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# Is Spending Money on Others Good for Your Heart?

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***Objective:*** Does spending money on others (prosocial spending) improve the cardiovascular health of community-dwelling older adults diagnosed with high blood pressure? ***Method:*** In Study 1, 186 older adults diagnosed with high blood pressure participating in the Midlife in the U.S. Study (MIDUS) were examined. In Study 2, 73 older adults diagnosed with high blood pressure were assigned to spend money on others or to spend money on themselves. ***Results:*** In Study 1, the more money people spent on others, the lower their blood pressure was 2 years later. In Study 2, participants who were assigned to spend money on others for 3 consecutive weeks subsequently exhibited lower systolic and diastolic blood pressure compared to participants assigned to spend money on themselves. The magnitude of these effects was comparable to the effects of interventions such as antihypertensive medication or exercise. ***Conclusions:*** Together, these findings suggest that spending money on others shapes cardiovascular health, thereby providing a pathway by which prosocial behavior improves physical health among at-risk older adults.

*Keywords:* health, life experiences, prosocial behavior, social behavior, well being

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Can spending money on others improve physical health? Recent research suggests that spending money on others improves emotional well-being (e.g., Dunn, Aknin, & Norton, 2008; see Dunn, Aknin, & Norton, 2014 for a review). Indeed, the happiness benefits of spending on others ("prosocial spending") have been documented in rich and poor countries around the world, from Canada and the United States to Uganda and India (Aknin, Barrington-Leigh, et al., 2013). There has been less research examining whether prosocial spending can affect physical health. There is some evidence that generous or stingy economic decisions may have downstream consequences for cortisol, a hormone that is implicated in the stress response (Dunn, Ashton-James, Hanson, & Aknin, 2010). However, research in this area has not yet explored whether prosocial spending leads to clinically relevant health benefits. Given that heart disease is the leading cause of death worldwide, and that high blood pressure puts people at a higher risk of a heart attack, this article focused on examining whether prosocial spending reduces blood pressure among at-risk older adults.

Providing indirect support for this hypothesis, correlational and longitudinal research suggests that individuals who provide help to others exhibit a reduced risk of mortality and better overall health (e.g., Brown, Consedine, & Magai, 2005; Brown et al., 2009; Piliavin & Siegl, 2007; Poulin, Brown, Dillard, & Smith, 2013; see Konrath & Brown, 2013 for a recent review). Helping others can take multiple forms, such as providing informal support to friends and family and participating in formal volunteer work (Tilly & Tilly, 1992; Wilson & Musick, 1997). In a ground breaking longitudinal study, researchers found that providing social support was associated with a decreased risk of mortality among older adults (Brown, Nesse, Vinokur, & Smith, 2003). Similarly, people who volunteered at least four hours per week were less likely to develop high blood pressure four years later (Sneed & Cohen,

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2013). Furthermore, research suggests that volunteering leads to the greatest benefits for at-risk groups, including adults with higher depressive symptomology (Wheeler, Gorey, & Greenblatt, 1998), youth from lower SES backgrounds (Schreier, Schonert-Reichl, & Chen, 2013), and older adults (Van Willigen, 2000) in part by buffering against declines in functional health (Fried et al., 2004). This research suggests that spending time helping others may have potent effects on the health of at-risk older adults, yet no longitudinal or experimental research has examined whether prosocial spending affects physical health.

Although time and money are typically identified as the primary resources that individuals may use to benefit others (Liu & Aaker, 2008), past research has focused primarily on the health benefits of giving time (i.e., volunteering). A growing body of research suggests that people think about time and money in profoundly different ways (e.g., Mogilner, 2010; Whillans, Weidman, & Dunn, 2015; Zauberman & Lynch, 2005). For example, whereas thinking about time leads people to prioritize social connections (Mogilner, 2010), thinking about money can lead people to distance themselves from others (Vohs, Mead, & Goode, 2008). Thus, it is unclear whether the observed health benefits of giving time would extend to giving money.

Two studies were conducted to assess whether spending money on others reduces high blood pressure, a clinically relevant health outcome that is responsible for 7.5 million premature deaths each year (World Health Organization [WHO], 2014). The decision to examine blood pressure was driven by conceptual and pragmatic considerations. Conceptually, research suggests that helping others can release restorative hormones that may have direct effects on blood pressure (Petersson, 2002). Furthermore, research suggests that helping others may have implications for blood pressure by decreasing activity in the hypothalamatic pituitary adrenal (HPA) axis and by regulating the cortisol stress response (e.g., Brown, Brown, House, & Smith, 2008). For example, research suggests that engaging in prosocial behavior can activate areas of the brain associated with the release of oxytocin and vasopressin—neurohormones that directly influence blood pressure *and* that are implicated in HPA regulation, such as the release of cortisol, a hormone involved in the stress response (e.g., Moll et al., 2006). Critically, dysregulation of the HPA axis has been causally linked to hypertension (e.g., Kelly, Mangos, Williamson, & Whitworth, 1998). It is also possible that prosocial spending directly impacts the sympathetic nervous system (SNS), resulting in greater parasympathetic activity (PNS) and/or reduced SNS activation. Indeed, recent research suggests that higher levels of generosity are associated with greater PNS activity and lower SNS activity (Miller, Kahle, & Hastings, 2015). Consequently, to the extent that spending money on others leads to the release of neurohormones that may directly affect blood pressure and/or directly regulate the HPA axis, prosocial spending should have consequences for metabolic processes, including cardiovascular functioning.

Practically, hypertension is an important, modifiable risk factor for cardiovascular disease that can be measured precisely using noninvasive procedures. Hypertension also exhibits reliable improvements resulting from lifestyle or psychosocial modifications within a short-time span (e.g., James et al., 2014). Although prosocial spending might exert other effects related to the HPA system, such as reduced inflammation and improved vasodilatation, blood pressure is a theoretically and practically relevant outcome to provide the first empirical examination regarding whether prosocial spending impacts cardiovascular health.

In Study 1, the association between financial generosity and lower blood pressure was assessed among older adults diagnosed with high blood pressure who were participating in the Midlife in the United States Study (MIDUS). It was predicted that respondents who spent more money on others would exhibit lower systolic blood pressure (SBP) and diastolic blood pressure (DBP). In Study 2, an experimental paradigm was employed to assess the causal benefits of financial generosity among older adults diagnosed with high blood pressure. Across both studies, we explored the effects of prosocial spending on cardiovascular health for older adults diagnosed with high blood pressure. Analyses focused on individuals diagnosed by a physician with hypertension based on recommendations from the Joint National Committee (JNC), which uses scientific evidence to create guidelines for the management of hypertension (James et al., 2014). According to the JNC, it is inappropriate to assess the effects of psychosocial variables or interventions on blood pressure for individuals who do not suffer from hypertension. These guidelines state that all patients who have systolic blood pressures less than 120 and diastolic blood pressures less than 80 are classified as 'normal' and do not require lifestyle modifications or pharmacological therapy since there is no evidence to support blood pressure lowering therapy for individuals who do not suffer from hypertension. Thus, across Studies 1 and 2, our analyses focused on individuals who were previously diagnosed with hypertension by a physician; analyses for normotensives are presented in the Supplemental Online Material (SOM).[1]

These studies focus specifically on the impact of financial generosity among older adults. Research suggests that older adults reap the greatest rewards from helping others (e.g., Van Willigen, 2000). According to activity theory—a prominent theory in social gerontology—older adults who remain productive and who keep or create new social networks maintain better health than older adults who disengage from social involvements (e.g., Erikson, Erikson, & Kivnick, 1986). Thus, prosocial spending may provide one way to help older adults maintain feelings of productivity and to maintain social networks in older age (e.g., Van Willigen, 2000). Although high blood pressure can affect people at any age, hypertension disproportionately afflicts older adults (WHO, 2014), underscoring the importance of examining factors that improve cardiovascular health among at-risk older adults.

[1] Participants who were included in Studies 1 and 2 had received a diagnosis of hypertension by a physician *before* participation. Thus, the majority of participants were being treated for high blood pressure at the time of data collection (see Tables 1 and 3), and participants' blood pressure at the time of measurement often fell within a "prehypertensive" range because their hypertension was being managed through medication and/or diet and exercise. Consequently, these two studies provide a conservative test of the impact of charitable spending on cardiovascular health—the effects of charitable spending on blood pressure occurred in a sample of individuals in which the vast majority were already being treated for hypertension.

## Study 1

### Method

**Participants.** Data from the MIDUS II biomarker project conducted in 2004 through 2006 were examined. The MIDUS examines the relationship between psychosocial factors and health in a nationally representative sample of noninstitutionalized adults aged 25 to 74 living in the contiguous United States (see Brim, Ryff, & Kessler, 2004 for additional documentation).

Biological data were collected on a subset of MIDUS II participants who completed telephone and mail surveys and who were willing and able to travel to one of three General Clinical Research Centers (GCRC) for an overnight visit. At the GCRC, individuals provided a complete medical history, underwent a physical exam with a physician, and completed health measures including blood pressure measurements. Biomarker data collection took place approximately two years after the initial phone and mail surveys ($M$ = 27.70 months, $SD$ = 14.74).

To include the largest number of older adult participants, while maintaining consistency with other large-scale empirical investigations of the benefits of volunteering (e.g., Oman, Thoresen, & McMahon, 1999), the a priori decision was made to focus these analyses on participants aged 55 years of age or older. Thus, the current analyses are based on MIDUS II respondents aged 55 and older who provided charitable giving data, received a diagnosis of high blood pressure by a physician prior to their participation in MIDUS, and provided blood pressure data at a GCRC ($N$ = 186; see Table 1 for demographic characteristics). It was predicted that participants who reported greater financial generosity at the initial data collection would demonstrate lower systolic and diastolic blood pressure at the follow-up visit two years later.

Table 1
*Characteristics of Participants in MIDUS Sample ($N$ = 186)*

| Characteristic | Mean (*SD*) |
|---|---|
| Female (%) | 50.5% |
| Caucasian (%) | 94.6% |
| Age | 65.74 (7.38) |
| Annual household income | $64,217.07 ($53,942.77) |
| Highest level of education[a] | 7.64 (2.63) |
| Married (%) | 69.6% |
| Hours of paid work per week | 31.93 (17.04) |
| Hours of volunteer work per week | 3.86 (11.28) |
| Ever smoked cigarettes? (%) | 47.8% |
| Cognitive Functioning Scale[b] | 5.33 (.72) |
| Depression Score[c] | 2.48 (1.56) |
| Take hypertension medication at T1 (%) | 82.3% |
| SBP | 138.72 (18.64) |
| DBP | 74.93 (9.32) |
| Waist to hip ratio | .93 (.09) |
| BMI | 30.76 (5.61) |

[a] The mean score of education represents the category "Graduated from 2-year college, vocational school, or with an associate degree." [b] Cognitive control, 1 = *lowest cognitive functioning* to 7 = *highest cognitive functioning*. [c] This scale ranges from 1 = *lowest depressed affect* to 7 = *highest depressed affect*.

### Measures

**Financial generosity.** During the MIDUS II phone and interview data collection, respondents reported how much money they contributed to each of the following people or organizations each month: (a) religious groups, (b) political organizations or causes, (c) friends and/or family, and (d) any other organization, cause, or charity (including donations made through monthly payroll deductions).[2] Participants' responses were totaled to create an overall index of the amount of money that participants reported contributing to others each month. Consistent with published research, participants who reported donating more than $5,000 per month were excluded because they were extreme outliers ($N$ = 4; Choi & Chou, 2010; see SOM for MIDUS survey items and variable names). The results are substantively unchanged by including these individuals in our analyses. Eighty-six percent of respondents reported that they had contributed money to at least one person or organization in the last 12 months. Given the high percentage of people who reported donating, our analyses focused on the amount that participants donated. Because of the size of our sample, fine-grained analyses looking at the specific spending targets were not conducted, given the limited power to detect reliable effects. This decision is consistent with a great deal of research that broadly defines prosocial spending as any act of financial generosity—from making charitable donations to providing financial support to family members (e.g., Dunn, Aknin, & Norton, 2008; Dunn, Aknin, & Norton, 2014).

**Blood pressure.** During the MIDUS II biomarker data collection, participants completed several health measures, including blood pressure. To measure resting systolic and diastolic blood pressure, participants were seated in a chair, and a trained nurse placed a blood pressure cuff on the participant's nondominant arm. Following a 5-min rest period, three blood pressure readings were collected using an automatic BP monitor (BPM, VSM MedTech; Ryff, Seeman, & Weinstein, 2010). Following standard protocol, the first reading was excluded to allow for participants to adjust to the procedure. Thus, SBP and DBP were calculated as the average of the second and third readings.

**Covariates.** The identical set of covariates was examined as in previously published research assessing the effects of social support on well-being with the MIDUS dataset (level of education, household income, self-rated health, physical activity and exercise, religious identification, work status, number of hours spent working, age, gender, race/ethnicity, and marital status; Choi & Chou, 2010; Choi & Kim, 2011). Additionally, income and net-worth as well as several consumption-based measures of socioeconomic status (SES) were examined—given that these measures often serve as a better proxy for SES than household income (Headey, Muffels, & Wooden, 2008). The length of time between the initial survey and the biomarker

[2] Because the MIDUS uses relatively broad spending categories, it is debatable whether all of these categories (e.g., donations to political organizations or causes) should be classified as prosocial spending. In the context of the MIDUS survey; however, all of these categories were presented as forms of giving financial support. Thus, consistent with past research (e.g., Choi & Chou, 2010), we include all categories to form a broad index of prosocial spending.

data collection, and variables known to influence cardiovascular health including body mass index (BMI), waist-to-hip ratio (WHR), smoking status (yes/no), heart condition (yes/no), number of chronic conditions, blood pressure medication (yes/no), and number of blood pressure medications were also examined. Furthermore, psychological variables such as conscientiousness and emotional well-being were examined. Finally, whether participants volunteered (yes/no), how many hours they reported volunteering, how many community organizations they participated in, and the amount of financial support that participants reported receiving were examined. These covariates allowed for the examination of the impact of financial generosity on blood pressure independent of other forms of social support received or provided (see SOM for names of the MIDUS variables assessed in these covariate analyses).

Each potential control variable was first included individually in the model to explore whether it was associated with the blood pressure measures assessed in this study (SBP and DBP); covariates that were not significantly associated with the key blood pressure measures either initially or upon entering other significant covariates into our analyses were not retained in the final model to preserve degrees of freedom (Adam, 2006). Because the associations between these covariates and each of our key blood pressure measures differed, the final regression models vary. To ensure that this covariate selection technique did not lead to spurious associations (Babyak, 2004), these analyses were also conducted controlling for an alternative set of covariates. These covariates were selected by the physician member of the author team who was not in charge of analyzing the data, and who identified covariates that are considered critical for assessing the impact of psychosocial factors on cardiovascular health: age, gender, smoking, alcohol intake, BMI, WHR, ethnicity, physical activity levels, BP medications, and whether participants had a heart condition (yes/no). The results across both BP outcome measures are substantially unchanged upon controlling for this alternative set of covariates (see SOM).

## Results and Discussion

As predicted, respondents who reported spending more money on others during the initial data collection had lower systolic blood pressure at the health visit approximately two years later, $\beta = -.15$, $p = .04$, and this relationship remained significant after controlling for our set of covariates, $\beta = -.21$, $p < .01$ (Tables 2 and 3). People who spent more money on others also had lower diastolic blood pressure, $\beta = -.16$, $p = .03$, and these results held controlling for our set of covariates, $\beta = -.23$, $p < .01$. Although the goal of this research project was to examine factors that predict healthy aging among older adults, the salutary effects of prosocial spending held upon examining adults of any age in this sample diagnosed with hypertension (SOM). Additional analyses revealed that the benefits of prosocial spending were not moderated by age, but were moderated by hypertension status (see SOM), further suggesting that the benefits of prosocial spending were strongest for individuals with high blood pressure.

These findings provide initial support for the hypothesis that financial generosity is associated with lower blood pressure among older adults who were previously diagnosed with high blood pressure. However, given the nonexperimental nature of these data, causality cannot be inferred. Although a wide range of potential confounds were controlled for (e.g., age, gender, physical activity, and multiple indicators of SES), it is always possible that some unmeasured variable might explain the observed relationship between prosocial spending and blood pressure. Consequently, in Study 2, an experimental study was conducted to investigate whether prosocial spending has a causal effect on blood pressure among at-risk older adults.

Table 2
*Regression Predicting Systolic Blood Pressure From Charitable Giving Amount and Covariates*

| $ Donated to charity β | Age β | BMI β | Ever smoked regularly (1 = *yes*) β | Physical activity β | Lag between T2 and T1 β |
|---|---|---|---|---|---|
| −.15* | | | | | |
| −.15* | .13† | | | | |
| −.16* | .18* | .18* | | | |
| −.17* | .17* | .17* | .20** | | |
| −.17* | .16* | .16* | .21** | −.10 | |
| −.21** | .16* | .15† | .21** | −.10 | −.12† |
| $R^2_{adj}$ | | | | | .11 |
| *N* | | | | | 184 |

*Note*. $N = 2$ participants were missing data from one or more of the retained covariates.
† $p \leq .10$. * $p \leq .05$. ** $p \leq .01$.

## Study 2

Participants who were diagnosed with high blood pressure by a physician before participation were given three payments of $40 to spend for three consecutive weeks during a 6-week study period. Participants were randomly assigned to spend the payments on other people (prosocial spending condition) or themselves (personal spending condition). Each week, participants received a phone call, which allowed us to collect information related to spending and health. Participants also completed three lab visits, during which we assessed blood pressure, body-mass index, and waist-to-hip ratio.

## Method

**Inclusion criteria.** Community-dwelling adults aged 65 and older responded to advertisements in community centers, newspapers, and shopping malls in the greater Vancouver area. Eligibility was determined based on responses to questionnaires administered over the phone and in the lab. A priori exclusion criteria was established to ensure that participants were able to complete the complex procedures required throughout the study and did not have health issues that would make their health unstable (e.g., new medications) or that would affect the key dependent measures (e.g., depression or recent surgeries; see Table S8 for the full list of eligibility criteria). Only noninstitutionalized individuals and individuals who did not report knowing anyone else completing the study were eligible to participate. The majority of participants identified as White and female, and had completed some postsecondary education.

Table 3
*Regression Predicting Diastolic Blood Pressure From Charitable Giving Amount and Covariates*

| $ Donated to charity β | Gender (1 = *female*) β | Age β | WHR β | Physical health β | Physical activity β | Marital status (1 = *married*) β | Household income β | BP medication (1 = *yes*) β | # BP medications β | Lag between T2 and T1 β |
|---|---|---|---|---|---|---|---|---|---|---|
| −.16* | | | | | | | | | | |
| −.16* | −.24* | | | | | | | | | |
| −.17* | −.25** | .22** | | | | | | | | |
| −.17* | −.23** | .22** | .03 | | | | | | | |
| −.17* | −.21* | .20* | .07 | −.15* | | | | | | |
| −.19* | −.22** | .20* | .08 | −.14† | −.04 | | | | | |
| −.20* | −.17† | .18* | .10 | −.14† | −.04 | .11 | | | | |
| −.23** | −.16† | .16* | .08 | −.14† | −.04 | .11 | .10 | | | |
| −.22** | −.10 | .13† | .12 | −.12 | −.08 | .11 | .09 | −.21** | | |
| −.22** | −.10 | .12 | .14 | −.12† | −.07 | .11 | .10 | −.16† | −.08 | |
| −.23** | −.09 | .12† | .14† | −.17* | −.06 | .09 | .13† | −.16† | −.06 | −.19* |
| $R^2_{adj}$ | | | | | | | | | | .22 |
| *N* | | | | | | | | | | 178 |

*Note*. $N = 7$ participants were missing data on one or more of the retained covariates.
† $p \leq .10$. * $p \leq .05$. ** $p \leq .01$.

The research team was interested in detecting effects of at least a medium size ($d = .40$; Cohen, 1992). Assuming an effect size of .40, and using a 2-sided test at a 0.05% significance level, it was determined that we needed 72 participants to attain 95% power to detect condition differences on our blood pressure measures (GPower, 2013; approx. 36 participants per condition). The research team slightly overrecruited to account for exclusions on a priori criteria, resulting in a final sample of $N = 73$ individuals who met the eligibility requirements. Because the aim of the current manuscript was to provide the first empirical evidence that spending money on others improves cardiovascular health, and given the significant time and monetary costs associated with conducting the study, only enough participants were recruited to detect a main effect of prosocial spending on blood pressure. This study is therefore underpowered to detect interactions between condition, other psychological variables, and/or spending targets. To encourage future research, the results of exploratory analyses examining when and how prosocial spending leads to cardiovascular benefits are reported in the SOM.

**Years 1 and 2.** Data collection occurred over two years. In Year 1, data were collected as part of a larger exploratory study on the emotional and physical consequences of prosocial spending. This sample ($N = 96$) included 36 people diagnosed with high blood pressure. Exploratory analyses suggested that prosocial spending was linked to lower blood pressure within this subsample of adults previously diagnosed with hypertension. Because this initial study was exploratory, data were collected for an additional 37 participants in Year 2 to confirm the hypothesis; therefore, in Year 2 (unlike in Year 1), only participants who were diagnosed with high blood pressure prior to participation were recruited. Not surprisingly, given that individuals with poorer cardiovascular health were purposefully recruited, individuals recruited in Year 2 of the study had significantly higher BMI and WHR and were significantly more likely to be taking blood pressure medication (Table S9). There were no other differences on demographic or psychosocial characteristics between participants recruited in Year 1 versus 2 of the study.

The data were analyzed after Year 1, potentially increasing the risk of Type I error (Simmons, Nelson, & Simonsohn, 2011). Thus, current best practices were used to quantify this risk (Sagarin, Ambler, & Lee, 2014). In the SOM, the $P_{augmented}$ statistic for each dependent variable is reported. These results suggest that Type I error was not substantially inflated.

**General procedure.** Individuals who expressed interest in participating in our study completed a brief phone screening. During this phone screening, individuals provided health, demographic, and availability information. After this initial phone call, individuals who still wished to participate and who met basic health criteria were invited to the laboratory to complete final eligibility measures and to receive more information about the study. During this initial lab visit, participants reviewed the study procedures and had the opportunity to ask questions before providing written consent. Participants also provided demographic information and completed blood pressure, weight, height, hip, and waist measures. Of the 85 individuals who participated in this initial lab visit, 92% ($N = 73$) completed the study in its entirety. Nine people were excluded during the initial lab visit for failing to meet the study's cognitive requirements, and three people chose not to participate in the study because of the time commitment involved.

During this initial lab visit, after eligibility was confirmed, participants were assigned to spend money on themselves or to spend money on others for the duration of the study. Each participant received two payments of $40. These payments were placed in a small bottle with a cap that recorded the date and time that the bottle was opened. Each bottle was clearly labeled with the date that participants were supposed to spend their payments and a reminder of their spending condition. Participants returned to the lab three weeks and five weeks after the initial lab visit (Week 4 and 6 of the study). Research assistants were blind to the hypothesis of the study and to condition assignment at the time of the health measures. During the Week 4 lab visit, health measures were assessed and participants received their final study payment of $40. During the Week 6 lab visit, health measures were assessed. Upon completion of each lab visit, participants received $10 for travel. At the end of the study, participants were debriefed and received a health report that included information about their blood pressure.

***Spending intervention.*** Participants who met the inclusion criteria were randomly assigned to spend money on others or to spend money on themselves. Participants assigned to the personal spending condition were provided with written instructions to "Spend the study payment on yourself. It does not matter how you spend the $40, as long as you spend it on yourself." Participants assigned to the prosocial spending condition were provided with written instructions to "Spend the study payment on someone else. It does not matter how you spend the $40, as long as you spend it on someone else." Participants were asked to spend the study payment by 4:30 p.m. on a day of their choosing during weeks 3, 4, and 5 of the study. At 4:30 p.m. on the spending day, participants received a phone call from a research assistant. To ensure that participants had spent their payment as instructed, participants completed a brief spending survey during this phone call. Participants were asked, "How did you spend your study payment today, and what did you spend it on? Please answer with as much detail as possible, in at least 2 to 3 sentences." Research assistants recorded participants' exact responses and completed a compliance report. To increase compliance, participants were asked to keep receipts of the purchases they made, and to provide these receipts at each lab visit throughout the study. Only one participant failed to comply with the spending instructions during the majority of spending weeks, and the results are robust when this participant is excluded from the critical analyses.

***Blood pressure.*** To measure resting systolic and diastolic blood pressure, participants were seated in a chair, and a research assistant placed a blood pressure cuff on the participant's nondominant arm. Appropriately sized cuffs were selected according to the diameter of each participant's arm. Following a 20-min rest period, six blood pressure readings, spaced two minutes apart, were collected using an automatic BP monitor (BPM-100, VSM MedTech). Following standard protocol, the first reading was excluded to allow participants to adjust to the procedure. SBP and DBP were calculated by averaging the last five measures taken. This device and protocol have been validated in adult populations and yield readings that meet the standards of the U.S. Association for the Advancement of Medical Instrumentation (Zorn, Wilson, Angel, Zanella, & Alpert, 1997).

***Other health measures.*** WHR was calculated as the ratio of the waist (measured at the narrowest point between the ribs and the iliac crest) to hip circumference (measured at the maximum diameter of the buttocks). Height and weight were measured by our research assistants at each lab visit (Weeks 1, 4, and 6 of the study) and BMI was calculated as weight in pounds divided by height in inches squared and multiplied by a factor of 703.

***Data availability.*** Because the data presented here were part of a larger study, participants also completed other measures. Complete data are available by request from the first author; these data are not posted online due to the sensitive nature of some measures.

## Results

Critically, there were no significant differences in age, blood pressure, BMI, or WHR between conditions at baseline (see Table 4), suggesting that random assignment was successful at equating groups on potential confounding variables. To assess condition effects on the study's cardiovascular measures (SBP and DBP), analyses of covariance were conducted assessing group differences in blood pressure collapsing across the two postspending measurements and adjusting for baseline. Consistent with reporting standards to maximize transparency (Simmons, Nelson, & Simonsohn, 2011), the results of condition assignment on the blood pressure measures at each occasion are also reported separately (see Table S10 and Figure S1).

Table 4
*Study 2 Characteristics of Participants at Study Entry by Condition*

| Characteristic | Mean (*SD*) Prosocial spending (*N* = 36) | Mean (*SD*) Personal spending (*N* = 37) | *p* value | 95% CI |
|---|---|---|---|---|
| Female (%) | 52% | 48% | .62 | [−.17, .28] |
| Caucasian (%) | 49% | 51% | .85 | [−.18, .21] |
| Age | 71.43 (4.09) | 72.59 (6.27) | .36 | [−3.70, 1.36] |
| Annual income[a] | 5.68 (1.78) | 5.08 (1.63) | .15 | [−1.39, .20] |
| Education[b] | 4.92 (.69) | 4.91 (.65) | 1.00 | [−.32, .32] |
| Married (%) | 48.3% | 51.7% | .82 | [−.30, 1.14] |
| Paid work/week (hrs) | 2.53 (7.45) | 2.91 (8.43) | .84 | [−4.17, 3.40] |
| Volunteer/week (hrs) | 5.26 (6.72) | 4.46 (6.35) | .50 | [−1.53, 3.14] |
| Cigarettes/day | .51 (.98) | .47 (.71) | .70 | [−.27, .39] |
| MOCA[c] | 27.78 (1.71) | 27.20 (1.81) | .17 | [−.26, 1.41] |
| GDS[d] | 1.00 (1.33) | 1.08 (1.25) | .79 | [−.69, .52] |
| BP meds (% yes) | 47% | 53% | .45 | [−.14, .31] |
| SBP | 122.67 (14.53) | 123.78 (17.18) | .77 | [−8.55, 6.32] |
| DBP | 72.00 (10.73) | 73.62 (11.05) | .40 | [−7.70, 2.46] |
| WHR | .87 (.09) | .88 (.09) | .90 | [−.04, .04] |
| BMI | 23.82 (10.67) | 27.42 (11.89) | .18 | [−8.88, 1.67] |

[a] The income category of 5.00 corresponds to an annual household income of $35,000 to $49,999 and the category of 6.00 corresponds to an annual household income of $50,000 to $74,999. [b] The education category of 5.00 corresponds to completed "college, university, or pre-university." [c] MOCA (Montreal Cognitive Assessment; Nasreddine et al., 2005). [d] GDS (Geriatric Depression Scale; Yesavage et al., 1983).

**Blood pressure measures.** After spending money on others, participants had lower systolic blood pressure ($M = 113.85$, $SD = 9.87$) as compared with participants assigned to spend money on themselves ($M = 120.71$ $SD = 15.04$), $F(1, 73) = 6.72$, $p = .012$, $\eta^2 = .09$, $CI_{95}[-11.19, -1.46]$. Likewise, participants assigned to spend money on others had significantly lower diastolic blood pressure ($M = 67.03$, $SD = 7.80$) compared with participants assigned to spend money on themselves ($M = 72.97$, $SD = 8.59$), $F(1, 73) = 10.45$, $p = .002$, $\eta^2 = .13$, $CI_{95}[-7.43, -1.76]$. There were no interactions between condition and cohort to predict blood pressure, and results held controlling for variables that differed across cohort, including BMI, WHR, and whether participants were taking BP medication (SOM).[3] Follow-up analyses revealed that these results were driven by *decreased* blood pressure among individuals who spent money on others, and not by increased blood pressure among individuals who spent money on themselves (see SOM).

**Other health measures.** Research suggests that prosocial behavior is associated with greater physical activity (Fried et al., 2004; Tan et al., 2009; Tan, Xue, Li, Carlson, & Fried, 2006). Thus, it is possible that these effects stemmed from participants in the prosocial spending condition increasing physical activity and/or medical compliance throughout the study. Although the measures were limited, this study provides suggestive evidence that improved physical activity and/or medical compliance might not explain the reductions in blood pressure among individuals who were randomly assigned to spend money on others (see SOM).

## General Discussion

Two studies provide the first empirical evidence that prosocial spending may lead to lower blood pressure among older adults diagnosed with high blood pressure. In Study 1, participants who spent more money on others exhibited lower systolic and diastolic blood pressure two years later. In Study 2, participants assigned to spend money on others showed significant improvements in systolic and diastolic blood pressure compared to participants assigned to spend money on themselves. Thus, prosocial spending was linked to lower blood pressure both when people used their own money to provide financial support to others in daily life (Study 1), and when they were instructed to spend a windfall of money on others (Study 2). Furthermore, the effects of prosocial spending on systolic and diastolic blood pressure, ranging from 5 to 7 mm of Hg in Study 2, were similar to the changes documented in response to starting new hypertension medication, high frequency exercise or diet modifications (Chobanian et al., 2003). The current studies point to the idea that financial generosity can lead to improvements in the cardiovascular health of at-risk adults.

This was the first research to examine the implications of prosocial spending for the cardiovascular health of at-risk older adults. Thus, the goal of this research was to document the existence of a relationship between financial generosity and cardiovascular health, rather than to illuminate the complex pathways that might underlie these effects. Nonetheless, to facilitate future research, exploratory analyses were conducted to assess three potential mechanisms that could shed light on how spending money on others improves cardiovascular health: improving emotional well-being, bolstering social connection, and buffering against stress.

First, it is possible that prosocial spending might reduce blood pressure by enhancing positive emotions or reducing negative emotions (Dunn, Aknin, & Norton, 2008). However, there was no support for this pathway in the present research (see SOM for additional analyses). Beyond self-reported affect, prosocial spending might confer other psychological benefits with downstream consequences for physical health, such as increasing social connection (Holt-Lunstad, Smith, & Layton, 2010). There was also no support for this pathway (SOM). Furthermore, spending money on others might improve cardiovascular health by protecting individuals from the deleterious effects of stress on cardiovascular health (e.g., Chida & Steptoe, 2010). Consistent with research documenting the stress buffering effects of helping others (Poulin et al., 2013), there was some evidence that prosocial spending protected participants from the negative impact of stress: For participants who were assigned to spend money on themselves, there was a positive association between stress and blood pressure; this relationship disappeared for participants assigned to spend money on others (SOM).

It is also possible that spending money on others is linked to improved cardiovascular health through mechanisms that are not measured here. Spending money on others may boost feelings of self-worth, which could protect older adults from social isolation and/or stressful life experiences (Seeman, Kaplan, Knudsen, Cohen, & Guralnik, 1987; Seeman, Lusignolo, Albert, & Berkman, 2001). Engaging in prosocial spending may give individuals perspective on their own life struggles, promoting more positive coping strategies in the face of stressful situations. For example, in a recent correlational study, people who provided more social support to others reported higher levels of self-efficacy, which predicted lower systolic and diastolic blood pressure (Piferi & Lawler, 2006). Spending money on others might also protect individuals from social isolation, as providing instrumental financial support to others might replenish social ties that can often be lost in older age due to social changes such as retirement and bereavement (see: Sneed & Cohen, 2013 for a similar discussion). Because participants were not explicitly asked to report how much self-worth or efficacy they felt after spending money on others, more research is needed to replicate and extend this research, such as by examining the specific pathways by which generous spending affects cardiovascular health.

What types of financial generosity might lead to the greatest benefits for cardiovascular health? Research on hedonic adaptation has shown that people adapt quickly to positive and negative lifestyle changes (Kahneman, 1999), and the effect of new circumstances can diminish quickly or disappear completely once people have habituated to their new circumstances (Brickman, Coates, & Janoff-Bulman, 1978). To sustain the health benefits of prosocial spending, it may be necessary to engage in novel acts of financial generosity (Sheldon, Boehm, & Lyubomirsky, 2012). In addition,

[3] The impact of prosocial spending among normotensives recruited during Year 1 of data collection was also examined (SOM). As expected, these additional analyses revealed that the benefits of prosocial spending were moderated by hypertension status. Along with Study 1, these results suggest that prosocial spending had the greatest benefits for hypertensive individuals.

research on prosocial spending and well-being suggests that individuals reap greater benefits from spending money on people they consider close social ties than from spending money on acquaintances or other weak ties (Aknin, Sandstrom, Dunn, & Norton, 2011). In Study 2, there was initial evidence that participants exhibited larger improvements in blood pressure if they spent money on close (vs. less close) others (SOM). Thus, this research tentatively suggests that individuals might benefit most from engaging in a variety of types of prosocial spending, while prioritizing people closest to them.

It is worth noting that financial generosity might not *always* benefit health. Studies of caregivers show that support provision can burden caregivers and negatively impact cardiovascular health (Capistrant, Moon, Berkman, & Glymour, 2012; Haley, Roth, Howard, & Safford, 2010). Even reflecting on support provision can have negative consequences; in a recent experimental study, participants who were asked to write about providing support had higher systolic and diastolic blood pressure upon completing a stressful task compared with participants assigned to write about receiving support (and as compared to a control condition; Creaven & Hughes, 2012). Of course, providing ongoing social support may be more physically taxing than providing financial support. Yet, this work points to the hypothesis that financial generosity might provide health benefits only when it does not incur overwhelming personal costs.

High blood pressure currently affects 67 million people in the United States (Centers for Disease Control and Prevention, 2012) and 1 billion people worldwide (WHO, 2014). This work provides the first longitudinal and experimental evidence that financial generosity can improve cardiovascular health. The impacts were clinically relevant—the effects of prosocial spending on systolic and diastolic blood pressure were similar in magnitude to the changes documented in response to well documented interventions such as high frequency exercise or diet modification (Chobanian et al., 2003). Given that most research on prosociality and health has relied on correlational or longitudinal designs, the use of experimental methodology in the present research provides some of the strongest evidence to date that prosocial behavior exerts a causal effect on physical health.

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