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From the Editor-In-Chief

The papers in this issue of *World Health & Population* provide a stark reminder of the relevance and importance of social determinants of health (SDOH), as well as evidence of the large effect these have on the health and well-being of individuals. As we push forward with the advancement of Sustainable Development Goals (SDGs), Universal Health Coverage (UHC), Primary Healthcare (PHC) and other global agendas, it is essential to understand that, in addition to discussions regarding health services, we must attend to SDOH.

The World Health Organization (WHO) defines SDOH as: "The social determinants of health are the conditions in which people are born, grow, live, work and age. These circumstances are shaped by the distribution of money, power and resources at global, national and local levels" (WHO 2008).

SDOH are any economic and social conditions that affect the health status of individuals and communities. Factors such as education, income, housing and environmental infrastructure contribute to the health status of people. It is estimated that only 25% of a person's health status is determined by the health services that they receive and that the remaining is a combination of their genetic composition and the SDOH that they experience, which are often shaped by policies.

The papers by Olorunlana et al. (2016), Safari et al. (2016) and Ciarmela et al. – from Nigeria, Iran and Argentina, respectively – clearly demonstrate the importance of education, literacy, income and basic infrastructure (such as access to clean water) as crucial determinants of health. In the manuscript by Safari et al. (2016), only 20% of the pregnant women surveyed were aware of the need for antenatal care. Although some efforts are made in Iran to provide the correct services, programs and infrastructures, it is crucial to understand the role and importance of cultural and traditional beliefs on these services and how community engagement and education can contribute to the uptake of the desired practices, whether it is the use of clean water or prenatal care. The influence of tradition and cultural practices on individual's actions and behaviours is not studied sufficiently, despite its importance. We need to have a better understanding of this area so that we can integrate the knowledge to appropriate interventions at the community level. At the same time, there is a need to increase the awareness that a sick child does not necessary show the signs of illness, just as Ciarmela and colleagues (2016) point out in their paper. Their research shows that apparently healthy children can suffer from anemia and parasitic infections unnoticed by conventional public health system.

The collection of papers in this issue also serves as a reminder that, although interventions to prevent and treat communicable diseases exist, these diseases are – unfortunately – still rampant and hundreds of millions of people are infected. Although the attention of many countries and global

organizations like the United Nations (UN) and WHO is increasingly focusing on the burden of non-communicable diseases, we have to realize that infectious diseases are still an issue and we must ensure appropriate interventions and policies are in place to support solutions for all diseases.

Other significant issues that we need to address include how to achieve the progress we aim for with the SDGs, UHC and PHC agendas and how we evaluate and measure this progress. The paper by Nickanor and Kazembe (2016) flags some significant issues. The malnutrition situation and undernourishment of children in this study got worse and not better between 1992 and 2006. This regression in health status occurred while we were aiming to achieve the UN's Millennium Development Goals (MDGs) by its set deadline of 2015. Billions of dollars in aid and development were invested to this aim, so where did we go wrong and how can we make sure that all of the good intentions, visions, global declarations and funding take us to the right outcomes?

It is my opinion that, without a solid integration of social, economic and health agendas with rigorous monitoring and evaluation, we might find the world population not achieving the desired levels of health and well-being.

WHO says that: "This unequal distribution of health-damaging experiences is not in any sense a 'natural' phenomenon but is the result of a toxic combination of poor social policies, unfair economic arrangements [where the already well-off and healthy become even richer and the poor who are already more likely to be ill become even poorer], and bad politics." (WHO 2016.)

As you read the papers in this issue of *World Health & Population*, keep some of these questions in mind and lets make sure that we move forward in a more-integrated manner where health, social and economic drivers are all taken into account.

Judith Shamian RN, PhD, FAAN
Editor-in-Chief

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Increasing Levels of Urban Malnutrition with Rapid Urbanization in Informal Settlements of Katutura, Windhoek: Neighbourhood Differentials and the Effect of Socio-Economic Disadvantage

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Abstract
Rapid urbanization and increasing urban poverty characterize much of Southern Africa, resulting in poor urban health. This study investigates inter-urban differences and determinants of undernutrition among marginalized communities. Using the 1992, 2000 and 2006/2007 Namibia Demographic and Health Survey data, we fitted hierarchical random intercept logit models, applied at 52 enumeration areas

in the capital city (Windhoek), to estimate trends in undernutrition, and investigate risk factors associated with stunting and underweight. Findings demonstrate that undernutrition among children has risen (7.4% to 25.1%, $p<0.001$ for stunting; and 9.7% to 17.6%, $p<0.001$ for underweight, between 1992 and 2006/2007). The risk was pronounced for children from socioeconomically disadvantaged households (OR=1.53, 95% CI:[1.01, 2.31] for stunting and OR=2.16, 95% CI:[1.03, 4.89] for underweight). Evidence emerged of intra-urban variation in undernutrition. We argue that with increasing urbanization, comes the challenge of food insecurity and, consequently, malnutrition. For improved child health, urban planners should have targeted interventions for poor urban households and deprived neighbourhoods.

Introduction

Until recently, rural areas were considered the epicentre of poverty and malnutrition. Even the proposed solution to food insecurity is entrenched in "increasing productivity of small-scale farmers" (Sanchez et al. 2009). Moreover, most measures of poverty, whether based on income, consumption or expenditure, show that rural poverty is deeper and more widespread than in the cities (World Bank 2013). However, there is now evidence that although urban centres on the whole offer better access to health, education, basic infrastructure, information, knowledge and opportunity, poverty is now increasing more rapidly in urban areas than in rural areas, especially in Africa, and most assessments underestimate the scale and depth of urban poverty (Haddad et al. 1999; Kessides 2005; Mitlin and Satterthwaite 2011; Satterthwaite et al. 2010).

Particularly, in many countries in Southern Africa, urban populations have increased, with some having reached proportions above 50%. Since 2010, 59% of Southern Africa Development Community's (SADC) population lived in urban areas, and this figure is projected to reach over 75% by mid-century (UN-Habitat 2010), and poverty and associated health problems are likely to increase. Recent studies show that Southern Africa is urbanizing rapidly (Crush 2012), urban poverty and malnutrition is growing (Haddad et al. 1999; Potts 2006) and the poor are migrating faster than the non-poor (Ravallion et al. 2007), increasing the proportion of urban poor. Namibia is no exception to these changes. Although urbanization and modernization are associated with increased income and improved nutrition, what is not clear is whether the urban poor, particularly those in the informal settlements, are reaping the benefits of the urban advantage and the increase in per capita income[1] or they are bypassed by this growth, especially given the rising income inequalities, which manifests in food insecurity and child undernutrition (Antai and Moradi 2010).

Food insecurity, which is defined as "access by all people at all times to sufficient food for an active healthy life" (FAO 1996), implies that food has to be available and accessible. In urban areas, the most source of food insecurity is accessibility (Crush and Frayne 2011), which is determined by lack of income rather than availability. Hunger and starvation represent the most severe forms of food insecurity. Food and Agriculture Organisation (FAO) estimated that nearly one billion people worldwide (14% of the world's population) are undernourished owing to insufficient access to energy- and protein-rich foods (FAO 2009). Undernutrition is defined as the outcome of insufficient food intake and repeated infections (UNSCN 2012). Undernutrition in adults is measured by the body mass index (BMI), with individuals with BMI of 18.5 or less being considered as underweight.[1] Urbanization is associated with changes in diets (especially in the developing world, which is now producing

a second "silent emergency" – overnutrition or obesity). Whereas obesity was once associated with rising incomes and industrialized countries, this is no longer the case. In Brazil, Monteiro et al. (2004) discovered that obesity was increasing among low-income women and decreasing among high-income women.

Similarly, for the poor areas in urban centres, there is a likelihood that the malnutrition might be on the rise owing to problems of inability to afford diverse diet. While there exist growing literature on the investigation between family/household income and the health status of children (Crush 2013), that greater resources at household level will increase the ability of household to acquire more calories and that parents and, in particular, women invest more in nutrition and child health (Levin et al. 1999), it remains unclear whether increased income improves nutritional status among urban poor, in particular the children. Lack of disaggregated data within the urban areas tends to mask these differences. Smith et al. (2005) illustrate these intra-urban differentials that urban children in the lowest socioeconomic quintile in some countries of Latin America had up to 10 times the risk of stunting than children in the highest quintile.

Urbanization and informal settlements in Windhoek, Namibia

During the apartheid colonial rule of Namibia by South Africa and in particular after 1948, the South African National Party began to implement its urban apartheid policy in Windhoek. Whereas white immigration was encouraged, especially between 1946 and 1960, leading to the significant proportion of the white population (6,985 to 19,378), at the same time, pass laws were implemented to control the influx of the black population to Windhoek, and the population stood at 13,935 in 1960. In 1959, the black residents of Windhoek were forcibly moved to a new place, Katutura, north-west of the city, to make way for the white population, as the blacks occupied the area of Hochland Park, which was considered suitable for whites (Pendleton 1996). They were moved to Katutura, which literally mean "a place where we will not stay." By 1981, the population of Katutura had escalated to 44,000 primarily through rural–urban migration. From then on, the black population in Windhoek continued to grow rapidly, and it almost doubled between 1981 and 1991 from 44,003 to 86,640. This unprecedented urban growth also meant that Windhoek's population grew as a proportion of the national population from 10.4% in 1991 to 12.4% in 2001 and to 16% in 2011. The 2011 census estimated Windhoek's population at 322,500, up from 230,000 in 2001 or an annual growth rate of 4%, making it one of the fastest-growing cities in Southern Africa. Today, the city is home to 36% of the total urban population.

Katutura today is divided into six constituencies and those at the peripheral areas, i.e., Tobias Hainyeko, Samora Machel and Moses Garoeb, are dominated by black population with lack of or low income, and most of these residents are recent migrants. During the period 1991–1994, the City of Windhoek established three reception areas to temporarily accommodate the new influx of poor migrants. However, within and outside these established areas, the number of informal housing continued to grow rapidly. The city found it difficult to keep people out of the designated reception areas, and major land invasions occurred prior to site layout and rudimentary construction (Mitlin and Muller 2004). The uncontrolled, unauthorized and unplanned occupation of land by unemployed rural–urban migrants continues even today. It is estimated that by 2011, about 114,000 people were living in shacks, an increase from 48,000 in 2001 (City of Windhoek 2005; NPC 2001). This translates to informal settlements growth of 9% per annum, a rate more than double that of the city (City of Windhoek 2012).

Unemployment is estimated at 40%. Given these living conditions, the increasing level of unemployment, the increased urbanization and the growth of the informal settlements have serious implications on the nutritional status of children.

Food production in Namibia is influenced by natural rainfall, and national cereal production fluctuates according to rainfall patterns. The cultivation of rain-fed crops is regionally concentrated and is primarily confined to the north-central and north-eastern communal areas, though a small but significant area of commercial maize production is found in the so-called maize triangle, i.e., Otavi, Tsumeb and Grootfontein areas (Sweet 1998). Considering Namibia as a whole, food availability is not a problem, as the country depends on food imports to ensure food security for its inhabitants. However, food security is a concern in a number of households.

A study in the non-formal areas of Windhoek found that the prevalence rate of wasting was 19.7% higher than that reported by the 2000 Namibia Demographic and Health Survey (NDHS) of 9% (Ochurus 2007). Similarly, stunting was reported to be 28.8%. The same study reported that wasting in one of the informal settlements stood at a high of 52.2%. Causes of malnutrition in the informal settlements were discovered to be unemployment and low income levels. Unemployment rate in the Khomas region, where Windhoek is located, stood at 22.3%, translating to 46,849 peorsons (NSA 2015); however, official unemployment in the informal settlements is high (at around 40%). Windhoek's population has increased from 235,500 in 2001 to 340,900 in 2011, with an annual growth rate of 5% and a total urban population of 36% (NSA 2013). Windhoek is about the same size as the cumulative population of the next 10 largest urban centres in the country, making it the focal point of Namibia's urban transition. This has implications on nutritional status of especially poor urban residents.

The 2006/2007 NDHS found that one of three Namibian children under the age of five were malnourished, one in three Namibian children under the age of five were stunted (too short for their age), one in five (underweight) were too thin for their age and one in 20 Namibian children weigh too much for their age (MoHSS and Macro 2008). The impact of malnutrition on Namibia's human and economic development is huge. While regional differences exist, undernourishment and undernutrition are growing rapidly under conditions of rapid urbanization. It is therefore useful to examine the level and trends of undernutrition in the rapidly growing areas of Windhoek and simultaneously identify determinants of undernutrition in the growing urban poor areas of this city.

Materials and Methods

Study area

The study site is Katutura Township, situated north-west of Windhoek. This study is based on the informal settlements of Katutura Township, in Windhoek, Namibia. The township has six constituencies (Tobias Hainyeko, Katutura Central, Katutura East, Soweto, Samora Machel and Moses Garoeb), of which three (Tobias Hainyeko, Samora Machael and Moses Garoeb) have informal settlements. According to the 2011 Namibian Population and Housing Census, the total population in the township was 199,100 within 52,100 households, and an average household size, per constituency, ranging between 3.3 and 4.9 persons. Therefore, over 60% of Windhoek's population lives in the low-income areas characterized by informal settlements. This study isolated all sampled enumeration areas (EAs) drawn from Katutura Township for the analysis of levels, trends and determinants of undernutrition in children under the age of five years.

It should be noted here, that the problem of informal settlements occurs in other

towns in Namibia, such as Walvis Bay, Oshakati and Swakopmund. These areas were not considered because the urban population of Windhoek is equal to that of three towns combined; thus, any pattern observed in Windhoek, and Katutura in particular, can be modelled to the smaller townships elsewhere in the country.

Data

Three sets of NDHS data, drawing independent population-based household samples conducted with similar sampling design and data collection methodologies, were used. The study draws from the 1992, 2000 and 2006/2007 NDHS. All samples were drawn using a two-stage cluster probability sampling. Details about the survey are provided elsewhere (MoHSS and Macro, 2008). In brief, the NDHS sampled, at the first stage, EAs, which are the primary sampling units, proportional to the size of the region – so as to obtain reliable estimates at regional and national level, while stratifying by rural and urban status of EA. The EAs were designed from the master sampling frame of the previous censuses. For example, the 1992 and 2000 EAs were sampled from the 1991 Namibia census, while the 2006/2007 EAs were sampled from the 2001 census. Having selected an EA, all households in that EA were listed, and a random sample of fixed households was drawn using systematic sampling. From the chosen household, all women of age 15–49 years were eligible for interview. Those who agreed to participate were asked questions pertaining to birth history and health, mostly for children under the age of five or of those children who were born within three years preceding the survey date. This study only considered the index child in the age range of 0 to 5 years.

Ethical considerations

The study was based on secondary data. At the time data were collected, ethical clearance was obtained from institutional review boards of the Ministry of Health and Social Services in Namibia and ORC Macro Inc., Washington DC. Participation in the survey was voluntary, and informed consent was obtained from all participants. The data were provided in an anonymized format.

Outcome variables

The outcome variables were nutritional statuses, which were measured by a binary indicator of chronic malnutrition: stunting (height-for-age) and underweight (weight-for-age). A child was considered stunted if his or her height-for-age z-score was two standard deviations below the median height of children of the same age and sex in a "healthy" reference population. The same definition applied for underweight based on the child's weight-for-age z-scores (WHO 2006). The z-score is defined as $z=00$; where AI_i is the individual anthropometric indicator, *MA1* is the median of the reference population and sigma is the standard deviation of the reference population.

Primary covariates

Two binary variables to capture exposure associated with urban disadvantage were constructed. The first was an indicator of material deprivation (categorized as 1 for most deprived or 0 for least deprived), defined by adapting an approach by Barnes et al. (2007) and Antai and Moradi (2010). The material deprivation was based on the following: (i) a child living in a household without piped water; (ii) child living in a house without flush toilet; (iii) child living in a house without finished floor; (iv) child living in a house with cooking using wood/charcoal or coal; (v) a child in a home without electricity; (vi) a child in a crowded house (with five or more household members based on average household size, which is 4.2 household members); and (vii) a child with a mother who is not working. Using these seven binaries, we created a quintile

index through principal component analysis; then, the two highest quintiles were classified as most deprived, and the other three as least deprived.

The second exposure indicator was based on assets to create a wealth index. The wealth index was again computed using principal component analysis based on questions asked on available household assets (e.g., radio, TV, car, oxcart, bicycle and refrigerator) and housing characteristics (electricity; type of roof, wall and floor; water source and time to water point). Details of how the wealth index is generated can be found in Rutstein and Kiersten (2004). Using the two lowest quintiles from this indicator, we generated a binary classifying the child as belonging to a poor-resource (coded as 1) or rich-resource (coded as 0) household. Collinearity between the two exposure variables was assessed.

Other control variables

The following explanatory variables, guided by literature, were identified for inclusion in the analysis: low birth weight, maternal education, maternal age, sex of the head of household, age of head of household, BMI of the mother, age of child, birth order of child, number of birth in the past five years, child is twin, immunization and feeding patterns of child and years lived at the present place.

Statistical analysis

We first ran the descriptive statistics and chi-square to assess variables related to stunting and underweight. The following variables did not vary and were dropped from further analysis: low birth weight, age of household head, child is twin (98% of births were single births), BMI (not available for all survey periods), immunization status (also left out in the analysis, as there was not much variation; about 99% of children were immunized), as well as feeding pattern and currently pregnant (which provided little variability).

We examined trends in stunting and underweight for the three periods: 1992, 2000 and 2006/2007. Furthermore, separate cross-tabulations for each outcome and all remaining variables, and by year, were carried out. We then pooled all the data and carried out a chi-square test of each outcome across all covariates. Those covariates that were associated with the two outcomes, at $p<0.2$, were then used for model fitting. The independent variables relate to the household, the mother and the child. Variables at *household level* included: material deprivation (proxy for urban disadvantage), wealth index (proxy of socioeconomic status), years lived in the current place and sex of the head of household; *mother level*: level of education and number births in the past five years; and *child level*: age of child and birth order.

The following multivariate logistic regression models were estimated. Model M1 fitted a trend, while model M2 adjusted for the exposure variables and cluster heterogeneity. In model M3, we added the remaining variables as fixed effects. The last model, M4, assumed smooth functions for the continuous variables such as age of child and length of residence at present place. All models were fitted using Bayesian inference and implemented in BayesX (Brezger et al. 2005). The choice of the Bayesian analysis is guided by the complexity of M3 and M4, which analytically might not be feasible to implement in many off-the-shelf statistical software such as SPSS.

In implementing the Bayesian analysis, the following priors were assumed: the trend and fixed effects were assigned diffuse priors, while cluster random effects were assumed to follow an exchangeable normal prior with mean of zero, a highly dispersed variance and an inverse gamma hyper-prior. The smooth functions were modelled using penalized splines with second-order random walk difference. For all the models, a random draw of 15,000 samples was carried out with a burn in of 5,000 and thin-in of 10, giving a final sample of 1,000 for parameter estimation.

Convergence of the model was assessed using Rubin–Gelman diagnostics and trace plots. Model comparison was based on the deviance information criterion (DIC), such that a small DIC signified a better model. Two comparable models were assumed to be different if the DIC between them was greater than 10.

Results

Descriptive statistics

A combined sample of 754 children under the age of five years was available from the three surveys for the selected constituencies; however, complete case analysis was based on 537 observations. The prevalence of stunting and underweight is given in Table 1. A significant upward trend in increased risk of stunting and underweight was established ($p<0.05$). The proportion of stunting increased by more than 20% between 1992 and 2000 and stabilized to 25% in 2006/2007. Similar patterns, but slightly lower, of increased underweight were observed between 1992 and 2006/2007.

Table 2 gives a cross-tabulation of the outcomes and background characteristics of respondents, assessed using chi-square test of association. The prevalence of stunting was associated with material deprivation, wealth index, age of the child, birth order of the child, maternal education and years lived at same location. Similar level of association was noted for child underweight. Across all variables, the prevalence of stunting was lower compared with underweight in 1992, but this was reversed in 2000 and 2006/2007 survey periods.

Risk factors of stunting and underweight

Table 3 provides summaries of model estimates of risk factors associated with stunting. A clear trend in risk of stunting was established in all models. More children in the poor areas of Windhoek in 2006/2007 were associated with stunting and underweight compared with 1992. Considering the DIC, M4 was the best with the smallest DIC of 491.29. We therefore report the results based on this model. Stunting was associated with increasing levels of material deprivation (OR=1.53; 95% CI:[1.01, 2.31]) and low assets (OR=1.43), although this was not significant. The risk of stunting also increased with birth order, with second- or third-born children at high risk compared with when a child was fourth-born or higher (OR=1.94; 95% CI:[1.02, 3.19]). The odds of stunting were higher for children born to mothers of primary education relative to those who had secondary or higher education (OR=1.68; 95% CI:[1.02, 3.04]).

Table 4 gives summaries of risk factors of underweight. Again, using model M1, the risk of underweight heightened in 2000 and 2006/2007 compared with 1992 for children in Katutura. Focusing on M4, which was the best model (DIC=446.47), the risk of underweight across years remained high (OR=2.45 in the year 2000 and OR=1.36 for the year 2006/2007), although these were not significant after adjusting for other variables in the model, suggesting interaction.

Table 1. Children nutritional indices between 1992, 2000 and 2006/2007 in Katutura Township, Windhoek

Year of survey	Stunted			Underweight		
	%	Total	Chi-square* (*p*-value)	%	Total	Chi-square (*p*-value)*
1992	7.4	175	31.6 (<0.001)	9.7	175	6.2 (0.044)
2000	31.3	163		18.4	163	
2006/2007	25.1	199		17.6	199	

*The chi-square for trend test.

Table 2. Sociodemographic characteristics of the sampled children in Katutura, Windhoek, according to year of survey and undernutrition outcome [*n*(%)]

Sample characteristics	Year 1992		Year 2000		Year 2006/2007		Total*	
	Stunted *n*=175	Underw. *n*=175	Stunted *n*=163	Underw. *n*=163	Stunted *n*=199	Underw. *n*=199	Stunted *n*=537	Underw. *n*=537
Age of child							*30.6 (<0.01)*	*19.1 (<0.01)*
<6 months	22 (0)	22 (0)	26 (3.8)	26 (0)	32 (6.2)	32 (3.1)	80 (3.8)	80 (1.2)
7–12 months	26 (7.7)	26 (15.4)	22 (18.2)	22 (22.7)	27 (25.9)	27 (7.4)	75 (17.3)	75 (14.7)
13–24 months	44 (11.4)	44 (15.9)	41 (53.7)	41 (24.4)	45 (40.6)	45 (28.9)	130 (34.6)	130 (23.1)
25–59 months	40 (7.5)	40 (10.0)	29 (27.6)	29 (13.8)	32 (21.9)	32 (18.8)	101 (17.8)	101 (13.9)
Age of mother							*0. 3 (0.99)*	*1.2 (0.98)*
<24 years	52 (9.6)	52 (7.7)	42 (21.4)	42 (14.3)	51 (28.3)	51 (25.5)	145 (20.7)	145 (15.9)
25–29 years	49 (2.0)	49 (6.1)	41 (43.9)	41 (28.6)	56 (31.4)	56 (14.3)	146 (22.6)	146 (15.1)
30–34 years	36 (8.3)	36 (8.3)	34 (32.4)	34 (17.6)	42 (21.4)	42 (16.7)	112 (20.5)	112 (14.3)
35–49 years	38 (10.5)	38 (18.4)	46 (28.3)	46 (15.2)	50 (22.0)	50 (14.0)	134 (20.9)	134 (15.7)
Birth last five years							*0.6 (0.45)*	*1.8 (0.3)*
One birth	99 (10.1)	99 (12.1)	109 (33.9)	109 (16.5)	129 (21.7)	129 (17.1)	337 (22.3)	337 (15.4)
Two or more	76 (3.9)	76 (6.6)	54 (25.9)	54 (22.2)	70 (31.4)	70 (18.6)	200 (19.5)	200 (15.0)
Birth order							*5.4 (0.12)*	*6.9 (0.1)*
First-born	47 (10.6)	47 (8.5)	43 (18.6)	43 (18.6)	63 (17.5)	63 (18.4)	153 (15.7)	153 (14.4)
Second-or third-born	63 (4.8)	63 (7.9)	71 (38.0)	71 (15.5)	84 (28.6)	84 (17.9)	218 (24.8)	218 (14.2)
Fourth-born or more	65 (7.7)	65 (12.3)	49 (32.7)	49 (22.4)	52 (28.8)	52 (19.2)	166 (21.7)	166 (17.5)
Mother education							*15.1 (0.07)*	*9.7 (0.08)*
None	24 (16.7)	24 (4.2)	9 (55.6)	9 (22.6)	11 (9.1)	11 (18.2)	44 (22.7)	44 (11.4)
Primary	75 (6.7)	75 (14.7)	35 (42.9)	35 (34.3)	37 (43.2)	37 (29.7)	147 (24.5)	147 (23.1)
Secondary or higher	76 (5.3)	76 (6.6)	119 (26.1)	119 (13.4)	151 (21.9)	151 (14.6)	346 (19.7)	346 (12.4)
Sex of household head							*0.8 (0.31)*	*0.1 (0.95)*
Male	114 (7.0)	114 (10.5)	91 (33.0)	91 (22.0)	111 (22.5)	111 (14.4)	316 (19.9)	316 (15.2)
Female	61 (8.2)	61 (8.2)	72 (29.2)	72 (13.9)	88 (28.4)	88 (21.6)	221 (23.1)	221 (15.4)
Material deprivation							*8.4 (0.04)*	*4.8 (0.028)*
Most deprived	69 (10.1)	69 (13.0)	85 (41.5)	85 (21.5)	76 (31.6)	76 (13.7)	210 (27.6)	210 (19.5)
Least deprived	106 (5.7)	106 (7.5)	98 (24.5)	98 (16.3)	123 (21.1)	123 (13.8)	327 (17.1)	327 (12.5)
Wealth index							*6.1 (0.03)*	*5.5 (0.04)*
Low	44 (6.8)	44 (11.5)	94 (37.2)	94 (24.5)	3 (33.3)	3 (33.3)	141 (27.7)	141 (20.6)
High	131 (7.6)	131 (9.2)	69 (9.2)	69 (10.1)	196 (25.0)	196 (17.3)	396 (18.9)	396 (13.4)
Years lived at present residence							*9.2 (0.07)*	*7.1 (0.09)*
<6 years	22 (0)	23 (4.3)	17 (52.9)	17 (23.5)	87 (29.9)	87 (20.7)	127 (27.6)	127 (18.1)
6–15 years	16 (6.2)	16 (6.2)	24 (33.3)	24 (20.8)	29 (13.8)	29 (13.8)	69 (18.8)	69 (14.5)
>15 years	105 (9.5)	144 (9.7)	120 (28.3)	120 (17.5)	78 (24.4)	78 (15.4)	303 (20.8)	303 (14.9)

*Italicized numbers in the total column refer to the chi-square (*p*-value). Underw = underweight.

Table 3. Risk factors of stunting in children under age of five in Katutura, Windhoek, given are the odds ratios (ORs) and corresponding confidence intervals (CIs)

Variable	Model 1 OR (95% CI)	Model 2 OR (95% CI)	Model 3 OR (95% CI)	Model 4 OR (95% CI)
Fixed effects				
Trend				
1992	1.00	1.00	1.00	1.00
2000	5.67 (2.95,10.92)	2.17 (0.33, 14.06)	4.97 (2.49, 9.90)	6.75 (2.43, 18.76)
2006/2007	4.18 (2.18, 8.01)	3.25 (0.46, 24.84)	6.02 (2.65, 13.71)	6.26 (2.01, 19.50)
Material deprivation				
Least deprived		1.00	1.00	1.00
Most deprived		1.83 (1.01, 3.26)	1.62 (1.02, 3.06)	1.53 (1.01, 2.31)
Wealth index				
Poor		1.21 (0.90, 2.50)	1.29 (0.83, 2.11)	1.43 (0.67, 3.07)
Rich		1.00	1.00	1.00
Age of child				
<6 months			0.14 (0.04, 0.54)	
7–12 months			1.02 (0.42, 2.58)	
13–24 months			2.48 (1.18, 5.53)	
25–59 months			1.00	
Birth order				
First-born			0.87 (0.39, 1.95)	0.94 (0.39, 2.21)
Second- to third-born			1.57 (0.99, 2.49)	1.94 (1.02, 3.19)
Fourth-born or above			1.00	1.00
Maternal education				
None			1.20 (0.41, 3.56)	1.29 (0.40, 3.56)
Primary			1.92 (1.01, 3.79)	1.94 (1.01, 3.88)
Secondary/Higher			1.00	1.00
Years lived at present place				
≤5 years			1.68 (1.06, 3.04)	
6–14 years			0.95 (0.48, 1.95)	
15 year or more			1.00	
Random components				
Community variance		0.064 (0.001, 0.35)	0.042 (0.001, 0.24)	0.036 (0.001, 0.21)
Model fit				
Deviance	519.54	511.70	498.02	442.32
DIC	529.51	525.43	524.28	491.29

Table 4. Risk factors of underweight in children under age of five in Katutura, Windhoek, given are the odds ratios (ORs) and corresponding confidence intervals (CIs)

Variable	Model 1 OR (95% CI)	Model 2 OR (95% CI)	Model 3 OR (95% CI)	Model 4 OR (95% CI)
Fixed effects				
Trend				
1992	1.00	1.00	1.00	1.00
2000	1.98 (1.07, 3.68)	2.00 (1.02, 3.19)	2.59 (1.10, 6.11)	2.45 (0.74, 6.18)
2006/2007	2.09 (1.11, 3.97)	1.90 (1.01, 3.90)	1.72 (1.01, 3.42)	1.36 (0.46, 3.95)
Material deprivation				
Least disadvantaged		1.00	1.00	1.00
Most disadvantaged		1.35 (0.57, 3.26)	1.23 (0.64, 2.36)	1.14 (0.50, 2.34)
Wealth index				
Poor		2.18 (0.99, 4.15)	2.55 (1.07, 4.25)	2.16 (1.03, 4.89)
Rich		1.00	1.00	1.00
Age of child				
<6 months			0.07 (0.009, 0.61)	
7–12 months			1.25 (0.64, 3.36)	
13–24 months			2.14 (1.12, 4.84)	
25–59 months			1.00	
Birth order				
First-born			0.84 (0.38, 1.85)	1.05 (0.51, 2.46)
Second- to third-born			0.49 (0.24, 0.98)	0.43 (0.19, 0.97)
Fourth-born or above			1.00	1.00
Maternal education				
None			0.73 (0.73, 2.54)	1.06 (0.28, 2.46)
Primary			2.21 (1.04, 4.15)	1.99 (0.89, 4.45)
Secondary/Higher			1.00	1.00
Years lived at current place				
≤5 years			1.34 (0.83, 2.18)	
6–14 years			0.51 (0.14, 1.74)	
15 year or more			1.00	
Random components				
Community variance		0.25 (0.002, 0.91)	0.36 (0.002, 1.19)	0.32 (0.002, 1.14)
Model fit				
Deviance	452.34	429.21	413.89	384.01
DIC	458.38	456.13	459.12	446.47

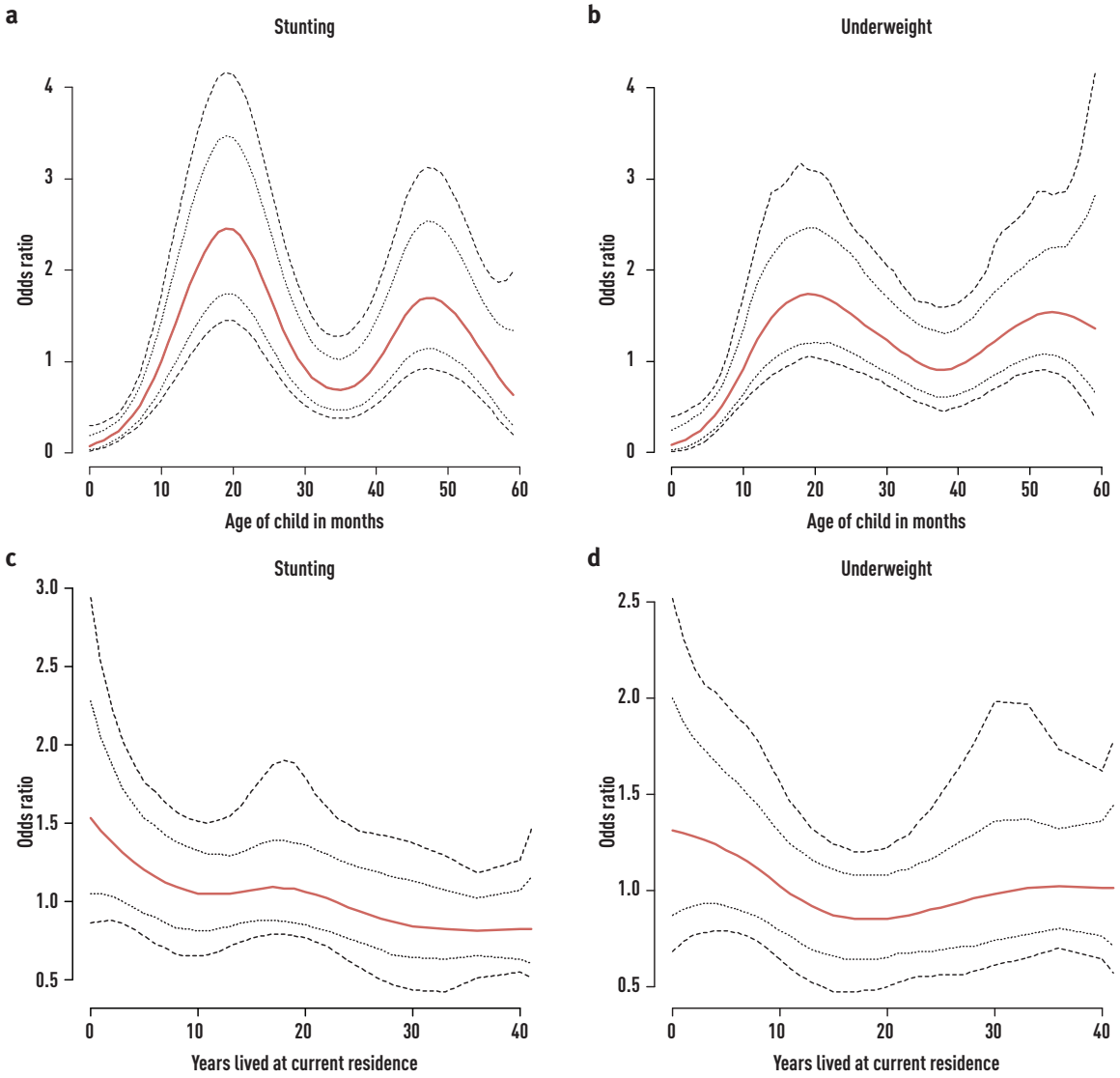
In the same Table 4, materially deprived children were at increased risk of underweight (OR=1.14; 95% CI:[0.50, 2.34]), although not significant. However, significant association was observed between underweight and wealth index, with children from poor households at OR=2.16 (95% CI:[1.03, 4.89]), compared with those in resource-rich households. Furthermore, despite a positive association between underweight with birth

order, and maternal education, no significant relationships were observed (Table 4).

Figure 1a shows the nonlinear effects of age of child. The odds of stunting were lower between the ages of 0 and 20 months, and rising above 1 at the age of 25 months, and then falling again to age of 35 months. The cyclical pattern repeated between this point to the age of 60 months, with the log-odds remaining within 0 and 1. In Figure 1b, the nonlinear effect of age on underweight is displayed. The shape of the curved line was similar to that obtained for stunting, with a rising risk between ages of 0 to 20 months, falling up to the age of 40 months and the cyclic patterns repeated to the end of the age range.

Figure 1c displays the effect of years living at same place on stunting. In general, the risk of stunting gradually fell for the entire period. This agrees with the fixed effects of the same variable generated in M3, which shows increased odds of stunting for those whose length of stay was less than five years compared with those who stayed 15 years or more (OR=1.68; 95% CI:[1.20, 3.04]; Table 3). The relationship between length of stay and underweight is captured in Figure 1d.

Figure 1. Nonlinear estimates of age of a child on risk of stunting (a) and underweight (b), and of years lived at current residence on risk of stunting (c) and underweight (d)*



*The lines represent the mean (middle), with corresponding 80% and 95% confidence bands (outer lines).

The risk was higher at the beginning and falls to about 15 months, and started picking up. However, the wide margins of the confidence bands suggest this pattern was not significant – again in agreement with the fixed estimates obtained in model M3 (OR=1.34; 95% CI:[0.83, 2.18] in Table 4).

Inter-cluster heterogeneity in stunting and underweight

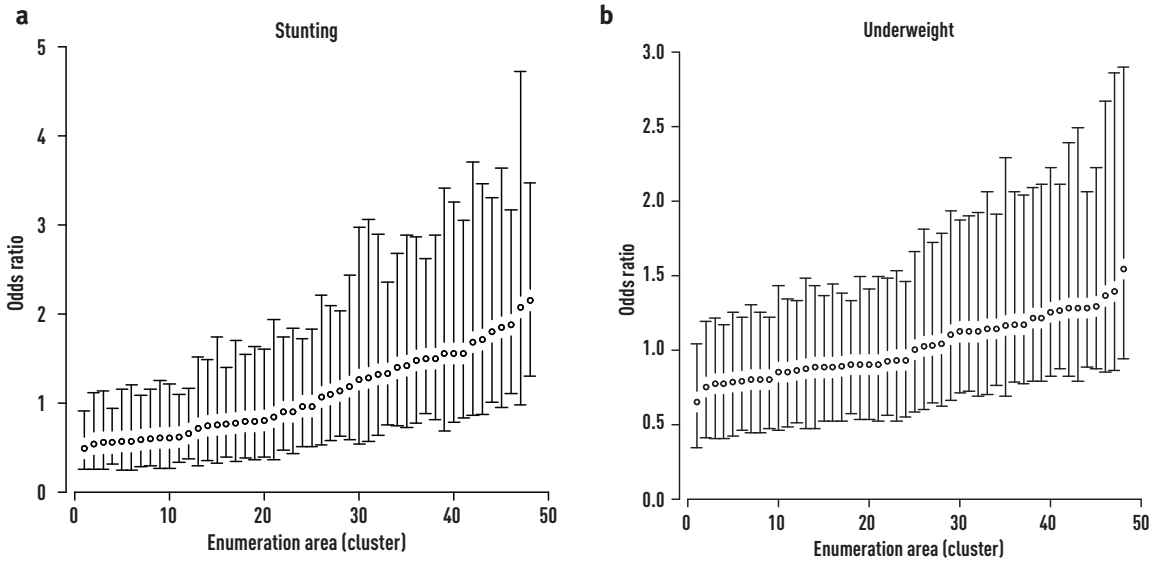
Figure 2a shows a caterpillar plot of risk estimates for each EA. Evidence of substantial heterogeneity across clusters can be observed. The estimated variance component for the clusters was small (coefficient: 0.036; 95% CI:[0.001, 0.21]), suggesting some similarities in risk of stunting for the areas considered. Figure 2b presents a caterpillar plot of cluster estimates of underweight. Some degrees of differences in risk of underweight across clusters were noted. The variance component confirms the same (coefficient: 0.32 in Table 4).

Discussion and Conclusions

We observed that levels and trend in stunting and underweight, in Windhoek, Namibia, between 1992 and 2006/2007, were rising, and overlap with rapid urbanization. Children enumerated in 2006/2007 were 4.2 times more likely to be stunted and 2.1 times more likely to be underweight compared with the year 2000, while malnutrition levels in children recorded in 2000 were 5.7 times more likely to be stunted and 1.9 times more likely to be underweight than those reported in 1992. At the same time, this trend coincides with massive movement of people to urban area, and in Namibia, Windhoek is prime city of choice. Windhoek grew its urban population by 5.4% since 1991 and accounts for 41% of urban dwellers in Namibia.

As most sub-Saharan African cities, Windhoek, is being fed by a rapid rural–urban migration pattern. Generally, these migrants are deprived and marginalized sections of the rural population who move to urban areas in search of better and sustainable livelihoods (Pendleton 1996; Smith et al. 2005; Crush 2013; Pendleton et al. 2014). The consequences of such rapid urbanization are socioeconomic transition (Custodio et al. 2008, 2010), which negatively affects the health of the population, particularly children. The socioeconomic transition emanates from the growing urban inequalities in a form of informal settlements characterized by crowded households, generally deprived in water and sanitation

Figure 2. Cluster heterogeneity in childhood stunting (a) and underweight (b)*



*Measured as odds ratios with corresponding 95% CI limits.

services, creating neigbourhoods that negatively impact child health (Antai and Moradi 2008). Our assertion is that unguided urbanization, as experienced in Windhoek, poses a public health impact to large sections of the migrant population, and even the already established, owing to environmental degradation and lack of access to basic services (Smith et al. 2005).

Similar to other studies (Antai and Moradi 2008), we confirm the evidence that urbanization in African cities is associated with increased ill-health, and this was more pronounced among the extremely deprived urban neigbourhoods. These effects were reduced but remained significant when we adjusted for material deprivation and wealth index (Tables 3 and 4), an important finding that points to the effect of socioeconomic transition and rapid urbanization on the increasing levels of childhood malnutrition. Our results validate earlier findings that roots of ill-health and health inequalities are evidently affected by poverty and social disadvantage (Wilkinson and Marmot 2003; Moradi 2010). Indeed, although the effects of social gradient can be felt in all sectors of society, these effects are more grave at the lower to middle class of socially position, a fact that has been documented in systematic reviews in nutrition (Wilkinson and Marmot 2003; Smith et al. 2005; Moradi 2010).

In this paper, two nutritional indicators were selected to reflect different dimensions of childhood nutritional status and their linkages to food insecurity. Stunting captures the failure to receive adequate nutrition over a long period, whereas underweight accounts for both acute and chronic malnutrition. Both aspects of undernutrition have implications in the life cycle of the child, with long-term cognitive compromise. The linkage between malnutrition and food insecurity is owing to inadequate food consumption or poor absorption or biological use of nutrients consumed. The former can be explained by conditions of illness, or disease or nutrient imbalance (Campbell 1991). While it should be acknowledged that an individual or household can be found to be food-insecure, but not undernourished, evidence in many African setting suggests the existence of the other direction of causal relationship between food insecurity and undernutrition (Cordeiro et al. 2012; Folaranmi 2012).

Urban households are more dependent on food purchase, which, if they have sufficient purchasing power, can lead to a more varied diet and higher reliance on "ready-made" and fast foods, compared with rural households. Food access has a direct impact on dietary diversity and can been seriously affected by rising food and fuel prices, and conflict (Cordeiro et al. 2012; Folaranmi 2012; Crush 2013). Consistent emerging trend indicated that in poorer urban households, women were either feeding their children a poor diet or skipping meals so their children could eat, which has a greater compromise in nutrition (Benson 2004; Labadarios et al. 2011; Pendleton et al. 2014). In the long run, such children are to be stunted and underweight. However, it should be emphasized that this relationship can be complex. Other underlying causes, including inadequate care and poor service delivery, equally impact on childhood health if a household is socioeconomically disadvantaged.

As pointed out by Moradi (2010), it is important to recognize that urban disparities may have been created by social and economic discrimination against black majority, of which its effects are still being felt in Namibia. Although Namibia has a better national income compared with other countries in sub-Saharan Africa, the benefits are not diffusing down to provide better housing, employment opportunities and improved water and sanitation services owing to the aftermath of apartheid system, findings that parallel those found in South Africa (Cameron 2003).

Even if such urban populations have access to better health services, the delicate balance of "putting food on the table" compromises treatment-seeking behaviour when the child's health condition is not life-threatening, and in the long run, leads to deteriorating nutritional status.

The established heterogeneity (Figure 2) speaks of the fact that even among disadvantaged urban areas, disparities do exist, which may help find hotspots of disease burden. There is growing interest to understand the sensitivity of health to the social environment. Social environment is conducive for better nutritional security, of which a compromise would lead to undernutrition (Wilkinson and Marmot 2003). We further demonstrate that the relationship between age of the child and undernutrition, be it stunting and underweight, is varying, with increasing risk as age increases, more pronounced in the first one year of life (Figures 1a and 1b). This changing pattern in risk is often missed, as most models assume fixed effects between age and undernutrition. A similar nonlinear pattern is established for length of stay and undernutrition (Figures 1c and 1d). What is certain from this association is that children of recent migrants are at relatively high risk than those who have stayed in town for more than five years. This fact can be explained by the fact that the longer one stays at a place, the more connected they become – they may get jobs, may establish business and have a better access to resources, ending up with many coping strategies, thus becoming more resilient to food insecurity, even if these are materially challenged (Magisa 2010; Alinovi et al. 2010). Using more rigorous measure of food insecurity combined with focus group discussions, Pendleton et al. (2014) observed that poor urban migrant households in Windhoek are less food-secure, and about 50% had a lower dietary diversity than other households.

Our study is not without limitations. First, the study is based on cross-sectional data, and therefore, the relationship obtained between outcomes and explanatory variables is associative. However, the analysis was based on data pooled across three survey periods: 1992, 2000 and 2006/2007. As such, the effects generated in the model indicate a persistent and strong effect. Second, the composite indicators of urban disadvantage and material deprivation are limited to the available variables in the data, which may not fully be what others have described for such indicators. In our analysis, we have tried to follow previous studies (Antai and Moradi 2010; Barnes et al 2007) to generate indicators similar in elements; as such, the interpretation of the effects of urban disadvantage and material deprivation should correspond. Third, this study only considered two of the three commonly used indicators of childhood undernutrition. It is our view that wasting, which reflects the current nutritional status, is variable and seasonal and fails to capture the long-term consequences associated with persistent food insecurity and may not directly be attributable to food insecurity (Cordeiro et al. 2012; Folaranmi 2012).

In conclusion, the findings suggest that the generally accepted notion that children in urban settings have better nutritional status is refuted. The fact that urban is considered homogenous conceals the extent of poverty and malnutrition. Therefore, any targeting mechanisms in urban areas have to be designed differently, considering that urban livelihoods are heavily dependent on income and employment to meet basic needs, including food.

Our study has a number of policy implications. First, there is a need for nutritional and food security advocacy by encouraging urban areas to be food baskets. Second, increased social support for urban poor by providing child grants and food subsidies, particularly targeting most recent migrants and other vulnerable groups.

Emphasis should also be placed, first, on education for mothers, with appropriate health education not to abandon slightly older children, especially when these are weaned. Second, there is necessity for increasing parents' awareness of children's food and nutritional needs at various stages of development to ameliorate the risk of micronutrient deficiencies. Third, there is need to provide health and preventive care facilities aimed at reducing malnutrition in children.

Namibia is experiencing rapid urbanization, and food insecurity and malnutrition are prevalent (Crush 2013; Pendleton et al. 2014). The trend is the shift in both poverty and malnutrition from rural areas to urban areas, given the massive movement of people from rural areas to urban areas. This paper demonstrates that malnutrition is increasing in the urban areas, and in particular among the poorest. In this analysis, we take note of the discussion on global nutrition transition, which has led to high intake of food that is rich in starch, sugar and fat (de Haen et al. 2011). The nutrition transition has led to declines in the rates of underweight, even for Namibia, but nutritional status of children in terms of access to a well-balanced diet containing all vital nutrients has not improved. Stunting seems to be less susceptible to this bias and more closely reflects children's long-term nutritional status. With increasing urbanization in Namibia, the need to reduce food insecurity and undernutrition should be one of the major focuses for the overall improvement in child health, and the poor urban neigbourhoods should be equally targeted just like the rural area for food security and nutrition programming.

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Notes

1. World Bank (2013) and Chen & Ravallion (2012) document the substantial income growth in Sub-Saharan Africa, estimated to 38% in per capita between 2004 and 2010. Leading to a significant decline in income poverty from 59% in 1993 to 47% in 2008, using the $1.25 poverty line.
2. BMI is the body weight in kilograms divided by height in metres squared (kg/m^2) and is commonly measured in adults to assess underweight, overweight and obesity. The international references are as follows: under-weight=BMI<18.5; overweight=BMI≥2.5; obese=BMI≥3.0. Obese is a subset of overweight.

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Anemia in Children Aged Four to Eight from a Semirural Community in Central East Area of Argentina

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Abstract

We present the results of the first stage of the Program for the Control of Intestinal Parasitosis and Nutrition, analyzing the frequency of anemia and its relation with intestinal parasitic infections and socio-cultural and environmental factors present in school children from a semirural community of Argentina. A total of 123 children aged 4–8 years were interviewed; 93 (75.6%) of them showed up for blood extraction and a fecal sample was taken properly. The frequency of anemia was 33.3%; 45.0% in children aged 4–5 years and 24.5% in those aged 6–8 years (p=0.038). Intestinal parasites were found in 83.9% of the children; 75.0% in children aged 4–5 years and 90.6% in those aged 6–8 years (p=0.043). No statistical differences were found when relating parasitic infections, social/cultural variables and housing characteristic with anemia, probably of nutritional origin. This study reveals the coexistence of anemia and parasitic infections in apparently healthy children who were unnoticed by the conventional public health system.

Introduction

An adequate nutritional status in mother and child population is a critical factor in favouring children's growth and development, preventing adverse conditions in the medium and long term and, ultimately, achieving optimal quality of life. Nutritional disturbances have causes ranging from environmental and production factors to the influence of disease and inadequate ingestion, leading to malnutrition and its consequences (Duran et al. 2009).

The Argentinean Pediatrics Society defines anemia as the "reduction of the red cell mass or the concentration of hemoglobin below the second standard deviation in relation to average age and sex" (Donato et al. 2009). Iron-deficiency anemia (IDA) is the most common nutritional deficiency worldwide. It affects vulnerable communities with lowest socioeconomic levels in particular, though this condition is not exclusive. It is the prototype of hidden malnutrition (Uicich et al. 2007). In South and Central America, IDA affects approximately 50% of children (Ianicelli et al. 2012). IDA causes a negative impact on mental, cognitive, motor and socio-emotional development, revealed by numerous studies conducted in several populations in the world, mainly in children (Jukes 2007). According to the UNICEF, within the micronutrients, iron is vital to prevent anemia. Adequate breastfeeding for each age of the child and consumption of nutritious complementary foods and timely medical care are essential to avoid the deficit of this mineral. Giving children a good start in nutrition has positive consequences for life, in regard to the mental, physical and social development (UNICEF 2015).

In Argentina, there is little information on the frequency of anemia in different age and risk groups. Even though it is a common issue in childhood and even in adolescence, most research in Argentina has been conducted in children under two years (Ianicelli et al. 2012; Ministerio de Salud de la Provincia de Buenos Aires 2012; Uicich et al. 2007; Winocur et al. 2004). In our country, the most representative data derive from the 2005 National Nutrition and Health Survey (Encuesta Nacional de Salud 2005). The results of the survey showed 16.5% of anemia in children aged 6–72 months and the highest frequency in those aged 6 to 23 months, 34.1% versus 8.9% in those aged 2–5 years.

In the province of Buenos Aires, the Ministry of Health reports high frequencies (between 34.9% and 48.3%) in children aged under 2 years from the Conurbano (districts surrounding Buenos Aires, capital city of Argentina) (Duran et al. 2009; Ministerio de Salud de la Provincia de Buenos Aires 2012).

The Program for the Control of Intestinal Parasitosis and Nutrition (PROCOPIN, by its acronym in Spanish), from the National University of La Plata, develops secondary prevention, focused on the diagnosis of early disease (without clinical manifestations). It searches diseases in "apparently healthy" school children (3–12 years old). It includes actions in distressed communities that are hyper-endemic of parasites and nutritional disorders. It is developed in four stages: (1) evaluation of the nutritional and parasitic condition of children; (2) therapeutic intervention in children with nutritional disorders and/or parasites; (3) educational intervention to avoid their return to the diseased state; and (4) post-intervention control.

The main objective of this work is to present the results of the first phase of a public health program called PROCOPIN, including the frequency of child anemia. The secondary objective is to explore potential relationship between anemia and intestinal parasitic infections in school children and other contextual factors such as country of origin, level of education and age of their parents and housing characteristic.

Materials and Methods

A cross-sectional, descriptive and analytical study was carried out in the town of Abasto (34° 59'12.84" S; 58° 5'20.04" W), province of Buenos Aires, Argentina, 64.2 km SE from the city of Buenos Aires. The 2001 National Population and Housing Census registered 6,799 inhabitants in the area; 50.6% of the homes have running water utility, 22% have natural gas and only 20% have sewer utility. Three areas can be distinguished: urban, semirural and rural (Municipalidad de La Plata 2014). A cross-sectional, descriptive and analytical study was developed.

Two educational facilities attended by children from the semirural area were selected. We worked with children aged between 4 and 8 years attending kindergarten (4 and 5 years old) and first and second grade (6 to 8 years old) in a primary school in the area selected. As school authorities and health professionals in the Healthcare Unit in the area reported, many families lack drinkable water supply and sewer systems, their houses are precarious and there is high overcrowding. The houses are settled around vegetable and fruit orchards where adults, and many times children also, work. Water comes from pumps shared by several families, and bathrooms are mostly latrines away from water supply.

The study was initiated with conferences held at the schools where the children's parents and guardians were interviewed and demographic, socio-cultural and environmental data were recorded. The information gathered was as follows: country of origin; level of education and age of the parents; and housing characteristic of the children – type of construction, indoor floor, bathroom inside or outside the house, toilet with/without water flushing system, type of water supply, flooding of area around housing, electricity, natural gas, waste collection and sewerage. This information was collected by researchers in a personal interview with the parents/guardians of the children prior to sampling.

For the hematological study, following an explanation of the procedure to parents/guardians and children and after obtaining informed consent, 5 mL of blood from a peripheral vein was extracted, with prior antisepsis of the area. Hemoglobin concentration was determined through the cyanmethemoglobin method (Hemocian B, Laboratorio Brizuela®, Argentina). Lower limit to define anemia was 11.5 g/dL, as set by the Argentinean Pediatrics Society in 2009 (Donato et al. 2009).

Severity of anemia was evaluated according to World Health Organization differential values (WHO 2011).

For the parasitological study, serial stool analysis and serial anal scraping were done. Instructions for sample-taking were imparted orally, and written instructions were given to parents/guardians. For the serial stool analysis, a daily collection of a portion of stools in a container with preservative for 5 days was indicated. For the anal scraping, each parent/guardian had to dab a folded piece of gauze previously soaked in water around the margins of the child's anus every morning after waking up, for 5 days, and put the gauze pieces in a second container with preservative. Stools were processed by the modified Telemann technique, and the obtained pellets were observed through an optical microscope (three smears per tube). The serial anal scraping samples were processed by cutting and homogenizing the gauze pieces with the same preservative in the container. After transferring the whole contents to a centrifuge tube, it was concentrated by centrifugation at 1,000 g for 5 minutes. Finally, three smears per tube were observed through the optical microscope.

Ethical aspects: parents/guardians were informed orally and in detail about the study in group meetings held at the school. They were requested to give their consent in writing and to be present at the moment of blood extraction. The children whose parents/guardians had given consent were informed about the study and the blood-extraction procedure using age-adjusted vocabulary, and their consent to participate was requested. Protocols developed were approved by the University National of La Plata School of Medical Sciences Ethics Committee (№ 0800-001483/09-000). Personal information remained confidential and was obtained in accordance with the Declaration of Helsinki (1964), the Nuremberg Code (1947) and National Act #25326. Approval of school and municipal authorities in the district was also obtained.

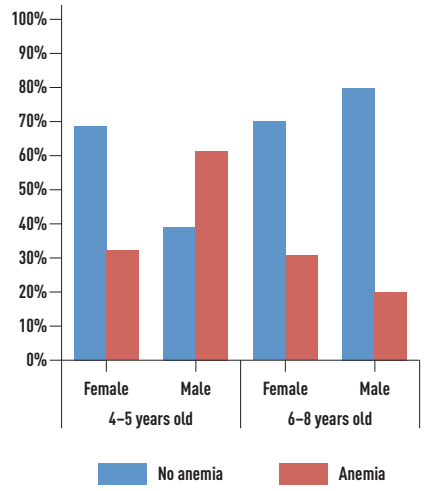
For the statistical analysis, anemia frequencies, total and specific parasitic infections and registered variables were estimated. The possible associations were analyzed using the chi-square test and Fisher's exact test. In the associations that turned out to be significant ($p \leq 0.05$), the odds ratio (OR) and 95% confidence interval (CI) were estimated. Statistical analysis was done through the SPSS19 program (SPSS 2013).

Results

A total of 123 children participated in the survey, 93 (75.6%) of them showed up for blood extraction and had appropriately handed in the samples for parasitological analysis. The children aged 4 and 5 years totalled 40/93 (43.1%); 22 of them (55.0%) were girls. Among the 53 children aged 6 to 8 years, 23 (43.4%) were girls.

The frequency of anemia was 31/93 (33.3%) (95% CI:[23.8&, 42.9%]). It was 45.0% in the 4–5-year age group and 24.5% in the 6–8-year age group ($p=0.038$; OR=2.52; 95% CI:[1.04, 6.09]). Figure 1 shows the distribution of anemia by sex and age group. Females had a frequency of 31.1% and males 35.4% (no significant difference). In those aged 4–5 years, the frequency in males (61.1%) was higher than in females (31.8%) ($p=0.064$; OR=3.37; 95% CI:[0.91, 12.42]).

Figure 1. Frequency of anemia by sex and age



The mean of hemoglobin level among non-anemic children was 12.12 g/dL (SD=0.48) and among the anemic children was 10.98 g/dL (SD=0.36).

Intestinal parasites were found in 78/93 (83.9%) children; 82.2% in females and 85.4% in males; 75.0% were found in those aged 4–5 years and 90.6% in those aged 6–8 years (p=0.043; OR=3.20; 95% CI:[1.00, 10.17]). Specific frequencies in 93 children were as follows: *Blastocystis hominis* (58.1%), *Enterobius vermicularis* (40.9%), *Giardia intestinalis* (20.5%), *Hymenolepis nana* (1.1%) and *Uncinaria* (1.1%). Among 78 parasitized children, the parasitic diversity registered per individual was as follows: 43.6% presented only one, 39.8% two, 15.4% three and 1.2% four.

Of the children with parasites, 35.9% showed anemia, while 20.0% of the non-infected children had it (p=0.232). No statistical differences were found when relating anemia to the number of parasite species or to each species in particular. The only child infected with *Uncinaria* had mild anemia.

Analyzing adult data, 35.7% of children with foreign parents/guardians and 29.7% of those with Argentinean parents/guardians showed anemia. No differences were registered in relation to their age. Of those children whose parents/guardians were included in the uneducated, incomplete primary school, attending primary school and completed primary school categories (n=60), 38.3% were anemic, while anemia appeared in 24.2% of children whose parents had a higher level of education (n=33) (p=0.168).

Tables 1 and 2 show the characteristics of the variables registered in the survey. Electricity is not shown among the variables, as 100% of the children had this utility at home. The sanitary survey of housing conditions of children revealed that over 50% of households were of sheet metal and/or wood, with the bathroom outside, no running water and no sewer, but no housing-related characteristic was associated with the variables "presence of anemia" and/or "presence of parasitic infections."

Table 1. Social and cultural variables of parents/guardians in the 93 studied children

	n	%
Origin		
Bolivia	43	46.2
Argentina	37	39.8
Paraguay	13	14.0
Level of education		
No education	4	4.3
Primary school, incomplete	34	36.6
Primary school, attending	1	1.1
Primary school, complete	21	22.6
High school, incomplete	12	12.9
High school, attending	0	0
High school, complete	19	20.4
Further education, attending	0	0
Further education, complete	1	1.1
No answer	1	1.1
Age		
21–30 years	48	51.6
+30 years	45	48.4

Discussion

According to WHO data, the global prevalence of anemia is 24.8%, and the more vulnerable groups are pregnant women and children (WHO 2008). Data provided by the National Nutrition and Health Survey show a prevalence of anemia of 8.9% in children aged 2–5 years in Argentina (Encuesta Nacional de Salud 2005). The percentage found in our study, close to 34% in children aged 4–8 years, is higher than the national mean for the age group considered and the average frequency in each province, except for Chaco (36.2%). We should note that for WHO and ENNyS, the cut-off limit for hemoglobin in children aged 6 months to 4.9 years is 11.0 g/dL and for older children is 11.5 g/dL. We have conducted the study taking into account the level recommended by the Argentina Society of Pediatrics since 2009, which is based on physiopathological aspects and expert reviewers of our country.

The frequency found is also higher than the one reported in the city of Rosario (Argentina), where the prevalence found in children aged 24–42 months was 32.5% using HemoCue test (Christensen et al. 2013). The methods recommended in studies to establish the prevalence of anemia in the population are cyanmethemoglobin and HemoCue® (WHO 2011). Our data also show higher values than those published in other Latin American countries. In Brazil, a study conducted in 945 children aged 6–59 months showed a frequency of 21.8% in children aged over 2 years (Albuquerque Silva de Paula et al. 2014). In Peru, according to 2011 official records, frequency in children aged under 5 years was 30.7% (Sobrino et al. 2014). Our results showed values close to those published by Sirdah et al. in a study in children aged 4 and 5 years attending kindergartens in peripheral areas in Palestine, with 33.5% (Sirdah et al. 2014). Anemia appeared with a higher frequency and in mild and moderate levels in males aged 4–5 years, according to the reference values of WHO for these age groups (WHO 2011).

While no corroboration tests were done in this study for iron deficiency as recommended by the National Hematology Committee, taking into account the national and international literature on this subject, we can consider the most frequent cause for anemia in these children is iron deficiency (Donato et al. 2009; WHO 2001, 2008). The tested children's parents/guardians work in vegetable- and fruit-producing orchards, and the main component of their diet are those foods. Consequently, their iron-rich food intake is probably insufficient. On the other hand, we must take into account what Angelova et al. reported when comparing children aged up to 3 years with IDA and control children: they found disturbances in their zinc, copper and cobalt levels contributing to the etiology of anemia through iron deficiency, and these disturbances were associated with an inadequate diet (Angelova et al. 2014).

The "Anemia Prevention and Treatment in Mother and Child Population Guidelines," issued by the Province of Buenos Aires Ministry of Health, lists the following vulnerable groups, sorted by significance: children aged under 2 years, pregnant women, fertile women, adolescents and children aged over 2 years (Ministerio de Salud de la Provincia de Buenos Aires 2012). The results found in this study show that children aged over 2 years from semirural communities working in vegetable and fruit production could be included among the "significantly vulnerable."

Table 2. Housing characteristics of the 93 studied children

	n	%
Type of construction		
Masonry	43	46.2
No masonry (metal sheet, wood)	50	53.8
Indoor floor		
Dirt	6	6.5
Concrete	87	93.5
Bathroom		
Indoors	38	40.9
Outdoors	55	59.1
Toilet		
With water flush device	39	42.0
Without water flush device	54	58.0
Drinking water		
From a pump	61	65.6
From supply system	32	34.4
Flooding of area around housing		
Yes	41	44.1
No	52	55.9
Natural gas		
Cylinder	90	96.8
From supply system	3	3.2
Town-managed waste collection		
Yes	58	62.4
No	35	37.6
Sewerage		
Yes	24	25.8
No	69	74.2

Parasite frequency was close to 84% of children, reaching 90% in the 6–8-year age group. Literature published in the past years indicates that the frequency of intestinal parasites in the province of Buenos Aires is between 23% and 86% (Gamboa et al. 2009, 2011; Minvielle et al. 2004; Molina et al. 2011; Pezzani et al 2004, 2009, 2012). Our results, like those of other field studies in the central region of Argentina, show that geohelminthiases are less frequent and of lower relevance than other parasite species infections, contrary to what occurs in the northern area of our country. Most frequently detected parasites were *B. hominis*, *E. vermicularis* and *G. intestinalis*, showing equal results to those found by other authors in Argentina (Bracciaforte et al. 2010; Milano et al. 2007; Soriano et al. 2005; Zonta et al. 2007). Our results also prove *B. hominis* to be the highest prevalence protozoa in diverse regions in the country (Gamboa et al. 2009; Menghi et al. 2007; Soriano et al. 2005). In Iran, of 6,851 people infected with *B. hominis* and 3,615 controls, an association was found between serum iron decrease and a higher frequency of occult blood in stools and the presence of this parasite (Javaherizadeh 2014). In our study, no association was registered between anemia and presence of intestinal parasitic disease, number of parasite species or with each species in particular, strengthening the concept of dietary origin for anemia.

Morales et al. state there is extensive literature supporting the relationship between a mother's low level of education and a poor nutritional status of children, but Pan American Health Organization, based on a study conducted in five Latin American countries, found that relationship in three/five of the cases (Morales et al. 2004; OPS 2009). In Brazil, anemia was associated to a higher number of people in the household, mothers aged under 20 years and children aged under 2 years (Alburquerque Silva de Paula et al. 2014). In Palestine, anemia was associated with parents' low level of education and smoking (Sirdah et al. 2014). In our study, the presence of anemia was not found to be associated with the housing characteristics or with parents/guardians' data, an outcome consistent with the nutritional origin of the disorder.

The Remediar Program provides to sick people antiparasitic drugs and/or ferrous sulfate for free in our country (Programa Remediar 2014). A study conducted by anthropologist Sanmartino G. in several healthcare centres in Argentina, including interviews to health professionals and mothers, detected the existence of professionals who do not consider important to give children iron supplements, therefore not prescribing it, as instructed by the regulations. In the group she studied, the reason why doctors do not prescribe iron supplements was they state that iron is better absorbed through nutrients supplied by food intake, especially meat, so they do not make an effort to determine whether patients can afford the appropriate nutrition (Sammartino 2010).

Considering these children had never had a blood panel done, health professionals underestimate anemia as a condition, and health regulations place them in the lowest rank among the vulnerable populations; this population should be reassessed and repositioned by public health agencies, as an early intervention facilitates reverting mild- and moderate-level anemia in the short term (Duran et al. 2009).

Limitations of this study are descriptive nature of the results, the small sample size and the lack of data about child growth. Taking into account the local nature of the results, the need arises to develop a larger number of studies in populations of similar characteristics.

Conclusions

This study reveals the coexistence of anemia and parasitic infections in apparently healthy children who were unnoticed by the conventional public health system.

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Persistent Transmission of Schistosomiasis in Southwest Nigeria: Contexts of Culture and Contact with Infected River Water

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Abstract

Transmission of schistosomiasis is aided by human behaviour. Globally, about 800 million people are at risk of schistosomiasis infection. Data exist on biomedical understanding of the disease transmission; there is a dearth of information from the social science perspective. Hence, this study explored the social and cultural context of schistosomiasis transmission among Yewa People in Nigeria. Qualitative methods were employed with purposive sampling, using the key informant interviews and focus group discussions, among 57 participants aged 17 to 54 years. The data were content-analyzed. River water was the most reported source of water supply among others. Participants drew from the cultural milieu the use of river water for "drinking" and "swimming" as part of the continual transmission of schistosomiasis. Transmission of schistosomiasis may not be abated without behavioural change.

Introduction

Schistosomiasis is a parasitic disease. It is also a major source of morbidity and mortality in developing countries in Africa, South America, the Caribbean, the Middle East and Asia (Njenga et al. 2014). Schistosomiasis, known as bilharzias, or snail fever is a very widespread disease in the developing world and the second most socioeconomically devastating tropical disease in the world after malaria (Kinunghi et al. 2014). The disease that has been recognized since the time of the Egyptian Pharaohs was first identified by Theodore Bilharz, a German surgeon working in Cairo in 1851. He discovered and identified the etiological agent *Schistosoma haematobium* (Nawal 2010). The disease can be found in areas where the water contains numerous freshwater snails, which may harbour the parasite and serve as the intermediate host between mammalian hosts (Alebie et al. 2014). According to Njenga et al. (2014), individuals within developing countries who cannot afford proper sanitation facilities are often exposed to contaminated water containing the infected snails.

Population at Risk

Globally, an estimated progression of 207 million people in 2010 to over 600 million people in 2014 were suffering from schistosomiasis infection (El Ridi et al. 2014; WHO 2013; WHO-TDR 2010), of whom 85% live in Africa, and another estimated 800 million people were at risk of infection in 76 countries where the disease is considered endemic (Van Dam et al. 2015; WHO 2010). Although schistosomiasis can be classified into four species, intestinal schistosomiasis and urinary schistosomiasis are the most common in Nigeria. In Nigeria, urinary schistosomiasis is known to have existed for a long time and might have been brought to the country by the migrants when they travelled westward from the Nile Basin (Cowper 1963).

World Health Organization (WHO 2013) reported that about 26.21% of the Nigerian population needed treatment; this indicated one of every four Nigerian. Although anybody can be infected with schistosomiasis, young individuals are mostly infected with peak prevalence and intensity of infection in the age group of 11–15 years (Anosike et al. 2006; Okoli and Odaibo 1999). The risk of infection is highest among those who live near lakes or rivers (IAMAT 2015). Schistosomiasis transmission may result into chronic illness that can damage the internal organs and, in children, impair growth and cognitive development (Negrão-Corrêa et al. 2014). Notably, schistosomiasis is a behaviour-related disease and could be explained through a theoretical view of the health belief model and has its association of risk infection to age, sex, occupation and patterns of settlement of individuals (Molyneux 2004), posing a great public health and socioeconomic threat in sub-Saharan Africa (Sangweme et al. 2010). Thus, increasing population size and corresponding needs for power and water supply led to the increase in schistosomiasis transmission (Besigye-Bafaki 2006).

Material and Methods

Research design

The study was descriptive and explanatory. The approach provides a better opportunity to understand the subtle and potentially important differences that may exist in the social and cultural beliefs of the participants, attitudes and opinions of the various participants on the phenomenon.

Objectives:

1. To explore the social and cultural context of schistosomiasis transmission in the study area.
2. To fill the gaps in the literature by explaining the reasons behind the unabated transmission despite several efforts to control the disease.
3. To provide baseline information for policy makers, in the case of further control program.

Study area

The study was carried out in Yewa North (formerly Egbado North) Local Government Area (LGA), Ogun State, Nigeria. It is situated in the west of Ogun State, Nigeria, bounded by the Ijebu-Ode and Republic of Benin in the west, Ewekoro LGA in the east, Imeko-Afon LGA in the north and Yewa South LGA in the south. Yewa North LGA has its headquarters in the town of Aiyetoro (or Ayetoro) at 7° 14'00" N 3° 02'00" E in the north-east of the area. It has an area of 2,087 km² and a population of 181,826 at the 2006 census, and the area is largely dominated by Yoruba-speaking people. The main occupations of the inhabitants are trading, timber logging and farming. The name "Yewa" is after the name of the Yewa River that passes through the area they inhabit. There are many flowing river bodies in the LGA, which serve as major sources of water supply. Thus, there are high human–water contact activities with rivers, which include bathing, swimming and other domestic usages.

Study population

Nine key informant interviews (KIIs) (among three religious leaders, two community health workers, two public school teachers and two traditional healers) and eight focus group discussions (FGDs) (among four male groups, where two groups were youths and two were adults in rural and urban areas; and four female groups, where two groups were youths and two other groups were adults in both rural and urban areas) were conducted.

Sampling technique

Qualitative sample was used using KII and FGD.

Inclusion criteria

Participants must have lived in the area for at least 10 years.

Exclusion criteria

Residents in the study area that have not lived in the area for at least 10 years were excluded.

Instruments

The KII and FGD guides' research instruments elicited information from the participants on sources of water, transmission of schistosomiasis disease and the role of social and cultural belief on the continual transmission of schistosomiasis disease.

Method of data collection

The data collection for the study entailed KIIs and FGDs with the participants. A detailed interview guide informed the discussion for all KIIs and FGDs, although interviewers and interviewees were allowed to deviate from the prepared guide as new themes emerged from the conversations. The interview and discussion sessions were digitally recorded.

Methods of Data Analysis

The data were analyzed with Nvivo software version 8, and content analysis guided interpretation of the data. Content analysis, as resides in the devising of precisely and clearly defined categories that apply to the material analyzed in accordance with explicitly formulated rules and procedures (Ball and Smith 1992), was also used. Prior to coding, transcriptions were read and re-read. The next step was coding the data using "sensitizing concepts" (Blumer 1969). A sensitizing concept was basically a working tool for this analysis. It was not set in stone and could be revised or elaborated to the topic being studied. The researchers then proceeded to the two phases of coding: "initial" and "selective or focused coding" (Charmaz 2002). These approaches allowed for free association of thematic issues and adoption of frequently reappearing initial codes in sorting and synthesizing large amount of data. Reliability was achieved by the use of "inter-coder reliability." We have shown that our assessment was recognized and agreed upon by others, as other observers were asked to review the analysis and see if they agree with our conclusions.

Results and Findings

Participants' profiles

Fifty-seven residents in the communities (30 participants in urban areas and 27 in rural areas) participated in the KIIs and the FGDs (31 males, 26 females). Participants with ages ranging from 17 to 55 years and an average range of length of residence in the community of 11 years were interviewed. Most participants were males (54.4%). Most of the participants were either Christians (49.0%) or Muslims (44.6%), with few representing the traditional religion (6.4%). A majority of the participants (38.4%) were farmers, followed by students (28.8%). More than half of the participants had at least secondary school education (61%). Please see Table 1 for details.

Sources of water and schistosomiasis transmissions

Participants acknowledged the patterns of interactions with stream as a source of water supply. Some had river water as their only source of water supply and claimed that other sources of supply are absent. According to a participant, "We drink water from the river here; there is no borehole here" (Adult male, FGD, rural). Similarly, a public school teacher from the same area corroborated this view and ascertained that the majority of the people depend solely on this same source of water. In her words: "Majority of the people here use river water, for drinking, washing, swimming and all other cleaning activities that demand water" (Public school teacher, KII, rural).

Others reported the availability of other sources of water, such as pipe-borne water and the use of pure water. According to one FGD report, the participants were aware that water from the river is associated with some diseases. The participant reported thus: "We do fetch water from the pipe borne water if there is electric power supply. So many people also buy pure water; because they say,

water from the river carries some disease" (Adult Female, FGD, rural).

Similarly, another participant from an urban area noted that they were used to river water before, but they now use borehole water instead. In his view, this must have occurred because of civilization: "In this community our source of water supply before civilization of getting borehole, was majorly from the river. But now, to cook, bath, wash and do other house work, people use bore hole instead of river water" (Religious leader, KII, urban).

Table 1. Demographic sketch of participants in rural and urban area

Variables	Rural	Urban	%	Total
Gender				
Male	13	18	54.4	31
Female	14	12	46.6	26
Age range				
Low	17	20	–	–
High	55	40	–	–
Educational level				
No education	6	0	10.0	6
Primary education	5	6	19.0	11
Secondary education	12	14	46.6	26
Post-secondary education	4	10	24.4	14
Religion				
Christianity	14	15	49.0	29
Islam	11	13	44.6	24
Traditional	2	2	6.4	4
Occupation				
Unemployed	0	3	5.0	3
Trader	7	0	12.8	7
Farmer	10	12	38.8	22
Teacher	1	1	3.2	2
Clergy	1	2	5.0	3
Student	6	10	28.8	16
Health worker	1	1	3.2	2
Traditional healer	1	1	3.2	2
Total number of participants	**27**	**30**	**100%**	**57**

Preference for river water: a pointer to continual schistosomiasis transmissions

Conversely, despite the availability of other sources of water, some participants describe their preference for river water. The reasons are not far-fetched, because to some, the pipe-borne water does not look fresh and sometimes it is "hard" when being used for drinking and household activities. According to a participant:

> We have pipe borne water here, we also have river water. Taking a lead from the Yoruba culture, people prefer to drink water from the stream to that of the pipe borne water. This is because the pipe borne water is sometime hard, and has taste, when it is being used for drinking. (Traditional healer, KII, rural)

Pointedly, interaction with stream or river water may continue unabated because of the cogent reasons given by different participants in this study. This is despite the fact that it has been scientifically proven that such contact aids schistosomiasis transmission. Moreover, the pattern of interaction with streams and schistosomiasis infection was summarized by the words of a health worker thus:

> Schistosomiasis is contacted through river water, which has snails that carried the infection. Whenever a person goes to the river to bath, the infection may be on the leaves that are on the river, or, even on the sand that is on the river, once a person is walking on it, the disease penetrates through the skin, from the skin to the blood stream and then to the bladder. But our people belief that schistosomiasis is contacted through dogs which they called *Àtòsíajá*. (Health worker, urban)

The youth participants in the focus group in rural areas emphasized their view on sources of water and its influence on schistosomiasis infection: "everybody likes to go to the river to play in the river." All other participants affirmed that they do go to the river "to play." The pattern of interaction is further enumerated by the experience of infected persons.

Discussion of Findings

This study explored why schistosomiasis transmissions continue despite the effort to control the infection. The data suggest that interaction with streams was coincidentally a major cause. As such, participants attest to this fact and one of the ways suggested by data is contact with infected river water. In fact, a participant unambiguously commented, "schistosomiasis is contacted through water; I mean river water, which has snails that carry the infection," and majority consented with this assertion. However, there exist oral tradition and cultural belief that the disease is being transmitted through dogs' urine, locally termed as "*Àtòsíajá*," a word that literally connotes dog gonorrhea.

It is postulated that cultural belief may act as a means of continual transmission of schistosomiasis. As such, the schistosomiasis control/elimination program (Bergquist et al. 2015) should include social and cultural understanding of people's behaviour, to avoid constant re-infection after treatment (Negrão-Corrêa et al. 2014).

Contact with infected water in the study area may have influenced the experience of infected persons on schistosomiasis. It is speculated that their exposure to river water may not only be because of ignorance but also poverty, as the source of water "before civilization of getting bore hole, was majorly from the river." Ugochukwu et al. (2013) noted that rivers and ponds, with divers' freshwater environment, offer favourable habitats for aquatic snails that serve as an intermediate host for schistosomiasis. As such, living in this environment without other sources of water supply can lead to a high prevalence of schistosomiasis disease.

In 2004, prevalence rate of schistosomiasis in the study area was calculated to be 25.0% (Ekpo and Mafiana 2004), while in 2012, it scaled up to 54.8% (Hassan et al. 2012) in the same study area. Notably, if the condition that predisposes people to infection had not changed, as affirmed by "we drink water from the river here," intrinsically, schistosomiasis transmission and its prevalence rate will intensify.

As reported by participants in the study, there were also other sources of water supply, such as electrically generated pipe-borne water (in the rural areas where supply of electricity is erratic) and borehole water (in the urban area where such belong to the wealthy, because of the cost of installing one). It is assumed that lack of accessibility to pipe-borne water and borehole water was the reason why the vast majority of the people make use of river water. However, some participants' decision to choose river water irrespective of the availability of other sources confirmed cultural context around river water "*omiafòwúròpo*," a word that socially connotes fetching early morning water, which is culturally believed to be fresher than any other time of the day. As such, the presence of other sources of water may not make any difference, as "people prefer to drink water from the stream to that of the pipe borne water" (Traditional healer, rural).

Conclusion

There are limitations to this study. The sample was small and geographically limited to Yewa North LGA. Invariably, experiences described by participants cannot be generalized to cultural context of schistosomiasis in other communities. It was beyond the scope of this article to examine the impact of the disparity in access to water sources among participants owing to living in rural versus urban areas, especially as it relates to

deliberate prevention of schistosomiasis. Also, this article did not delve into the questions of other forms of causation apart from the one mentioned by the participants, so a further study could be proposed on cultural perceived causation of schistosomiasis disease.

Notwithstanding the limitations, this current study contributes to the understanding of the role that cultural context may play in schistosomiasis transmission among the study area. Therefore, culture can provide valuable insight into future schistosomiasis control/elimination programs. Thus, policies on schistosomiasis control and elimination programs can benefit from understanding cultural context. As behaviour does not occur in a vacuum outside of culture, policies should take advantage of this context and its influence on schistosomiasis transmission. Consequently, WHO policies on schistosomiasis elimination can be strengthened through working with social scientists. Such social scientists, for example, sociologists and anthropologists, can be a resource to schistosomiasis control programs in this context, as they can serve as a link between community knowledge and scientific explanation, not only in the education of the community members about mode of transmission but also providing them with cultural adaptation strategy that may ensure reversal of re-infection of schistosomiasis. We anticipate that, without a careful understanding of the cultural context of schistosomiasis transmission, control program or elimination proposal of the disease may remain a continual dilemma, if not totally difficult.

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Knowledge of Prenatal Healthcare among Pregnant Women in Boyer-Ahmad and Dena County of Kohgiluyeh and Boyer-Ahmad Province, Iran

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Abstract

Introduction and objective: Prenatal care knowledge is critical for pregnant women's use of antenatal services. The aim of the study was to assess the extent of prenatal healthcare knowledge among pregnant women of the Boyer-Ahmad and Dena County of Kohgiluyeh and Boyer-Ahmad Province, Iran.

Methods: A cross-sectional survey was conducted between April and June 2013. Pregnant women who came for delivery to the only available public hospital were interviewed by trained research assistants. Interview questions were designed to assess their knowledge on five broad categories of prenatal care practices of immunization, diet, supplementation, antenatal checkups and warning signs. Collected information was converted into numerical scores and average score for each individual was calculated. Independent-samples *t*-test, analysis of variance and multiple comparison tests were used to compare scores among groups with different demographic and socioeconomic status. **Results:** A total of 400 pregnant women with 66.8% illiterate or lowly educated and an average age of 28.5 ± 6.1 years participated in the study. The average care knowledge score was 16.8 out of a maximum of 30. The highest awareness was observed on immunization (54.4%) and the lowest for prenatal checkup (20.3%).The average knowledge scores were significantly different among age groups, educational level, number of gravidity, type of occupation, place of residence and time of starting of prenatal care. There were no significant differences between women with and without obstetric complications. **Conclusion:** Not surprisingly, the level of education was the most significant factor influencing women's knowledge of parental healthcare, reinforcing the need for the improvement in literacy and expansion of health education among pregnant women using various educational methods.

Introduction

About 800 women die from pregnancy or childbirth-related complications around the world every day. In 2013 alone, 289,000 women died during pregnancy or at childbirth. In developing countries, maternal mortality is a significant public health issue, with a mortality rate of 230 per 100,000 live births versus 16 per 100,000 in developed countries. Almost all maternal deaths (99%) occur in developing countries (WHO 2014), with large disparities between countries, and between women with high and low income and those living in rural and urban areas.

Maternal health improvement was adopted as the eight Millennium Development Goals (MDG5) of the international community in 2000. Under MDG5, countries committed to reducing maternal mortality by three-quarters between 1990 and 2015. Since 1990, maternal deaths worldwide have dropped by 45% (WHO 2005). In Iran, maternal death has declined from 83 in 1990 to 19 in 2015 (WHO et al. 2015). However, the global maternal mortality ratio declined by only 2.6% per year during the same period, far from the annual decline of 5.5% required to achieve MDG5 (WHO 2014).

In order to achieve this goal, all women need to have access to high-quality prenatal care, including medical and nursing care recommended for women during pregnancy and regular checkups to detect as well as treat potential health issues that may arise during pregnancy (WHO 2005). Lack of prenatal healthcare has been identified as one of the risk factors for maternal mortality and other adverse pregnancy outcomes in developing countries (Anandalakshmy et al. 1993; Fawcus et al. 1996). Women who receive prenatal healthcare have lower rates of maternal and infant mortality, as well as better pregnancy outcomes (De Brouwere et al. 1998). Health knowledge is considered as one of the key factors that enable women to be aware of their rights and health status to seek appropriate health services. Knowledge on prenatal care is critical in determining

pregnant women's use of antenatal services. Moreover, studies have shown that adequate knowledge of prenatal care has a positive and statistically significant effect on prenatal care use (Nisar and White 2003; Paredes et al. 2005; Simkhada et al. 2008).

The objectives of the study were to assess the extent of the prenatal healthcare knowledge among pregnant women of Boyer-Ahmad and Dena County, identify the contributing factors and provide a framework for further maternal health education. The Boyer-Ahmad and Dena counties were selected because no previous study was conducted and nearly half of the province population live in these two counties. Boyer-Ahmad is the largest and most populated county of the Kohgiluyeh and Boyer-Ahmad province, with a population of 243,771 and 58,281 households based on the 2011 census. The number of 10–49-year-old women is reported to be 50,527, with a population growth rate of 2.18 and a total fertility rate of 2.2 in 2013-2014. The Dena County population was reported to be 52,242, with 11,117 households (Census of the Islamic Republic of Iran 2011). The number of 10–49-year-old women is reported to be 7,454, with a population growth rate of 1.77 and a total fertility rate of 2.18 in 2013–2014 (Census of the Islamic Republic of Iran 2011).

Methods

A cross-sectional survey was conducted between April and June 2013.The target population were all pregnant women who were referred to the labour and delivery floor of Imam Sajjad Hospital for delivery, the only available public labour ward. This hospital covers about 94% of delivery and birth services of these two counties (Medical Deputy of YUMS 2013).

We chose to obtain our sample population from a public hospital where all women, regardless of socioeconomic status, can receive equal care and covers majority of pregnant women. We did not include women who were referred to two other hospitals in this area, one private and the other semipublic, which covered only 6.3% (592) of deliveries, mostly (98%) in elective caesarean section (Medical Deputy of YUMS 2013).

All the pregnant women who came for delivery during the study period were recruited and informed about the aim of the study. A questionnaire consisting of two parts (socio-demographic and prenatal healthcare knowledge information) was administered by the trained research assistants. Demographics information included age and place of residence, education and occupation status as well as state of previous and current pregnancies. The knowledge section consisted of 15 multiple-choice questions. The questions were designed to assess their knowledge about five broad categories of prenatal care practices; immunization (two questions), diet (four questions), supplementation (three questions), antenatal checkups (four questions) and warning signs (two questions). The content of the questionnaire, which was based on the materials used by the local health system, was explained to women for the sake of clarification.

The percentages of correct answers were calculated to determine the extent of their knowledge in each category. The answers were also converted into a scores ranging from 0 to 2 (0 indicated an incorrect answer, 2 indicated a correct answer and 1 indicated answer choices that could apply in some situations). After assigning each response a score, the average score for each individual was calculated.

The data were analyzed using the statistical package for social sciences (SPSS) version 22. Independent *t*-test, analysis of variance, multiple comparison and chi-square tests were used to compare scores between subgroups of demographics and socioeconomic status. A p-value of ≤ 0.05 was considered significant.

Results

The average age of 400 pregnant participant women was 28.44, with a standard deviation of 6.04, and ranged from 14 to 50 years.

The average prenatal healthcare knowledge score was 16.8 out of a maximum of 30. The highest percentage of awareness was observed for immunization (54.4%) and the lowest for the prenatal checkup (20.3%; Table 1).

Table 1. Pregnant women awareness for different categories of parental care knowledge

Maternal practice	Awareness (%)
Immunization	54.5
Diet	41.2
Supplement	50.5
Antenatal checkups	20.3
Warning sign	40.0

Urban women awareness was higher than rural for all domains, with the exception of warning sign (Table 2). Socio-demographic characteristics of the participants are presented in Table 3. A majority (56.8%) belonged to the 20–29-year age group, 77.7% were housewives, 37.3 % were illiterate and 32.7% were primigravida. More than half (52%) were urban residents and 65.2% have started prenatal care visit during the first trimester. Only 4.8% of the participants had post-secondary education.

Table 2. Pregnant urban and rural women awareness for different categories of parental care knowledge

Maternal practice	Awareness (%)		*p*-value
	Urban	Rural	
Immunization	73.3	26.7	0.00
Diet	52.6	47.4	0.30
Supplement	56.9	43.1	0.03
Antenatal checkups	54.4	45.6	0.03
Warning sign	42.9	57.1	0.20

Table 3. Mean, standard deviation and significance level of pregnant women knowledge score for demographic and prenatal care practices

Variables	Freq. (%)	Mean ± SD	Sig.
Age (years)			0.001
<20	17 (4.2)	16.8 ± 3.0	
20–29	227 (56.8)	17.1 ± 2.4	
30–39	136 (34.0)	16.5 ± 2.5	
≥40	20 (5.0)	14.8 ± 3.4	
Gravidity			0.020
1	131 (32.7)	17.09 ± 2.3	
2	109 (27.3)	17.1 ± 2.3	
≥3	160 (40.0)	16.3 ± 2.9	
Education			0.030
Illiterate	149 (37.3)	16.4 ± 2.8	
Primary school	118 (29.5)	16.8 ± 2.4	
High school	114 (28.4)	17.2 ± 2.5	
Post-secondary	19 (4.8)	17.2 ± 1.8	
Place of residence			0.018
Rural	192 (48.0)	16.6 ± 2.7	
Urban	208 (52.0)	16.9 ± 2.5	
Occupation			0.004
Civil servant	32 (8.0)	16.7 ± 2.4	
Health professionals	57 (14.3)	17.8 ± 2.4	
Housewife	311 (77.7)	16.6 ± 2.6	
Husband occupation			0.40
Unemployed	29 (7.3)	17.3 ± 2.6	
Worker	37 (9.3)	16.8 ± 3.0	
Civil servant	95 (23.8)	17.2 ± 2.1	
Personal business	239 (59.8)	16.6 ± 2.5	
Time of first prenatal visit			0.001
Preconception	75 (18.8)	17.6 ± 2.4	
First trimester	260 (65.2)	16.8 ± 2.5	
Second trimester	32 (8.0)	15.7 ± 3.2	
Third trimester	10 (2.5)	14.8 ± 2.4	
Never	22 (5.5)	15.9 ± 2.5	
Pregnancy status			0.27
Without complication	320 (80.0)	17.08 ± 2.4	
With complication	80 (20.0)	16.7 ± 2.6	

Freq. = frequency; Sig. = significance level.

The average knowledge scores were significantly different among age groups, education status, gravidity, occupation, place of residency and time of starting of prenatal care (Table 3). However, there was no significant difference between knowledge score of women with and without obstetric complications.

Using multiple comparison tests, significant differences were found between women older than 40 and 20–29-year-old ($p \leq 0.001$) and 30–39-year-old ($p \leq 0.030$) age groups, primigravida and multigravida ($p \leq 0.045$), illiterate and tertiary level of education ($p \leq 0.020$) and housewives with health professionals ($p \leq 0.002$). There were also significant differences in the average knowledge score between women who have started prenatal visit during preconception period and women who have started during second trimester ($p \leq 0.005$) and third trimester ($p \leq 0.01$) of pregnancy.

Demographic characteristics and prenatal care knowledge of rural and urban pregnant women are presented in Table 4. Pregnant women with age less than 20 and greater than 40 (high-risk age group) were more frequent in rural than urban. Younger women (<20 years old) were in majority in the rural category, while women in 40 and older age group were in minority. Significant age group difference was found in knowledge score among rural women. While women illiteracy was higher in rural women, tertiary education was higher in urban women. The percentage of civil servants and health professional was significantly higher among urban than rural women. The rate of preconception visit was significantly higher in urban women than rural and their knowledge level was higher than both rural and urban women who had their first preconception visit.

Discussion

Prenatal care has long been considered a basic component of any reproductive healthcare program. In this study, the average prenatal healthcare knowledge score was 16.8 out of a maximum of 30. This can be attributed to the fact that about two-thirds of women were either illiterate or with primary school education. Urban women had a significantly higher average total parental care knowledge score than their rural counterparts (Table 3) due to higher literacy rate.

Not surprisingly and in agreement with other studies (Kishk 2002; Ohnishi et al. 2005; OnasogaOlayinka et al. 2012; Riazi et al. 2012; Sharma and Sharma 2012; William et al. 2008), education was found to be the most important factor affecting prenatal care knowledge. Knowledge not only transforms, but also empowers women and improves their self-esteem (Renkert and Nutbeam 2001). It is expected that educated women are more likely to be aware of their health status and seek health information. Furthermore, educated women may have a greater decision-making power on health-related matters.

The prenatal care knowledge score was decreased, as women got older, particularly in rural women. The highest score was recorded for the 20–29-year-old age group. However, differences among age groups were statistically significant only between those aged 40 and higher and 20–29 and 30–39-year-old age groups. In rural women, the highest score was recorded for those with age group under 20 years, suggesting some improvement in recent years. Other studies also reported significant age effect (French et al. 2003; Wu et al. 2007).

The prenatal care knowledge score was significantly lower for women with three or more pregnancies than other groups. This difference was more obvious in rural women. This might be due to lower educational level and higher gravity score in this group compared with the younger women. The lack of adequate prenatal healthcare knowledge among older women and multigravidas may be due to non-attendance at antenatal care and/or insufficient information received in the previous pregnancy. Women without basic education are more likely to acquire

information on pregnancy from friends and relatives, which often make them to believe that their prenatal health knowledge is adequate. However, their "knowledge" might be traditional beliefs and habits. Several studies have reported a negative association between gravidity and prenatal care (Riazi et al. 2012; Qi Zhao et al. 2009; William et al. 2008).

Table 4. Mean, standard deviation and significance level of urban and rural pregnant women knowledge score for demographic and prenatal care practices

Variables	Urban			Rural			X^2 test and sig. of comparing freq. (%) of variables
	Freq. (%)	Mean ± SD	Sig.	Freq. (%)	Mean ± SD	Sig.	
Age (years)			0.4			0.001	$X^2 = 10.1$; df =3; $p = 0.01$
<20	7 (3.4)	16 ± 0.3		10 (5.2)	17.4 ± 2.8		
20-29	134 (64.4)	17.1 ± 2.5		93 (48.7)	17.12 ± 2.4		
30-39	59 (28.4)	16.6 ± 2.4		76 (39.8)	16.3 ± 2.6		
≥40	8 (3.8)	16.7 ± 2.1		12 (6.3)	13.5 ± 3.5		
Gravidity			0.5			0.002	$X^2 = 8.8$; df = 2; $p = 0.01$
1	7 (37)	16.8 ± 2.3		53 (27.8)	17.5 ± 2.2		
2	62 (29.8)	17.2 ± 0.3		47 (24.6)	16.9 ± 2.1		
≥3	69 (33.2)	16.9 ± 2.6		91 (47.6)	15.9 ± 3.07		
Education			0.02			0.02	$X^2 = 24.9$; df = 3; $p = 0.001$
Illiterate	55 (26.4)	16.2 ± 2.7		94 (49.2)	16.5 ± 2.9		
Primary school	68 (32.7)	17 ± 2.5		50 (26.2)	16.6 ± 2.1		
High school	26 (12.5)	16.8 ± 2.3		20 (10.5)	16.5 ± 2.3		
Post-secondary	59 (28.4)	17.7 ± 2.1		27 (14.1)	17.1 ± 3.2		
Occupation			0.04			0.1	$X^2 = 23.7$; df = 2; $p = 0.001$
Civil servant	21 (10.1)	17.7 ± 2.5		11 (5.8)	16.3 ± 2.2		
Health professionals	45 (21.6)	17.7 ± 2.2		12 (6.3)	18.2 ± 2.3		
Housewife	142 (68.3)	16.7 ± 2.5		168 (87.9)	16.5 ± 2.7		
Husband occupation			0.6			0.3	$X^2 = 15.2$; df = 3; $p = 0.002$
Unemployed	24 (11.5)	17.08 ± 2.6		5 (2.6)	18.6 ± 2.7		
Worker	52 (25)	17.2 ± 2.7		43 (22.5)	16.3 ± 3.2		
Civil servant	22 (10.6)	17.3 ± 2.2		15 (7.9)	17.0 ± 1.9		
Personal business	110 (52.9)	16.7 ± 2.4		128 (67)	16.5 ± 2.6		
Time of first prenatal visit			0.02			0.02	$X^2 = 21.1$; df = 4; $p = 0.001$
Preconception	55 (26.4)	17.7 ± 2.5		20 (10.5)	17.4 ± 2.16		
First trimester	115 (55.6)	16.9 ± 2.3		145 (75.9)	16.7 ± 2.6		
Second trimester	19 (9.2)	16.3 ± 2.6		13 (6.8)	14.9 ± 2.2		
Third trimester	5 (2.4)	15.0 ± 2.9		4 (2.1)	14.2 ± 2.7		
Never	13 (6.3)	16.0 ± 2.5		9 (4.7)	15.8 ± 2.6		
Pregnancy status			0.5			0.04	$X^2 = 2.48$; df =1; $p = 0.07$
Without complication	160 (76.9)	17.0 ± 2.4		159 (83.2)	16.4 ± 2.8		
With complication	48 (23.1)	16.7 ± 2.6		32 (16.8)	17.5 ± 2.1		

Freq. = frequency; Sig. = significance level.

The average prenatal healthcare knowledge scores were lower for housewives than employed women, particularly for health professionals with higher educational status. The percentage of civil servants and health professionals in urban women was significantly higher than rural women due to their higher basic formal education. While knowledge score difference for occupation was significant for urban women, it was not significant for rural women. Similar studies in Iran found employment to be a significant factor and majority of the women with low prenatal healthcare knowledge score to be housewives (Riazi et al. 2012).

Most of the pregnant women had their first visit during the first trimester of pregnancy. Women with lower average prenatal healthcare knowledge score started their prenatal care at the second trimester of pregnancy and later. It is recommended that all expectant mothers receive prenatal care training before and during the first trimester of pregnancy. The initiation of prenatal care during training and education during the first trimester of pregnancy allows for timely diagnosis and treatment of numerous health issues (Villar and Bergsjo 2003). This study confirmed that the utilization of prenatal healthcare service among women with sufficient knowledge about the benefits of prenatal healthcare during pregnancy was higher than among women lacking such knowledge, in agreement with other studies (Diego et al. 2009; Kulkarni and Nimbalkar 2008; Mahajan and Sharma 2014; Yang et al. 2007).

Women who initiated prenatal care before their pregnancy were second in the total frequency ranking, both in rural and urban, but the rate of preconception visit was significantly higher in urban women than rural women (Table 4). Furthermore, they had the highest knowledge score and their average knowledge score about prenatal healthcare was significantly higher than women who initiate prenatal care during the second trimester and later. Preconception health knowledge means knowing how health conditions and risk factors could affect women and their unborn babies at pregnancy. New WHO report shows that preconception care has a positive impact on maternal and child health outcomes. Preconception care is the provision of biomedical, behavioural and social health interventions before conception occurs. Preconception care aims at improving women health status, and reducing behavioural and environmental factors that contribute to poor maternal and child health outcomes. Its ultimate aim is to improve maternal and child health, in both the short and long term (WHO 2013).

In this study, we chose to obtain our sample population from a public hospital. We did not include women who referred to two other hospitals in this area, one private and the other semipublic. This might be a source of bias, given that this group had a higher socioeconomic status and perhaps higher prenatal healthcare knowledge. Furthermore, our results might not be representative of the whole province, given that a cross-sectional survey was conducted in only one area. Further broad-based studies with larger sample size are needed to confirm these findings.

Iran's approach to family planning policies has changed during the past few years. After authorities and policymakers suggested the need for population increase, the Supreme Leader stated that family planning policies should be ceased. In July 2012, the budget for family planning was reduced drastically and women were encouraged to have three children by the age of 30. At present, public access to free contraceptives is not banned; however, it is restricted to a great extent. It is not clear what impact the change in family planning policy will have on prenatal care.

Conclusion

Based on our findings, educational status plays a very significant factor in the

understanding of the importance of prenatal care knowledge. The main factor was the lower formal education particularly in rural women and higher age and gravidity of both rural and urban women. This finding suggests the need for a targeted health education using various educational methods for pregnant women. Women should be aware of the importance of prenatal care to proactively prepare for pregnancy and seek care early. Healthcare providers, educators and policymakers can use these insights to develop strategies and assess health service needs of pregnant women. Furthermore, the risk of an education gap between rural and urban areas is real. Despite the fact that education is a basic right in itself and essential for improving the living conditions of both rural and urban populations, adult illiteracy is much higher and quality of education is poorer for rural people. To address this challenge, more rigorous and scientific approaches are needed for building awareness about the importance of education to overcome the urban/rural education gap through access to basic education, improvement of basic education quality through design and implementation of basic education plans.

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