

## Association of hypotension with positive and negative affect and depressive symptoms in the elderly

ANTHONY F. JORM

**Background** Previous research associating hypotension with depression has produced inconsistent results. A possible reason is that depressive symptom scales reflect both high negative affect and low positive affect.

**Aims** To examine the association of hypotension with depressive symptoms, negative affect and positive affect.

**Method** Community survey of 340 elderly persons aged 77–99 years.

**Results** Diastolic hypotension had a weak association with depression, no association with negative affect and a strong inverse association with positive affect. Systolic hypertension was associated with positive affect. Use of antihypertensive medication was independently associated with lower positive affect.

**Conclusions** Diastolic hypotension shows a specific association with low positive affect. This association may explain the weak and inconsistent results of earlier studies relating hypotension to depression.

**Declaration of interest** Funding was provided by the National Health and Medical Research Council and the Australian Rotary Health Research Fund.

A number of studies have reported associations of hypotension with depressive symptoms (Pilgrim *et al*, 1992; Barrett-Connor & Palinkas, 1994; Henderson *et al*, 1997; Stroup-Benham *et al*, 2000), fatigue (Wessely *et al*, 1990) or lower well-being (Rosengren *et al*, 1993). A longitudinal study found that low blood pressure at baseline predicted later depression scores, whereas high depression scores at baseline did not predict later hypotension (Paterniti *et al*, 2000). However, the associations reported have been weak and inconsistent (Gilmore *et al*, 1995; Donner-Banzhoff *et al*, 1997).

### Depression and affective systems

One interpretation is that the positive associations in the literature are simply due to selective reporting of Type I errors (Donner-Banzhoff *et al*, 1997). However, another possibility is that depression scales are only weakly tapping the psychological characteristics associated with hypotension. Research into the psychology of emotion has distinguished two independent affective systems, involving positive and negative affect. Whereas anxiety involves the negative affect system, depression involves both high negative affect and (to a lesser degree) low positive affect (Watson *et al*, 1988; Clark *et al*, 1994). According to Watson *et al* (1988), high positive affect is “a state of high energy, full concentration, and pleasurable engagement, whereas low [positive affect] is characterized by sadness and lethargy” (p. 1063). The same authors describe negative affect as “a general dimension of subjective distress and unpleasurable engagement that subsumes a variety of aversive mood states, including anger, contempt, disgust, guilt, fear, and nervousness, with low [negative affect] being a state of calmness and serenity” (p. 1063). The present study assessed the association of hypotension with measures

of depression, anxiety, positive affect and negative affect.

### METHOD

Participants were 340 community-dwelling persons aged 77–99 years from the third wave of a longitudinal study based in Canberra and Queanbeyan, Australia (Henderson *et al*, 1997; Korten *et al*, 1999). Blood pressure was measured twice in the interview using an Omron automatic digital blood pressure/pulse monitor (Model HEM-703C) and the results were averaged. Following Barrett-Connor & Palinkas (1994), normal systolic pressure was defined as 120–139 mmHg and normal diastolic pressure as 75–84 mmHg. Participants also were given anxiety and depression symptom scales (Goldberg *et al*, 1988; Mackinnon *et al*, 1994) and a range of physical health measures (Korten *et al*, 1999). On Wave 3 only, participants were asked to self-complete the Positive and Negative Affect Scales (PANAS; Watson *et al*, 1988). The PANAS consist of 20 words describing emotions: 10 positive and 10 negative. Participants were asked to rate each word to indicate ‘to what extent you feel this way in general’. There was a five-point rating scale ranging from ‘very slightly’ or ‘not at all’ to ‘extremely’.

Multiple linear regression analyses were carried out to predict the affect score from hypotension and hypertension (dichotomous variables). To control for potential confounders, additional regression analyses were carried out with the confounders entered as simultaneous predictors.

### RESULTS

Table 1 shows the mean scores on depression, anxiety and affect measures for the blood pressure groups. Diastolic hypotension was weakly associated with higher depression (unstandardised  $\beta=0.55$ ,  $P=0.031$ ), was not associated with negative affect and was strongly associated with lower positive affect ( $\beta=-3.21$ ,  $P=0.0002$ ). The association with positive affect was found separately in males and females and when those taking antihypertensive medication were excluded (not shown). Systolic hypertension was associated with higher positive affect ( $\beta=2.12$ ,  $P=0.015$ ), but the number of participants with systolic hypotension was too small to evaluate adequately its association with

positive affect. When individual PANAS items were examined for associations with hypotension, significant differences ( $P < 0.05$ ) were found for Interested, Strong, Enthusiastic, Inspired, Determined and Attentive between subjects with diastolic hypotension and those with normal diastolic blood pressure.

To control for possible confounders, a multiple linear regression analysis was carried out to predict the positive affect from hypotension, hypertension, use of antihypertensive medication, age, gender, education, marital status and a range of physical health and cognitive measures (see Korten *et al*, 1999, for details). Controlling for these factors, positive affect was related to diastolic hypotension (unstandardised  $\beta = -2.18$ ,  $P = 0.031$ ) and the use of antihypertensive medication ( $\beta = -2.61$ ,  $P = 0.004$ ). Antihypertensive medication was being taken by 39% of the sample. Among those on medication, 24% had diastolic hypotension and 5% had systolic hypotension.

## DISCUSSION

Diastolic hypotension was associated with lower positive affect but not with higher negative affect. The weak and inconsistent associations of hypotension with depression in the literature could be because depression measures are correlated more strongly with negative affect than with low positive affect.

**Table 1** Mean (and 95% CI) values for depression, anxiety, positive affect and negative affect for hypotensive, normotensive and hypertensive groups

Measure	Diastolic hypotensive ( $n=104-120$ )	Diastolic normotensive ( $n=98-111$ )	Diastolic hypertensive ( $n=94-104$ )	$P^I$
	Depression	2.35 (1.98–2.71)	1.89 (1.44–2.16)	
Anxiety	2.39 (2.02–2.76)	2.20 (1.81–2.59)	2.21 (1.82–2.60)	0.738
Positive affect	29.90 (28.65–31.16)	33.12 (31.96–34.27)	32.75 (31.54–33.96)	0.0002
Negative affect	17.19 (15.94–18.45)	16.95 (15.70–18.21)	18.19 (16.74–19.63)	0.389
	Systolic hypotensive ( $n=31-37$ )	Systolic normotensive ( $n=68-80$ )	Systolic hypertensive ( $n=196-222$ )	
Depression	2.29 (1.70–2.87)	1.99 (1.56–2.43)	2.03 (1.78–2.29)	0.724
Anxiety	2.35 (1.66–3.04)	2.11 (1.69–2.54)	2.32 (2.04–2.59)	0.727
Positive affect	31.53 (29.46–33.61)	30.34 (28.81–31.87)	32.46 (31.59–33.33)	0.0496
Negative affect	17.30 (14.51–20.09)	16.39 (15.03–17.75)	17.82 (16.87–18.77)	0.304

I. Regression model predicting affect from blood pressure status.

## CLINICAL IMPLICATIONS

- Hypotension may be associated with lowered positive affect, which is a feature of depression.
- Antihypertensive medication may lead to hypotension and lower positive affect.
- Hypotension is not associated with increased negative affect, which is a feature common to both anxiety and depression.

## LIMITATIONS

- Small numbers did not allow a reliable assessment of the association of systolic hypotension with positive affect.
- Blood pressure was measured only on a single occasion.
- Information on the type of antihypertensive medication and on the use of psychotropic medication was not collected.

ANTHONY F. JORM, PhD, Centre for Mental Health Research, Australian National University, Canberra 0200, Australia. Tel: +61 2 61252741; Fax: +61 2 61250733; e-mail: Anthony.jorm@anu.edu.au

(First received 16 June 2000, final revision 22 December 2000, accepted 22 December 2000)

## Effect of antihypertensive medication

Diastolic hypotension was found in a quarter of users of antihypertensive medication, suggesting that treatment might be leading to hypotension in some cases. Furthermore, the use of antihypertensive medication was found to be associated with low positive affect when blood pressure

status was statistically controlled. As previous studies have done, we defined hypotension based on a single measurement occasion (although measured twice), which would have involved some unreliability. Whether or not a participant uses antihypertensive medication may be an independent predictor because it gives additional reliable information about blood pressure status. Unfortunately, we did not collect data on type of medication, so we could not explore whether the association is a general one or specific to particular classes of medication.

## Limitations

Other limitations of this study must be acknowledged. A cross-sectional study such as this one cannot distinguish whether hypotension is a cause or effect of low positive affect, or whether there is a common cause of both. Although the present study had longitudinal data on blood pressure, positive affect was measured only at Wave 3. Another limitation is that the use of psychotropic medication, which is another potential confounding variable, was not measured. The association of hypotension with lower positive affect requires further research in

longitudinal studies and in controlled trials of antihypertensive treatment.

## ACKNOWLEDGEMENTS

Ailsa Korten, Helen Christensen, Scott Henderson, Patricia Jacomb and Bryan Rodgers were co-investigators on this study. Help in various phases of the study was provided by Suzanne Dee, Colleen Doyle, Susan Lindsay, Karen Maxwell and Ruth Scott.

## REFERENCES

- Barrett-Connor, E. & Palinkas, L. A. (1994)** Low blood pressure and depression in older men: a population based study. *British Medical Journal*, **308**, 446–449.
- Clark, L. A., Watson, D. & Mineka, S. (1994)** Temperament, personality, and the mood and anxiety disorders. *Journal of Abnormal Psychology*, **103**, 103–116.
- Donner-Banzhoff, N., Chan, Y., Szalai, J. P., et al (1997)** Low blood pressure associated with low mood: a red herring? *Journal of Clinical Epidemiology*, **50**, 1175–1181.
- Gilmore, C., Green, B. H., Copeland, J. R. M., et al (1995)** Blood pressure as a risk factor for depression in elderly people: a prospective study. *Acta Psychiatrica Scandinavica*, **91**, 126–129.
- Goldberg, D., Bridges, K., Duncan-Jones, P., et al (1988)** Detecting anxiety and depression in general medical settings. *British Medical Journal*, **297**, 897–899.
- Henderson, A. S., Korten, A. E., Jacomb, P. A., et al (1997)** The course of depression in the elderly: a longitudinal community-based study in Australia. *Psychological Medicine*, **27**, 119–129.
- Korten, A. E., Jorm, A. F., Jiao, Z., et al (1999)** Health, cognitive, and psychosocial factors as predictors of mortality in an elderly community sample. *Journal of Epidemiology and Community Health*, **53**, 83–88.
- Mackinnon, A. J., Christensen, H., Jorm, A. F., et al (1994)** A latent trait analysis of an inventory designed to detect symptoms of anxiety and depression using an elderly community sample. *Psychological Medicine*, **24**, 977–986.
- Paterniti, S., Verdier-Taillefer, M.-H., Geneste, C., et al (2000)** Low blood pressure and risk of depression in the elderly. *British Journal of Psychiatry*, **176**, 464–467.
- Pilgrim, J. A., Stansfeld, S. & Marmot, M. (1992)** Low blood pressure, low mood? *British Medical Journal*, **304**, 75–78.
- Rosengren, A., Tibblin, G. & Wilhelmsen, L. (1993)** Low systolic blood pressure and self perceived wellbeing in middle aged men. *British Medical Journal*, **306**, 243–246.
- Stroup-Benham, C. A., Markides, K. S., Black, S. A., et al (2000)** Relationship between low blood pressure and depressive symptomatology in older people. *Journal of the American Geriatrics Society*, **48**, 250–255.
- Watson, D., Clark, L. A. & Tellegen, A. (1988)** Development and validation of brief measures of positive and negative affect: the PANAS scales. *Journal of Personality and Social Psychology*, **54**, 1063–1070.
- Wessely, S., Nickson, J. & Cox, B. (1990)** Symptoms of low blood pressure: a population study. *British Medical Journal*, **301**, 362–365.