PAA Abstract Submission – Additional Text and tables

Blood Pressure and BMI among Adult Migrants and Non-Migrants from Agincourt, South Africa

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Introduction

Blood pressure (BP) levels and hypertension tend to be higher in urban migrants compared to non-migrants from the same rural source population. Factors such as migrant selectivity, exposure to urban diets and physical activity patterns, increased psychosocial stress and differential access and use of health systems may be partially responsible for these rural non-migrant versus urban migrant differences. South African Blacks have high levels of overweight and hypertension, which have been increasing over the last 10-20 years. This study reports on levels of BP, hypertension, and body mass index (BMI) and overweight, as measures of adiposity levels, among non-migrants from Bushbuckridge, South Africa and migrants from that area residing in Gauteng Province. We show these cardiometabolic disease risk levels at the baseline of a longitudinal study of migration, urbanization and health.

Methods

A sample of 3,800 adults age 18-29 years was drawn from the Agincourt Health and Demographic Surveillance System in Mpumalanga Province, northeast South Africa. Initial recruitment contacts with those selected resulted in 3061 individuals for whom contact information and non-migrant and migrant status was known. The target baseline sample is 2,079 non-migrant participants residing in Agincourt or Bushbuckridge, and 982 migrants, with many residing in Gauteng Province where Johannesburg and Pretoria are located. Gauteng is a major destination for migrants from the rural Bushbuckridge area. Fieldwork began in late 2017 and is continuing through 2018, when the first wave of baseline data collection will stop. Four waves of data collection are planned over 5 years with annual interviews, some by telephone. Human biological assessments, including BP and adiposity, are being done in Wave 1 and are scheduled to be performed again in Year 4.

For this interim analysis a representative sample of 1,589 men and women 19-42 years of age from the rural and urban areas had BP and body mass index (BMI) measured and were interviewed at baseline of a longitudinal study. By the end of Wave 1 later in 2018 the study sample size will increase towards the goal of ~3,000.

BP was measured after a 10-minute seated rest period blood pressure (BP) was measured three times, with 3-minute rest periods between measurements, using an Omron HEM907 XL digital blood pressure monitor (Omron Healthcare, IL). Hypertension was defined as having either a systolic BP $\geq$ 140 mm Hg or diastolic BP $\geq$ 90 mm Hg, or currently taking medication for hypertension. Height and weight were measured with standard methods and BMI calculated as weight divided by the square of height. BMI was categorized into four groups based on BMI (See Table 1): Underweight - BMI < 18.5 kg/m^2; Normal weight - 18.5 $\leq$ BMI < 25.0 kg/m^2; Overweight – 25.0 $\leq$ BMI < 30.0 kg/m^2 ; Obese – BMI $\geq$ 30.0 kg/m^2. > 25 kg/m^2.

This concise descriptive report highlights the basic differences between the two samples; non-migrants compared to migrants, stratified by sex. We also run exploratory multivariable models of BP levels and hypertension to understand the roles of age and BMI on any differences between migrants and non-migrants.

Results

In rural Bushbuckridge hypertension prevalence was 11.1% and 17.0%, in women and men, respectively. Among migrants residing in urban Gauteng prevalence was significantly higher in each sex, 22.1% and 32.3%, p= 0.0004 for women and p< 0.0001 for men, respectively (Table 1). The sex difference in hypertension prevalence was significantly different in Bushbuckridge, p= 0.002, but in Gauteng the difference was marginal, p=0.052.

Few people with hypertension reported current use of hypertensive medication. Overall only 7.5% and 5.6% of hypertensives were using medication in Bushbuckridge and Gauteng, respectively. There were strong sex differences in use of medication among those with hypertension. In the rural location, 13.8% (11/80) of women with hypertension used medication, compared to 2.2% (2/93) among men. Similarly in Gauteng, 13.8% (4/29) of women and 1.6% (1/61) of men use hypertensive medication.

Among rural women and men cross-sectional age was significantly correlated with both systolic and (r = 0. 0.22, p<0.001, and r= 0.14 p=0.01, respectively) and diastolic BP levels (r = 0.27, p<0.001, and r= 0.30 p< 0.001, respectively). Among urban migrant women cross-sectional age was significantly correlated with both systolic and diastolic BP (r = 0. 0.1922, p=0.03, and r= 0.18 p=0.04, respectively). In contrast age was not associated among migrant men (r = 0. 04, and r= 0.09, both p>0.20, for systolic and diastolic BP respectively). This is unusual since BP levels are generally positively associated with adult age.

BMI was not different among women when comparing the two locations (Table 1). However, among men BMI was significantly higher, 1.12 kg/m^2, among the Gauteng migrant sample. BMI was associated with age in women and men from rural Bushbuckridge, (r = 0. 0.24 and r= 0.25 both p< 0.001, respectively). However, in Gauteng age was not associated with BMI in women but was in men, r=0.22, p=0.003.

The unadjusted positive association between weight status, assessed by BMI category, and hypertension was significant in both sexes and in both locations, although the level of hypertension was greater in the overweight and obese groups in Gauteng (Table 2).

In all women multiple regression of mean systolic BP and diastolic BP on age, BMI and location showed significant (all p<0.0001) positive associations of age and BMI with both BPs and that age and BMI adjusted BPs were significantly higher among the Gauteng migrants. For systolic BP for example, adjusted BPs were higher by 4.5 mm Hg in the Guateng women. In men adjusted systolic BP was significantly associated, p<0.0001, only with BMI, and neither age nor location were. Adjusted diastolic BP in men was significantly positively associated with age and BMI and location, with Gauteng men having an adjusted diastolic BP approximately 2.7 mm Hg higher than Bushbuckridge men.

Logistic regression with hypertension as the outcome showed that for both women and men the migrants in Gauteng had higher odds for hypertension, 2.7 (95 % CIs: 1.6, 4.5) and 1.9 (1.3, 2.9), respectively (Table 3).

Discussion

The higher hypertension prevalence among the migrants from rural Bushbuckridge to Guateng is notable with more than one-fifth of women and almost one-third of men having hypertension. The analysis of this ongoing cross-sectional baseline of a longitudinal study indicated that even after adjusting for the expected positive association of adiposity, assessed by BMI, and age, there was a 2 – 3 fold greater odds of hypertension in the Gauteng migrants relative to the Bushbackridge non-migrants. This suggests that factors beyond age and adiposity influence hypertension and BP levels.

This preliminary analyses will be improved with additional numbers of participants at baseline as the first wave of fieldwork ends in late 2018. The basic contrasts described here do not assume that we should find differences in the complete baseline data, nor that we understand the various factors that may be contributing to the differences detected in this early analysis. We are careful about over-interpreting the BP and hypertension differences reported here as due to migration. The purpose of the longitudinal interdisciplinary study is to focus on much more complex analyses and adjustments for sample weights, non-representativeness, migrant selectivity and the measured longitudinal effects of the heterogeneous rural and urban environments that may influence blood pressure levels and trajectories. These factors include indicators of diet, well-being, occupational and residential factors in each location, and *a priori* hypothesized interactions among some of these.

Nonetheless the results here are consistent with other studies in South Afrcia and Sub-Saharan Africa in the early 21th century and indicate the need to more fully understand the impact of migrant and urbanization on BP and hypertension. The findings about the low level of hypertensive medication use among those with hypertension, especially among men, is of special note and public health and primary care systems should be aware if these unmet needs as the health transition proceeds in S Africa and elsewhere.

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Table 1. Sample description by Location

Sample Characteristics		Bushbuckridge (n=1270)	Gauteng (n=319)
Sex % (n)			
Female		56.8 (n=722)	40.8 (n=130)
Male		43.2 (n=548)	59.2 (n=189)
Age yrs Mean (sd)			
Females		28.3 (6.0)	27.8 (5.2)
Males		26.5 (5.8)	29.7 (5.2)
Blood Pressure (BP) mm Hg & Hypertension[1] %			
Females	Systolic BP Mean (sd)	120.5 (12.6)	125.1 (14.4)
	Diastolic BP Mean (sd)	76.4 (9.6)	81.4 (11.1)
	Hypertension %	11.1	22.1
	Hypertension Medication[2] %	13.7 (n=11)	13.8 (n=4)
Males	Systolic BP Mean (sd)	129.2 (10.9)	131.1 (12.7)
	Diastolic BP Mean (sd)	77.2 (9.5)	81.7 (9.1)
	Hypertension %	17.0	32.3
	Hypertension Medication[2] %	2.1 (n=2)	1.6 (n=1)
Body Mass Index (BMI) & Weight status[3]			
Females			
	BMI kg/m^2 Mean (sd)	27.6 (6.4)	27.9 (5.9)
	Underweight %	4.2	2.3
	Normal weight %	34.2	29.2
	Overweight %	30.5	35.4
	Obese %	31.2	33.1
Males			
	BMI kg/m^2 Mean (sd)	22.7 (4.2)	23.9 (4.1)
	Underweight %	9.9	4.8
	Normal weight %	68.1	62.4
	Overweight %	16.8	24.3
	Obese %	5.3	8.5

[1] Hypertension: Systolic BP $\geq$ 140 mm Hg or Diastolic BP $\geq$ 90 mm Hg, or current use of antihypertensive medication.

[2] Hypertensive Medication: percentage of people with hypertension currently on antihypertensive medication.

[3] Weight Status: Underweight - BMI < 18.5 kg/m^2; Normal weight - 18.5 $\leq$ BMI < 25.0 kg/m^2; Overweight – 25.0 $\leq$ BMI < 30.0 kg/m^2 ; Obese – BMI $\geq$ 30.0 kg/m^2.

Table 2. Bivariate Association of Hypertension and BMI by Sex and Location

	Normal BP	Hypertension
Bushbuckridge Women	(n=642)	(n=80)
Underweight[1]	93.3%	6.7%
Normal Weight	95.1%	4.9%
Overweight	91.4%	8.6%
Obese	85.8%	14.2%
Severely Obese	69.2%	30.8%
Chi-square 48.7, p<0.001		
Bushbuckridge Men		
Underweight	90.7%	9.3%
Normal Weight	87.4%	12.6%
Overweight	70.7%	29.3%
Obese	54.2%	45.8%
Severely Obese	40.0%	60.0%
Chi-square 38.1, p<0.0001		
Gauteng Women		
Underweight	100%	0%
Normal Weight	86.8%	13.2%
Overweight	82.6%	17.4%
Obese	66.7%	33.3%
Severely Obese	53.9%	46.1%
Chi-square 9.7, p=0.046		
Gauteng Men		
Underweight	88.9%	11.1%
Normal Weight	72.0%	28.0%
Overweight	63.0%	37.0%
Obese	41.7%	58.3%
Severely Obese	25.0%	75.0%
Chi-square 10.4, p=0.035		

[1]: Weight Status: Underweight - BMI < 18.5 kg/m^2; Normal weight - 18.5 $\leq$ BMI < 25.0 kg/m^2; Overweight – 25.0 $\leq$ BMI < 30.0 kg/m^2 ; Obese – BMI $\geq$ 30.0 kg/m^2.

Table 3. Logistic Regression of Hypertension on Age, BMI and Location by Sex

	ORs	95 % CI
Women N= 843		
Age	1.10	(1.06, 1.15)
BMI	1.10	(1.07, 1.14)
Location[1]	2.69	(1.62, 4.49)
Men N= 727		
Age	1.03	(0.99, 1.06)
BMI	1.15	(1.10, 1.21)
Location[1]	1.93	(1.28, 2.91)

[1]: Location – 0= Bushbuckridge, 1= Gauteng