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## Anger and mortality following ICD implantation

We were interested to read the article by Pedersen *et al.*<sup>1</sup> suggesting that state but not trait anger is associated with increased mortality following implantable cardioverter-defibrillator (ICD) implantation. We believe that caution should be exercised when drawing conclusions from the data used in this publication for the reasons outlined below:

Primary data analysis demonstrated no significant difference in state or trait anger between patients who were alive or had died 7 years following ICD implantation. Significant difference was found between 'adjusted analysis' of state anger and 7-year mortality.

Average state and trait anger scores were lower in the ICD ventricular arrhythmia group. This group also had a marginally higher mortality, i.e. the group with the higher mortality was the less angry group.

State anger was shown to be relatively unreliable compared to trait anger (test–retest reliability was 0.21 in females and 0.27 in males, 0.70 in males and 0.77 in females, respectively). Therefore, we can assume that trait anger would be the more valuable characteristic to evaluate in this scenario. To our knowledge, the STAS score has not been validated in patients undergoing procedures.

Eight percent of the patients were excluded from the study following heart transplants. This group of patients was significantly more likely to have New York Heart Association (NYHA) Class III–IV heart failure, paroxysmal or permanent atrial fibrillation, diabetes, and to be on diuretics ± digoxin, i.e. the group of patients excluded made up a relatively large proportion of severe clinical characteristics.

There is a clinical role for evaluating anger in relation to ventricular arrhythmia and ICD mortality, as suggested by Lampert *et al.* in 2009. Lampert demonstrated that patients with higher anger induced T-wave alternans were more likely to experience arrhythmias and to have ICD terminated arrhythmias ( $P < 0.01$ ).<sup>2</sup> The discussion posed by Pedersen *et al.* draws attention to the need to examine emotion in relation to mortality and sudden cardiac death. Whilst the data is interesting and thought provoking, in the context of the limitations above, we believe the results should be interpreted and applied with caution.

**Conflict of interest:** none declared.

### References

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2. Lampert R, Shusterman V, Burg M, McPherson C, Batsford W, Goldberg A *et al.* Anger-induced T-wave alternans predicts future ventricular arrhythmias in patients with implantable cardioverter-defibrillators. *J Am Coll Cardiol* 2009;**53**:774–8.

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## Anger and mortality following ICD implantation: Authors' reply

In their comment, Taylor<sup>1</sup> suggest that we excluded 8% of the patients from the analyses due to a heart transplant. To clarify, this was in fact 5.6% (25 patients out of 448). The 8% are related to patients not completing the State-Trait Anger Scale (STAS). Given that we had to exclude patients from the analyses for these two reasons and they differed systematically on baseline characteristics, we acknowledged as a limitation that the results cannot be generalized to the entire study population. However, we felt that it would be inappropriate to keep patients who had a heart transplant in the analyses, as they are considerably different than patients with an implantable cardioverter-defibrillator (ICD).

We completely agree with Taylor that the results of our study on anger and ventricular tachyarrhythmias and mortality should be considered preliminary, which was also acknowledged in the study limitations.<sup>2</sup> The State-Trait Anger Scale (STAS)—a measure of anger widely used in research with patients who have heart disease<sup>3</sup>—has not specifically been validated in this patient group.

As Taylor suggest, we also expected trait anger to play a larger role than state anger. However, the adjusted analyses taking into account the competing risks associated with other variables showed that state but not trait anger was a risk factor for mortality. Experimental approaches conducted by Burg and Lampert have provided more solid and consistent evidence for a link between anger and ventricular arrhythmias.<sup>4</sup> From this perspective using questionnaires to determine anger in ICD patients and examining their influence over time may constitute a challenge that we have only begun to unravel. Ecological momentary assessment either alone or in combination with standardized and validated anger questionnaires may better capture anger and evolution in their anger over time among ICD patients and related patient groups. We also need

to look at the role of expression vs. suppression of anger<sup>5</sup> and the correlates of each (e.g. cardiac rhythm) in order better to understand whether it is anger per se that is a risk factor or how patients deal with anger. The better identification of which aspects of anger are toxic — e.g. related to patient outcomes, would then lead to the development and testing of better targeted interventions to treat anger to reduce morbidity and mortality.

Given that anger and hostility are associated with risk of incident heart disease in healthy individuals and poor prognosis in patients with established heart disease,<sup>6</sup> there is an urgent need to pursue this area and fill the gaps in order to improve the quality of care for patients.

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