially for facilitating care of small children. Levine (1987), in her work on differential childcare in Tibetan societies, reported that historical patterns of child mortality were not shaped merely by son-preference but also by economic pressures – households with increased access to childcare, such as older daughters, grandmothers, and aunts, had lower morbidity and mortality among children. Retaining an older daughter in the household then, may be a practical strategy to facilitate child survival and/or improved child size (although recent child care collectives at the village level may serve a similar function); sons are more likely to be recalled to villages at older ages to facilitate household succession responsibilities to the community (Childs & Choedup, 2018).

**Research question 2.** *Are there differences in height for age and weight-for age z-scores between children remaining in their natal communities for education and children migrating out for education?*

The initial analyses identified significant differences in size for age between older children attending boarding schools and their peers who remained in their natal villages. However, there were no such patterns among younger children. We hypothesize that all educational outmigration may not be equal: the type of boarding school environment may play a crucial role in determining the impacts of migration on child size.

Although we were unable to access the duration of time children had spent in boarding schools, there were some differences in the educational recruitment practices between individual-sponsored and group-sponsored boarding schools. ISBS schools will enroll children around ages 7–8 whereas GSBS will enroll children starting at age four. The GSBS school had opened within the last year and recruited many children from Nubri who may have been out of their natal villages for only a few months at the time of measurement, potentially biasing results, although many had been in other boarding schools in either Nubri or Kathmandu. Further, the proximity of the measurements to the devastating 2015 Nepal earthquakes, the epicenters of which were very close to Nubri, likely inflated the number of recent out-migrant children in the GSBS sample, while the ISBS sample would have had students in place well before the earthquakes. In particular, young monks from one of the monasteries in Nubri had been brought to the GSBS for education while the earthquake damage to the monastery was repaired.

Nelson (2016) has written on the importance of understanding the context of institutional care on children's health in Jamaica. Among children residing in orphanages, those in group homes oriented toward a family care model have improved size for age compared to children in more traditional orphanages. While the boarding schools are not orphanages, they do serve similar institutional functions in the context of educational migration and may provide an important lens to better understand the ways in which institutionalized

care impacts children's growth and health. Previously, in ethnographic work in these schools, children have reported not seeing parents or natal villages for a decade or more as well as language loss that impairs ability to communicate with families and natal communities (Burack et al., 2023). In ISBS, formal and informal mentoring support networks are established for newly arriving students that pairs each new student with an older student from their natal community who can provide direct care, emotional support, and help facilitate communication with parents (Burack et al., 2023). Such practices by the ISBS, including supplementing additional food, nutritional supplements, and counseling, mirror those practices that Nelson (2016) described as improving child growth in institutional care contexts in Jamaica. Children attending ISBS have access to health clinics staffed by licensed nurses within the school, while children attending GSBS are cared for by lay staff and receive medical care outside the school as needed (Jhangchuk Sangmo, personal communication with school staff).

The children attending GSBS are younger than children attending ISBS, especially males. Some of this may be an artifact of the 2015 Gorkha earthquake, which forced relocation of many male children training as monks from village monasteries into the secular GSBS, although the ISBS also provided secular education to young monks from nearby monasteries. As noted above, the children also tend to come from poorer households, which may have contributed to early differences in child HAZ and WAZ. Ethnographic research in the different school types identified greater dietary diversity in the ISBS, greater access to hygiene support (heated showers, clean toilets, less crowded dormitories), and school-based healthcare that may have reduced the burden of infectious diseases and facilitated growth in these contexts (Observations by Jhangchuk Sangmo and Sarah Burack). As discussed previously, the context of care in the educational facilities may have important impacts on child growth and health (Nelson, 2016), and on children's mental health.

Beall (2013) cautions that one must consider how both biological and cultural adaptations may ameliorate different stressors associated with altitude. This study removes some of these barriers, however based observations with children at the two boarding schools, infectious diseases are much more common in the group boarding schools compared to the villages or individual boarding schools. Chronic immune activation, as suggested by the reports and observations in the GSBS may limit energy available for growth, forcing reallocation of finite energy toward immune activation.

## 5.2 | Potential economic influences on school choice and child growth

Childs and Choedup (2018) have documented wealth effects on educational migration that may also provide insights into these differences. As referenced in the introduction, ISBS tend to depict rural Himalayan villages as highly impoverished areas with minimal social stratification; however, this is not an accurate depiction of these communities. New economic opportunities, such as trekking and gathering plants for Chinese medicine (*yartsa gunbu*; *Ophiocordyceps sinensis*),

have dramatically increased economic opportunities in these communities (Childs et al., 2014). Villages have considerable social stratification and wealth disparities which in turn shape educational migration. Children from families with greater wealth are more likely to attend ISBS (Childs & Choedup, 2018) reflecting increased ability to use social ties to family or friends in Kathmandu in order to locate sponsors for their children's education. Children from poorer families or from lower social castes (such as Kami; a group that was occupational caste of blacksmiths and their families and historically excluded from legal rights, education, temples, and homes across Nepal and India), without these social networks, are more likely to attend GSBS or remain in the villages into older ages. Until recently, children from the lowest social castes were even excluded from village schools but progressive head masters and lamas (religious leaders) have worked to end these discriminatory policies (see <https://youtu.be/8aoKy7UEOIs> for an interview with a boarding school headmaster in Sama).

Children attending ISBS may have already had better growth than children who remained in villages or attended GSBS simply reflecting greater household resources available to children in early life. We have previously shown however, that there were no differences in WAZ or HAZ among children two and under in Nubri by degree of village participation in trekking—that is, children living in villages on the main trekking route were not taller or heavier than children living off the main trekking route; however as not all households within a village will participate in trekking, village level analyses cannot get at the household level dynamics in wealth disparities within villages. In villages directly on the trekking routes, wealthier families may run lodges or small shops, while poorer households may be excluded or limited to portering jobs carrying loads between villages or to the base camp on Manaslu (Kutang 1). As such, the lack of association between village, altitude, and child WAZ or HAZ is not surprising given the social stratification within villages.

High-altitude villages also have access to high pastures where *yartsa gunbu*, a fungus that parasitizes and mummifies the larva of several species of Thitarodes, forming fungus-caterpillar complex, can be harvested. *Yartsa gunbu* is highly valued in Chinese medicine and represents a significant source of income for high-altitude villages in Nubri (Childs et al., 2014). In their work on the economics of *yartsa gunbu*, Childs et al. (2014) found that earnings over what the household needed to survive were frequently invested in livestock or children's education, both of which may impact child health and size for age. Hoke (2017) has shown among high-altitude herders in Peru that increased participation in dairy production was associated with greater HAZ and WAZ for age among children, and similarly, larger herds and increased access to animal milk may contribute to improved nutritional status among wealthier households.

### 5.3 | Children's narratives of educational migration

Additional context for understanding children's lived experiences of educational migration comes from multiple sources with our expanded work with the communities in Nubri. Childs and Choedup (2018), in their work among adults on migration and education, found that while

many of the families sending children out for education were deeply concerned for their children most saw fewer other options. Education has historically been highly valued in Tibetan (and Nubri) society, and the recent emphasis on secular boarding schools in Kathmandu for education is the current manifestation of these values with opportunities for greater educational inclusion of females. Contemporary religious leaders, such as monks and lamas from the communities, frequently speak to the benefit of education, and the difficulty in balancing community, family, and educational opportunities that parents and children must navigate (Childs & Choedup, 2018).

In 2018, as part of ongoing research into children's health, we conducted research using the participatory method of drawing (Hunleth, 2011), accompanied by interviews with children about their drawings (Burack et al., 2023). This is a common technique in research with children (Pridmore and Benelow, 1995; Backett-Milburn and McKie, 1999; Mitchell, 2008; Hunleth, 2011; Johnson et al., 2013; Angell et al., 2015). Participating children were given paper, colored pencils, and instructions in English, Nepali, and/or Nubri-K. Researchers then asked each individual their preferred interview language and audio recorded brief interviews in which the children explained their drawings. Observations during the drawing sessions by the Nubri researchers were integrated into the analyses, described in detail in Burack et al. (2023). Children were asked to draw based on several prompts organized around themes of “coming to school,” “daily lives,” “families,” and “future plans.”

One student, a 16-year-old female noted “Sometimes we read books but still our mind goes to village and makes worried how my parents are doing at the village. I feel worried and I don't know what they're doing. It's very hard. Because my mom and dad lots of work to do and no kids to help them. I think they are facing a very hard time there. I have 3 siblings. All are studying. One of my sister is in the village but she is also in school.” Another student, male aged 15, said “here is a picture, this is the first time I came to school. It was very difficult for me. At that time so unhappy because there were no friends, after one year I made new friends. After that I am very happy here.” (Figure 8).

These adolescent voices, which tended to dominate the interviews, articulated the long adjustment process that many children experience in the boarding schools. Many children referenced an older sibling, cousin, or teenager from their natal village that served as a crucial support person for the individual during the transition, especially with managing language barriers. Another 15-year-old girl commented, “When I was very young my father and mother had already got divorced so that's why only my mother comes. Then my older brother was already in a monastery as a monk and the other brother was in this school. I was the youngest one and in the village. When I was 6 I got a sponsor and my mother and I came here. My mother took me to the school and she said “you stay in the gate, I'll go to buy momo and come” and when everyone is small everyone loves momo. And my mom went and did not come back and I was waiting (individual went on to say she cried for 1 year).

By comparison, in village schools, few children reported crying or being upset when starting school. Many children will start as day



**FIGURE 8** Drawing by a male student describing his experience with coming to boarding school. He said “And walking to village to Arugat took us like 3 days. And then when we reached Arugat, it was 2006, there some revolution so there was a bandh (protest), so because of the bandh from Arugat to Kathmandu we had to walk. So my father took me to school and he returned back and he stayed two or three days in Kathmandu and he went back to the village by walking from Kathmandu. So when I was left in school I felt so lonely I cried two or three days. There were a lot of friends but they didn't know me, all of them were from different villages and there were only a few from our village and most of them are from upper village. So I didn't talk with them much, I stayed alone. Slowly after a week, and month, I made so many friends and cooperate with them. And like that, 11 years I stayed in the hostel.”

scholars, living at home and attending community schools during the day and are frequently surrounded by neighbors and relatives in school. Other students may board at in village schools and return to their natal villages for weekends or holidays. Most students reported school being “more fun” than home, which was interpreted by the research team to reflect the greater opportunity for leisure activities, such as football, cricket, drawing, and reading while boarding at school compared to being at home where children's time would be spent collecting firewood or hauling water from community taps.

## 6 | IMPLICATIONS

Our research has both theoretical and practical implications. On the theoretical side, child growth is but one measure of child health and development, and in this study, we have shown that altitude is not a risk factor for sub-optimal height or weight among children ages 3–16. Younger children who have left natal communities for education have lower height and weight for age z-scores (WAZ) compared to peers who remained in communities until older ages, while older children in boarding schools show improved weight and height for age compared to peers remaining in natal villages. Some of this may reflect bias in the sample, as children who remain in village may be different in other measures from children who are sent out for education. Among older children, we have documented uneven experiences of educational outmigration and growth suggesting that the removal of altitude-related stressors alone is not a panacea but is part of a

larger—and much more complicated—set of experiences that contribute to growth, development, and health.

On the practical side, the findings that earlier educational migration is associated with only modest improvements in size for age for females and no improvements for males suggest that an educational strategy predicated on rural to urban migration of very young children is less than ideal. This finding, along with the recent improvement in health care programs in Nubri and the related sharp drops in infant and childhood mortality, makes it unreasonable to assume that children are better off growing up in Kathmandu—a city renowned for toxic air (Saud & Paudel, 2018) and a water supply contaminated by sewerage, pesticides, and an array of other pollutants (Warner et al., 2008). Furthermore, studies elsewhere have raised concerns about the psychological, emotional, and social consequences of raising children in boarding schools far away from their families. Based on research among boarding school students across the globe, one should not assume that the effects are negligible because they could include trauma associated with the loss of primary attachment to parents, anxiety, depression, and other mental health issues (Schaverien, 2011; Wahab et al., 2013; Agmon et al., 2015; Wang, Liu, et al., 2016). In the case of Nubri's children, we can add to this list an array of social repercussions including the weakening of family ties, the diminishing ability for out-migrants to speak the local vernacular, and the loss of cultural knowledge that has been transmitted intergenerationally for generations (Childs & Choedup, 2018). More research with these children is needed to fully understand the implications of educational out-migration on their psychological well-being.



Further, while the boarding schools that participated in this project were all organized by Buddhist leaders and provided both secular and non-secular education in Tibetan Buddhism, the natal religion of the children, there are many boarding schools recruiting Himalayan children with an emphasis on religious conversation (Coburn, 2017). Cultural loss, including the local dialect of Tibetan, is already documented among Himalayan educational migrants (Childs & Choedup, 2018) and that is within the context of Tibetan Buddhist institutions. Among other institutions, cultural loss and assimilation in Nepali society and Western models of Christianity are far more likely. Schilling (2020), writing in *Indian Country Today*, compares similar practices targeting ethnic minorities across Southern Asia to the cultural assimilation through education practices by residential boarding schools in the United States and Canada which have contributed to intergenerational trauma and cultural loss among Indigenous North American communities (Yellow Horse Brave Heart, 2011; Evans-Campbell, 2008; Gone, 2013). Granted, the family separation circumstances of Native American and Nubri children differ considerably: the former was often coerced and inseparable from colonizing policies that emphasized culture change as a core objective, the latter is mostly voluntary and often includes the cultivating of cultural continuities within broader Tibetan society. Nevertheless, we simply do not know the mental health implications of family separation for Nubri's children.

When the outmigration phenomenon gained momentum two decades ago, conditions in the village may not have been ideal for childhood growth and development. But the situation has changed since then. Nubri has a network of health posts maintained by reputable non-profit organizations, as well as four boarding schools that are managed at the community level with the aid of foreign financial backing and allow children to both participate in education, their natal communities, and have access to family. In addition to benefiting childhood growth and development, the traditions and social fabric of rural communities—now under immense strain due to the high level of educational outmigration—would be more sustainable if the educational infrastructure allowed families to remain intact for longer durations, with educational out-migrated delayed until later ages. Although children would eventually need to go to the city for further education, keeping them in the valley for as long as possible could benefit individuals and communities alike. One program that has met with considerable success has been a partnership between Shree Gauri Shankar Basic School in Nubri and a Nepali NGO that matches any child completing grade 5 with a sponsor to attend boarding school through grade 10 (school leaving certificate), thus allowing even the poorest children access to the social networks that facilitate educational outmigration.

## 6.1 | Summary of primary research findings

In this study we found mixed results for WAZ and HAZ among Nubri's children who migrated to urban areas for education. Children in ISBS schools had greater size for age compared to peers in GSBS or who remained in the village, but village children had larger size for age than

children attending GSBS. Some of this may reflect dedicated specialized care received by rural students when they arrive at ISBS. School administrators described common protocols such as treatment for parasitic infections, multivitamin supplements, and protein supplementation that may act to promote child growth.

This study found that all educational migration of young children is not equal in regards to improving or reversing growth faltering or other associated reductions in size for age. In fact, there seemed to be important health implications of sending very young children (ages 5–9) out to boarding schools with regards to WAZ and HAZ—children under age 9 had lower WAZ and HAZ than children still in their natal villages. In the expanded narrative drawing project briefly described here, children in the ISBS described later ages at out-migration and expanded support networks by kin and “village” kin—older adolescents from their natal village who served as support systems.

Among the male adolescents, attending an ISBS was associated with increased HAZ; males attending GSBS did not show differences from village peers. These findings suggest that while cultural buffering of males may not be common in Tibetan communities, males are capable of catch group growth in later childhood following improved nutritional condition. The absence of these improvements in GSBS and village males suggest that the improvements in height are context dependent. The majority of males remaining in villages after the age of 10 are training as Buddhist monks and living in religious schools which may impact results. For example, during the time this study was running, one monastery was constructing heated showers for winter bathing of the young monks, as they had identified concerns about disease spread and the inability to bathe during long, freezing winters. Such innovations may act to improve child growth among village males by reducing infectious disease burdens and consequently improving nutritional status.

## 7 | AFTERWORD—EDUCATION AND MIGRATION IN THE CONTEXT OF COVID-19

During the time this manuscript was under revision and being revised, Nepal began to report increasingly large number of SARS-CoV2 cases. The resulting outbreak led to the closure of boarding schools in Kathmandu, first in 2020 and again in May 2021. Adolescents have been retained in Kathmandu to complete national educational exams while younger children have returned to their natal villages and community schools for education. As of final publication, many boarding schools have been able to reopen and new educational initiatives to increase access to education is currently underway (Jhangchuk Sangmo).

### AUTHOR CONTRIBUTIONS

**Elizabeth A. Quinn:** Conceptualization (equal); data curation (equal); formal analysis (lead); funding acquisition (equal); investigation (equal); methodology (lead); project administration (lead); supervision (equal); writing – original draft (lead); writing – review and editing (equal). **Jhangchuk Sangmo:** Data curation (equal); investigation

(equal); methodology (equal); project administration (equal); visualization (equal). **Sarah Burack:** Investigation (equal); methodology (equal); visualization (equal); writing – review and editing (equal). **Geoff Childs:** Conceptualization (equal); data curation (equal); formal analysis (supporting); funding acquisition (equal); investigation (equal); methodology (equal); project administration (equal); supervision (equal); writing – review and editing (equal).

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## CONFLICT OF INTEREST

The authors have no known conflicts of interest.

## DATA AVAILABILITY STATEMENT

De-identified data from the research is available upon reasonable written request after review by the authors and approval by the communities and schools that participated in this research.

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