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Richer but fatter: the unintended consequences of microcredit financing on household health and expenditure in Jamaica

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Abstract

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Objective

To determine whether there was a difference in wealth and cardiovascular disease (CVD) risk between microcredit loan beneficiaries and community-matched non-beneficiaries (controls).

Methods

Seven hundred and twenty-six households of microcredit loan beneficiaries were matched with 726 controls by age, sex and community. A standardised interviewer administered questionnaire was used to collect data on health and household expenditure. Weights, heights, waist circumference and blood pressure measurements were taken for an adult and one child (6–16 years) from each household.

Results

Amongst adults, there was no difference in the prevalence of pre-hypertension and hypertension. More male (68.1% *vs*. 47.8%) and female beneficiaries (84.5% *vs*. 77.9%) were overweight/obese. More male (17.2% *vs*. 7.1%; $P < 0.05$) and female beneficiaries (68.5% *vs*. 63.3%; $P < 0.05$) exhibited substantially increased risk for CVD. Children of beneficiaries displayed higher mean BMI-for-age *z*-scores than their control peers: males 0.56 [95% CI 0.40–0.72] *vs*. 0.18 [95% CI 0.02–0.35] ($P < 0.001$) and females 0.66 [95% CI 0.52–0.80] *vs*. 0.42 [95% CI 0.29–0.56] ($P < 0.001$). Based on BMI-for-age *z*-scores, children of beneficiaries had greater odds of being overweight/obese (OR = 1.46; 95% CI 1.18–1.82) Beneficiaries were economically better off; their mean total annual expenditure and house ownership were significantly higher than controls ($P < 0.001$).

Conclusions

Microcredit financing is positively associated with wealth acquisition but worsened cardiovascular risk status.

Introduction

Microcredit schemes provide access to small amounts of capital to individuals traditionally operating outside the formal banking system and have transformed the economic status of families and communities worldwide (Yunus **2007**). Many successful microcredit schemes have directly or indirectly improved women's empowerment, family health, girls' education and the incorporation of micro-entrepreneurs into the cash economy (Pitt & Khandker **1998**). Nobel Peace Prize 2006 recipient Muhammad Yunus highlighted the role that microcredit plays in the economic and social development of the poor and the promotion of peace through poverty reduction (Yunus **2006**). However, studies have found microcredit schemes to be associated with greater debt (Brett **2006**), increased levels of violence against women in culturally conservative areas (Koenig *et al*. **2003**) and increased levels of perceived stress (Fernald *et al*. **2008**). Nevertheless, the successes of the global experience suggest that microcredit financing may provide a path to poverty alleviation and economic development (Yunus **2007**).

One stakeholder in microcredit allocation is Jamaica National (JN) Small Business Loans Limited, a wholly owned subsidiary of the Jamaica National Building Society. The beneficiaries are predominantly women of lower socio-economic status, who typically would not have enough collateral to qualify for a loan from a commercial bank. Loans of $30 000–$500 000 Jamaican Dollars (JMD) are offered to finance microbusinesses, on a term of 10–50 weeks. Interest was calculated at 1% of the principal per week. To qualify, candidates had to be at least 18 years of age and their business must be in operation for at least 6 months prior to applying. Collateral accepted included proof of ownership of household appliances and furniture (Jamaica National Small Business Loans Ltd. **2013**). Although the loan is available to all qualified persons, in order to receive the programme, individuals had to apply for it at one of the branches where the loan was offered; unlike other microcredit finance schemes the JN scheme is not community based.

The study aimed to determine whether access to microcredit finance was associated with changes in consumption, and whether beneficiaries and their children were at greater risk of cardiovascular disease (CVD) than non-beneficiary (control) counterparts of the same community. We hypothesised that both parents and children in the loan beneficiaries group, compared with community-matched controls, would have increased household expenditure, but exhibit greater CVD risk. Numerous studies have found a similar association between microcredit loan schemes and increased household income, consumption and expenditure. In their analysis of studies examining the impacts of microcredit financing, Bauchet *et al*. (**2011**) identified that 'microloans help some households reprioritize their expenditures and smooth consumption'. These findings were similar to the Asian Development Bank's special evaluation study on the effects of microfinance on poor households, which found that microfinance loans positively impacted *per capita* income and expenditure (Asian Development Bank **2007**).

Previous studies involving microcredit and nutritional health outcomes have focused on the impact of the loan on food insecurity and improving body mass index [BMI] (Doocy *et al*. **2005**; Hamad & Fernald **2012**). As far as we are aware, this is the first study to explore the relationship between CVD risk and microcredit financing. Several studies have shown that lower income is associated with greater CVD risk (Perel *et al*. **2006**; Ali *et al*. **2011**; Fukuda & Hiyoshi **2013**). However, studies conducted in Jamaica have found associations between high income and increased prevalence of CVD risk factors (Mendez *et al*. **2004**; Ferguson *et al*. **2010**). Dinsa *et al*. (**2012**) found similar results in their systematic review which showed that obesity, a CVD risk factor, was more prevalent in families that had a higher income in developing countries such as Jamaica.

Materials and methods

Study design and participants

The Jamaica National (JN) micro-finance beneficiaries database was used to select a random sample of JN's micro-finance beneficiaries from the parishes of Kingston, St. Andrew, and St. Catherine. These three parishes comprise 43.2% of the Jamaican population and are a mix of rural and urban communities (Planning Institute of Jamaica, PIOJ **2007**).

The study was conducted between December 2007 and September 2008. Beneficiaries were those who had received disbursements under the micro-finance scheme for at least 2 years at the time of the study. These were matched with households from the same community who had never been beneficiaries of a microcredit finance loan (controls). Matching was performed on the basis of 10-year age bands, sex of the beneficiary and a 6–16 year old child living in the household.

Ethical approval was obtained from the Ethics Committee of the Faculty of Medical Sciences, University of the West Indies, Mona, Jamaica. Written informed consent was obtained from each study participant; parental consent and child assent were also obtained.

Sample size

The sample size estimates were based on the projected effect of the receipt of microcredit on mean BMI. Power calculations were based on the rate of weight gain expected in the Jamaican population by Durazo-Arvizu *et al*. (**2008**). Based on Durazo-Arvizu's rate of weight gain, it was assumed that by the 2nd year of receiving a loan disbursement a clinically significant one-unit change in BMI would be detected in the respondent (Durazo-Arvizu *et al*. **2008**). At 90% power, a sample of 1514 adults (757 beneficiaries and 757 controls) was required to detect a one-unit difference in the mean BMI between groups. One child within the required age group (6–16 years) from each household was then randomly selected yielding a sample size of 1514 children.

Recruitment

A master list was created of potentially eligible beneficiaries that were randomly selected from the JN database. From this list, recruitment was undertaken by a house-to-house survey. This list was distributed to interviewers who visited the beneficiaries to identify households that fulfilled the eligibility criteria: JN's micro-finance beneficiaries who, at the time of data collection, were in receipt of Biz Grow loans for a minimum of 2 years. The beneficiary should have at least one child 6–16 years old. Each beneficiary was matched with a control. Eligibility criteria for controls were as follows: living in the same community as the case; be the same sex as the case; be within the same 10-year age band as the case; have a child 6–16 years old living in the household; no member of the household should be a beneficiary of a microcredit finance loan.

After consent was obtained, the interviewer proceeded to the 4th household to the right and to every 4th household if necessary, until a matched control was identified within the same community. Within each household, the adult beneficiary or the matching control and one child aged 6–16 years were assessed. The child was selected for assessment using a modified version of the KISH method (Kish **1949**). The Kish method employs a stratified random selection to choose one member from a sample household to be interviewed. A coversheet is assigned to each household in the sample which lists each child within the household that was 6–16 years old. Children were assigned a rank based on their sex (males first) and by decreasing age. The participant to be interviewed was selected randomly from this list of ranks.

Measurements

Questionnaire

Permission was obtained from the PIOJ, Ministry of Finance and Planning, to administer selected modules of the 2006 version of the Jamaica Survey of Living Conditions (JSLC) questionnaire (PIOJ **2007**). The JSLC is an annual survey conducted by the Statistical Institute of Jamaica (STATIN).

The modules of the JSLC administered included those on household health, education, housing and consumption expenditure. Consumption expenditure was obtained using a shorter 'point of purchase' approach, utilised in an earlier version of the JSLC used in 1994, which gave comparable results (PIOJ **1996**). The questionnaire was administered to the adult in the household who was the beneficiary and to the matched control.

Physical measurements

Weight was measured to the nearest 0.1 kg using a portable electronic balance (SECA®, Medical Measurement Systems and Scales Chino, California). Height was taken with the head facing forward in the Frankfort plane with feet together and in light clothing without shoes using a portable stadiometer (SECA®, Medical Measurement Systems and Scales Chino, California). Waist, hip and mid upper arm circumferences were measured to the nearest 0.5 cm using non-stretch tape measure. Waist circumference (WC) measurements were taken at the midpoint between the lower costal margin and the anterior superior iliac spine. WC was used as it has been proven to be a very strong independent risk factor for CVD (National Institutes of Health **1998**). Blood pressure (BP) was measured with an oscillometric device (Omron®, Kyoto, Japan).

Nutritional assessment for the children was carried out by comparing mean anthropometric measurements by group and sex. Anthropometric measurements for the children were converted to *z*-scores using the Stata WHO 2007 Macro Package (World Health Organization **2014**). The package utilises WHO 2007 Child Growth Standards and calculates age and sex-specific *z*-scores for children 5–19 years old.

For adults, BMI was calculated as weight divided by height squared and compared according to WHO standards (World Health Organization **1995**). WC was used as a summary risk factor for CVD; hypertension status was also determined (National Institutes of Health **1998**, **2003**) (Table 1).

Table 1. Measurements and cut-off used as indicators

Measure	Indicator	Cut-off point
Systolic blood pressure (National Institutes of Health **2003**)	Normal systolic blood	<120 mmHg
	Non-normal blood pressure (Pre-hypertension–hypertension range)	120–139 mmHg
	Hypertension	≥140 mmHg
Diastolic blood pressure (National Institutes of Health	Normal systolic blood	<80 mmHg

Measure	Indicator	Cut-off point
	Non-normal blood pressure (Pre-hypertension–Hypertension range)	80–89 mmHg
	Hypertension	≥90 mmHg
Body mass index (BMI) (World Health Organization **1995**)	Underweight	<18.5 kg/m^2
	Normal weight	18.5–24.9 kg/m^2
	Overweight	25–29.9 kg/m^2
	Obese	≥30 kg/m^2
Waist circumference (used as marker for cardiovascular risk) (National Institutes of Health	Increased cardiovascular risk (Male)	≥94 cm or 37 inches

Economic measurements

An analysis of household expenditure over the survey period was undertaken to assess the impact of micro–credit finance on the welfare of the household. Household expenditure was selected as an economic measurement as this variable has been accurately captured in the JSLC, which is considered the leading tool for measuring the standard of living in Jamaica. The JSLC has used data on expenditure to determine *per capita* consumption, which is used as a proxy for income (PIOJ **2007**). Household expenditure was disaggregated into four major categories: Food, Textiles and Household Needs, Other Recurrent Needs, and Non-Consumption. Food expenditure included meals at home and meals away from home. Textiles and Household Needs expenditure included expenditure on apparel and household appliances. Other Recurrent Needs included expenditure related to personal grooming and child care; Non-Consumption items included repayment of loans, weddings, and funerals.

At the time of the study, the exchange rate for the Jamaican dollar was USD $1 = JMD $72.92 (PIOJ **2009**).

Data management and statistical analysis

All interviewers were trained and certified in the techniques of measurement and underwent recertification every 3 months. Quality assurance checks included independent repeat measures conducted by a second observer to validate the data. The data were double-entered, checked for accuracy and analysed using Intercooled Stata® version 9.0, Data Analysis and Statistical Software-College Station, Texas and the Statistical Package for Social Sciences (SPSS v 12®, Chicago, Illinois). Distribution of all variables was plotted, plots of plausible associations made and examined for consistency. Non-normal data were transformed to normality or alternative nonparametric tests used to test for association.

Descriptive statistics were tabulated and compared between beneficiaries and controls. The unpaired *t*-test was used to compare the anthropometric and CVD risk factor measurements, mean household expenditure and household crowding between beneficiaries and controls. Chi-squared tests were performed to determine associations between beneficiaries and controls for categorical variables. Binary logistic regression analyses were performed to compare the odds of cCVD risk factors between beneficiaries and controls. All models were adjusted for age, sex and household size. A *P* value of ≤0.05 was considered significant.

Ethical approval

The survey was approved by the Ministry of Health, Jamaica and the University of the West Indies/University Hospital of West Indies (UWI/UHWI) Ethics Committees.

Results

Profile of study participants

A total of 726 adult beneficiaries and 726 controls were recruited (Table 2). Females comprised 83.7% and 84.3% of the sample beneficiaries and controls, respectively. Seven hundred and twenty-six (50.9% female) children were recruited from households of beneficiaries, 726 (52.3% female) from control households. Mean household size and mean age of adults and children of both groups were similar. Significantly more beneficiaries (67.6%) than controls (61.9%) owned their dwelling ($P < 0.05$) (Table 2).

Table 2. Profile of study participants by sex, age and household size

	Beneficiaries (*N* = 726)	Controls (*N* = 726)
Adults		
Females	610 (83.7%)	612 (84.3%)
Males	116 (15.8%)	114 (15.7%)
Mean age (95% CI) years	41.2 (40.6–41.7)	41.3 (40.7–41.9)
Children		
Females	370 (50.9%)	380 (52.3%)
Males	356 (49.1%)	346 (47.7%)
Mean age (95% CI) years	10.9 (10.7–11.1)	10.9 (10.7–11.1)
Mean household size (95% CI)	4.4 (4.3–4.6)	4.4 (4.3–4.6)
Owned dwelling	491 (67.6%)*	450 (61.9%)

*$P < 0.05$.

Health

Means of anthropometric and BP measurements of children and adults are shown in Tables 3 and 4. Children of beneficiaries and controls showed no difference in their mean height-for-age Z-scores.

Beneficiary girls had higher mean weight, weight-for-age z–scores, BMI, BMI-for-age z–scores and WC (Table 3). Beneficiary boys had higher mean BMI-for-age *z*-scores and weight-for-age *z*-scores.

Table 3. Means and 95% CI for anthropometry, body composition and blood pressure of male and female children by beneficiaries and controls

	Females mean (95% CI)		Males mean (95% CI)		Total mean (95% CI)	
	Beneficiaries	Controls	Beneficiaries	Controls	Beneficiaries	Controls
Age (years)	11.3 (11.0–11.6)	11.0 (10.6–11.3)	10.5 (10.2–10.8)	10.9 (10.6–11.3)	10.9 (10.7–11.1)	10.9 (10.7–11.2)
Height (cm)	150.0 (148.5–151.6)	147.9 (146.3–150)	145.4 (143.4–147.2)	147.3 (145.3–149.3)	147.7 (146.5–149.0)	147.6 (146.3–148.9)
Height-for-age (*z*-score)	0.90 (0.76–1.03)	0.85 (0.72–0.98)	0.65 (0.52–0.78)	0.55 (0.40–0.69)	0.78 (0.68–0.87)	0.71 (0.61–0.80)
Weight (kg)	46.9 (45.2–48.5)*	44.0 (42.2–45.7)*	41.6 (39.8–43.4)	41.8 (40.0–43.6)	44.3 (43.1–45.5)	42.9 (41.7–44.2)
Weight-for-age (*z*-score)***	1.30 (1.05–1.54)	0.76 (0.58–0.94)	1.06 (0.85–1.27)	0.60 (0.39–0.81)	1.16 (1.00–1.32)	0.69 (0.55–0.82)
BMI (kg/m^2)	20.2 (19.8–20.7)*	19.4 (18.9–19.8)*	19.0 (18.5–19.4)	18.5 (18.0–19.0)	19.6 (19.3–20.0)	19.0 (18.6–19.3)
BMI-for-age (*z*-score)***	0.66 (0.52–0.80)	0.42 (0.29–0.56)	0.56 (0.40–0.72)	0.18 (0.02–0.35)	0.61 (0.50–0.72)	0.30 (0.20–0.41)
WC (cm)*	67.4 (66.2–68.5)*	65.6 (64.4–66.8)*	64.6 (63.4–65.8)	64.5 (63.27–65.7)	66.0 (65.2–66.8)	65.1 (64.2–65.9)

BMI, body mass index; WC, waist circumference; SBP, systolic blood pressure; DBP, diastolic blood pressure; 95% CI, 95% confidence interval.

**P* < 0.05, ****P* < 0.001.

Table 4. Means and 95% confidence intervals for anthropometry, body composition and blood pressure of adult males and females by beneficiaries and controls

	Females mean (95% CI)		Males mean (95% CI)		Total mean (95% CI)	
	Beneficiaries	Controls	Beneficiaries	Controls	Beneficiaries	Controls
Age (years)	41.0 (40.4–41.6)	41.1 (40.4–41.8)	42.1 (40.7–43.5)	42.6 (40.9–44.2)	41.2 (40.6–41.7)	41.3 (40.7–41.9)

	Females mean (95% CI)		Males mean (95% CI)		Total mean (95% CI)	
	Beneficiaries	Controls	Beneficiaries	Controls	Beneficiaries	Controls
Height (cm)	162.9 (162.4–163.4)	163.6 (163.1–164.2)	173.8 (172.4–175.2)	174.5 (173.2–175.8)	164.7 (164.1–165.2)	165.3 (164.8–165.9)
Weight (kg) **	82.4 (81.0–83.8)	80.3 (78.9–81.8)	82.3 (79.3–85.2)	76.1 (73.5–78.6)	82.4 (81.1–83.7)	79.7 (78.4–81.0)
BMI (kg/m^2) ***	31.0 (30.5–31.5)	30.0 (29.5–30.5)	27.2 (26.4–28.1)	25.0 (24.2–25.8)	30.4 (30.0–30.9)	29.2 (28.7–29.7)
WC (cm) **	95.2 (94.1–96.4)	93.7 (92.5–94.9)	90.8 (88.5–93.1)	85.6 (83.4–87.8)	94.5 (93.5–95.6)	92.4 (91.3–93.6)
SBP (mm Hg)	124.3 (122.8–	126.3 (124.9–	129.3 (126.0–132.7)	127.2 (124.1–130.3)	125.1 (123.7–126.4)	126.5 (125.1–127.8)

BMI, body mass index; WC, waist circumference; SBP, systolic blood pressure; DBP, diastolic blood pressure; 95% CI, 95% confidence interval.

**$P < 0.01$, ***$P < 0.001$.

Based on BMI-for-age *z*-scores, children of beneficiaries had greater odds of being overweight/obese (OR = 1.46; 95% CI 1.18–1.82) than the children of controls. The odds did not change when the analysis was adjusted for household size.

Amongst adults, there was no difference in mean systolic and diastolic BP (Table 4). However, both male and female beneficiaries had higher mean weights and WC than matched controls. More than 50% of females and more than 70% of males had pre-hypertension or hypertension, but there was no significant difference in the frequency between beneficiaries and controls (Table 5). There were significant differences in BMI between beneficiaries and controls and beneficiaries with the majority of female beneficiaries being obese ($P < 0.01$). When WC was used as a summary indicator of CVD risk, significantly more beneficiaries, both males and females, were classified as having 'any risk' ($P < 0.05$) (Table 5).

Table 5. Percentage of adult beneficiaries and controls with increased cardiovascular risk by sex

	Females		Males		Total	
	Beneficiaries	Controls	Beneficiaries	Controls	Beneficiaries	Controls
Sample size (*N*)	613	612	117	114	730	726
BMI (kg/m^2) **						
Underweight	1.0	2.3	2.6	4.4	1.2	2.6
Normal	14.5	19.8	29.3	47.8	16.9	24.2

	Females		Males		Total	
	Beneficiaries	Controls	Beneficiaries	Controls	Beneficiaries	Controls
Overweight	31.8	30.1	41.4	36.3	33.3	31.1
Obese	52.7	47.8	26.7	11.5	48.6	42.1
Hypertension [a]						
Normal	44.5	41.4	25.9	24.8	41.6	38.8
Pre-hypertensive	40.3	40.4	55.2	64.6	42.6	44.2
Hypertensive	15.2	18.2	18.9	10.6	15.8	17.0
WC as a CVD risk factor [b] *						
No Risk	13.1	17.5	65.6	76.1	–	–

CVD, cardiovascular disease; BMI, body mass index; WC, waist circumference.

[a] Systolic blood pressure: <120 mmHg = Normal; 120–139 mmHg = Pre-hypertensive; ≥140 mmHg = Hypertensive.

[b] Different cut-off points for males and females used.

*$P < 0.05$, **$P < 0.01$.

Binary logistic regression analyses of CVD risk status revealed that adult beneficiaries had greater odds of being overweight/obese than their matched controls (OR = 1.72, 95% CI 1.33–2.23) (Table 6). Male beneficiaries were three times more likely and females one and a half times more likely to be at a substantially increased risk for CD than their matched controls (Table 6). All odds ratios were adjusted for age, sex and household size.

Table 6. Cardiovascular disease risk status using binary logistic regression analysis comparing adult beneficiaries and controls (reference group)

Cardiovascular disease (CVD) risk factor indicator	Reference group	Odds ratio [a]	95% CI
BMI (kg/m^2) Overweight/Obese ***	Normal weight (18.5–24.9 kg/m^2)	1.72	1.33–2.23
WC (cm) [b]			
Any risk for CVD			
Female *	No CVD risk (WC < 80 cm)	1.40	1.02–1.93
Male *	No CVD risk (WC < 94 cm)	1.81	1.01–3.26
Substantiallyincreased CVD risk			
Female *	No CVD risk (WC < 80 cm)	1.42	1.02–1.99

Cardiovascular disease (CVD) risk factor indicator	Reference group	Odds ratio	95% CI
Male*	No CVD risk (WC < 94 cm)	3.23	1.32–7.92

CVD, cardiovascular disease; BMI, body mass index; WC, waist circumference; 95% CI, 95% Confidence interval.

[a] Adjusted for age, sex and household size.

[b] Waist circumference (cm) and gender-specific cut-off points used as an indicator for Cardiovascular disease risk.

*$P < 0.05$, ***$P < 0.001$.

Economic status

Beneficiaries had a much higher mean annual *per capita* household expenditure JMD$160 574.40 than controls [JMD$108 578.11, $P < 0.001$] (Table 7). Differences were also recorded for mean total expenditure on Food, Textiles and Household Needs, and Non-Consumption items with beneficiaries spending significantly more in these categories ($P < 0.001$). Significantly more beneficiaries (67.6%) owned their own dwelling (Table 2).

Table 7. A comparison of mean annual expenditure of beneficiaries and controls

Category	Beneficiary mean (95% CI) $JA	Control mean (95% CI) $JA
Mean annual *per capita* expenditure***	$160 574.40 ($152 589.61–$168 559.18)	$108 578.11 ($103 335.25–$113 817.96)
Per household		
Food **	$431 509.37 ($392 591.29–$470 427.45)	$284 016.21 ($270 0084.30–$297 948.12)
Textiles & Household Needs **	$122 354.81 ($96 163.18–$148 546.44)	$70 036.56 ($63 167.90–$76 905.23)
Other Recurrent Needs	$102 571.06 ($93 463.50–111 678.63)	$118 981.73 ($60 618.80–$177 344.66)
Non-Consumption expenditure**	$112 889.14 ($96 433.33–$129 344.95)	$48675.23 ($34 601.04–$62 749.43)
Total expenditure**	$639 752 ($611 434.13–$668 071.65)	$429 181 ($411 156.06–$447 206.05)

$JA, Jamaican Dollars.

**$P < 0.01$, ***$P < 0.001$.

Discussion

The annual *per capita* household expenditure was significantly higher amongst beneficiaries and more owned their home. Adult beneficiaries had higher BMIs, exhibited higher WC and were more likely to be overweight/obese than controls. When WC was used as a summary indicator of CVD risk, both male and female beneficiaries had greater odds of substantial risk than controls. At least 50% of the sample was classified as pre-hypertensive or hypertensive, with the prevalence amongst males being 74.1% amongst beneficiaries and 75.2% amongst controls; however, the difference was not significant. Children of beneficiaries also had higher weights and BMI-for-age Z–scores than their controls and were more likely to be overweight or obese. Individuals who had a higher total household expenditure were at greater odds of being overweight or obese, when adjusted for sex. Similarly, males from households with higher expenditure were more likely to be at substantial risk for CVD, when adjusted for household size.

The assumption that people of the same community are of similar social and economic standing is widely accepted and is frequently used in the stratification of social class. In the United Kingdom, postal code is often used as a unit of analysis in socio-demographic studies (Acheson **1998**). The analysis showed that there was a difference in cardiovascular risk factors for beneficiaries and their matched community controls.

There has been controversy around the impact of microcredit financing on children. Pitt and Khandker (**1998**) demonstrated an increase in height-for-age in children of microfinance beneficiaries using econometric modelling. This finding, however, was not replicated (Roodman & Morduch **2011**). Deloach and Morduch (**2011**) employed econometric modelling to measure the impact of microfinance on child health outcomes in Indonesia. They used data from the Indonesian Family Life Survey to determine whether microfinance institutions within a community affect child outcomes. Their results showed that children residing in communities with maintained access to microfinance institutions gained one standard deviation in height relative to international standards. One of the strengths of our study is that direct comparisons were made with children of community-matched controls, eliminating some of the uncertainties associated with modelling.

The downside of economic transition from poverty to wealth is the associated increased risk of CVDs. This is evident in the transitions in the epidemiological profile of developing countries, which now outweigh developed countries in regards to their contribution to the global burden of CVD (Reddy **2002**). CVDs contribute to approximately 30% of all deaths in low and middle income countries (Institute of Medicine of the National Academies **2010**). In Jamaica reports indicate that CVDs are associated with 42% of mortality, which indicates that the country is following the general trend of developing countries where they are becoming one of the leading causes of death (Wilks *et al*. **2001**). As countries get richer, overweight and obesity become more prevalent with a concomitant rise in the incidence and prevalence of chronic and CVDs (Forrester *et al*. **1998**; Wilks *et al*. **1998**; Sargeant *et al*. **2001**). In this study, significantly more beneficiaries and their children displayed worse CVD risk status than controls. We hypothesize that this may indicate the onset of a shift in the disease profile of the beneficiaries as a result of the increased consumption derived from greater disposable income flowing from the microenterprise.

Of concern is the CVD risk profile of the beneficiaries, as the prevalence of pre-hypertension or hypertension and overweight/obesity was higher than the national prevalence. There was no significant difference in the prevalence of pre-hypertension/hypertension between the two groups, but at least 50% of women and 70% of men were pre-hypertensive/hypertensive. This prevalence exceeds the national figure of 41.8% for males and 29% for females (Wilks *et al*. **2008**). A similar pattern was observed for combined overweight/obesity with significantly more male beneficiaries (68.7%) being overweight/obese than male controls (48.2%). The prevalence for male beneficiaries was twice the national prevalence of overweight/obesity for men (38.2%) (Wilks *et al*. **2008**). Amongst females, both beneficiaries and controls had combined overweight/obesity prevalence of more than 75%, exceeding the national prevalence of 64.7% (Wilks *et al*. **2008**). This nuance cannot be explained in this cross-sectional study and national data on obesity are not sufficiently disaggregated to determine the prevalence of obesity at this micro level. Further studies are needed to explore this phenomenon.

Beneficiaries were clearly 'richer' with significantly higher expenditure on food, Household Needs and Non-Consumption items. No difference, however, was recorded in 'Other Recurrent Needs' which could be expected as this category includes payment of taxes, which would be similar across social groups and, by extension, communities. Also, possibly indicative of this intent is the higher level of household ownership amongst the beneficiaries. In the Jamaican context, household ownership is an important feature of social mobility.

Regardless of whether beneficiaries were *a priori* less healthy or became so as a result of increased consumption, there now exists an opportunity to design interventions to reverse or minimise the risk of overweight, the consequent impact on BP and presumably other metabolic disturbances such as insulin resistance and dyslipidaemia. Institutions providing microcredit financing should explore partnerships with health providers in identifying feasible interventions that can be coupled with the microcredit programme.

Strengths and limitations of the study

There was a disproportionate female-to-male ratio amongst beneficiaries, which reflects the disproportionate sex composition of JN's micro-finance beneficiaries of 74% female: 26% male beneficiaries. This is similar to the general global experience of greater uptake of microcredit financing by women (Funna *et al*. **2006**; Pronyk *et al*. **2007**).

While the study was able to match on pertinent tangible characteristics, it is conceivable that participants of microcredit are a self-selected subgroup who may exhibit characteristics or preferences which differentially affect their health and wider economic and social development. These characteristics may also include entrepreneurial tendencies that may be innate to the beneficiary. This self-selection can lead to both selection bias and endogeneity, which in turn may lead to spurious conclusions being drawn.

Baseline data on household expenditure and health status prior to being a loan recipient were not available for beneficiaries or controls. Although this may be considered a limitation because *a priori* comparisons cannot be made, the cross-sectional comparisons demonstrate that there are differences between JN's micro-finance beneficiaries and community-matched control peers. We also attempted to account for this by adjusting for potential confounders in logistic regression analyses.

Propensity score matching which has been shown to reduce selection bias was not calculated for this study (Bajracharya & Amin **2013**). Data on the response rate of the participants were not available. However, results from the pretest indicated that on average, three households were visited before a matched control was recruited.

Conclusion

The results demonstrate that microcredit financing is positively associated with wealth acquisition but worsened CVD risk status. Our review of the published literature revealed a dearth of evidence on the comparative differences in CVD risk between beneficiaries and controls of microcredit finance schemes. Other authors have focused on comparing changes in equity and access to health services and other health indicators amongst communities exposed to microcredit (Dohn *et al*. **2004**). We support the economic and other developmental benefits of micro-credit financing, but recommend that health promotion should be incorporated in such schemes to militate against a possible increase in CVD risk amongst beneficiaries. A number of initiatives report success in coupling microcredit with other innovative ideas inclusive of health promotion and education programmes (Dohn *et al*. **2004**; Hamad *et al*. **2011**), health service delivery (Funna *et al*. **2006**) and money management (Leatherman *et al*. **2012**). Such initiatives should be incorporated into microcredit financing programmes.

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