Are ACE scores useful for identifying individuals at risk of health problems?

Clinics are increasingly screening for ACEs, but ACE scores may not tell us who will go on to develop poor health, explain Jessie R Baldwin and Andrea Danese.

One in two children in the UK are exposed to adverse childhood experiences (ACEs), such as abuse, neglect, or dysfunctional home environments.[1-3] Because ACEs are associated with poor health outcomes in later life, public health advocates are interested in buffering the impact of ACEs through targeted health interventions.

To identify children and adults who may be at risk and benefit most from these interventions, several clinics and schools screen for ACEs. Children and adults with high ACE scores (generally 4+ ACEs) are thought to be at high risk for later health problems and may be offered interventions. But can a person's ACE score accurately predict whether they will have future health problems?

## ACEs and population-level risk of health problems

To answer this question, we studied two birth cohorts from the UK and New Zealand – the E-Risk Longitudinal Twin Study and the Dunedin Longitudinal Study.[1] ACEs were assessed in childhood through interviews and observations in both studies, and were also self-reported in adulthood in the Dunedin Study. Participants were then assessed for later mental and physical health problems – in late adolescence (age 18) in E-Risk or at midlife (age 45) in Dunedin.

We first examined whether ACE scores were associated with risk of health problems in the

population. Like in the original ACE Study,[4] we found that groups of children with higher ACE scores had a greater risk of mental and physical health problems later in life.[1]

For example, a larger proportion of children with 4+ ACEs had later mental health problems compared to children with fewer ACEs, as shown in Figure 1. In other words, as a group, children with 4+ ACEs had higher average risk of mental health problems than children with fewer ACEs (relative risk = 1.14 for each additional ACE; 95% confidence interval = 1.10-1.18).

Figure 1. Prevalence of mental health problems at age 18 in the E-Risk Study by ACE score. Adapted with permission from Baldwin et al. (2021).[1]
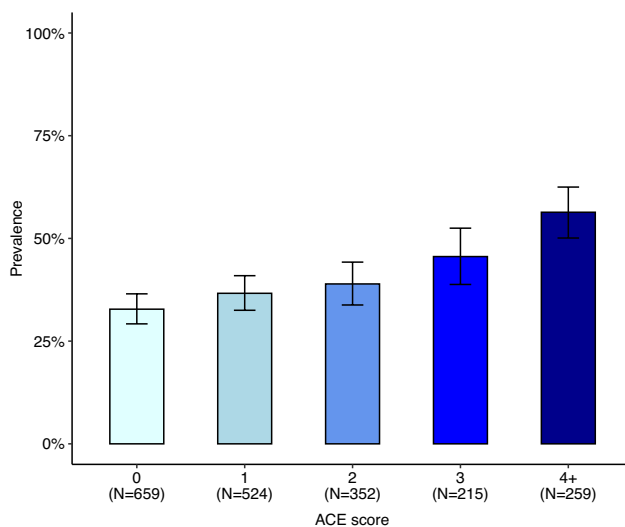

However, as also shown in Figure 1, not all children with 4+ ACEs had mental health problems – and some children with fewer or no ACEs had mental health problems. Because of these differences between individuals in each group with the same ACE score, it was unclear if ACE screening could accurately predict risk for individual children.

ACEs and individual-level risk of health problems

To test whether ACE scores could identify individuals at risk of health problems, we computed the Area Under the receiver operating characteristic Curve (AUC). The AUC shows whether the prediction of health problems based on each ACE score identifies more true positive results (e.g., the proportion of people with mental health problems who had 4+ ACEs; on the y axis in Figure 2) than false positive results (e.g., the proportion of people without mental health problems who had 4+ ACEs; on the x axis in Figure 2).

Figure 2. Accuracy of predicting mental health problems based on ACE scores in the E-Risk Study. Adapted with permission from Baldwin et al. (2021).[1]
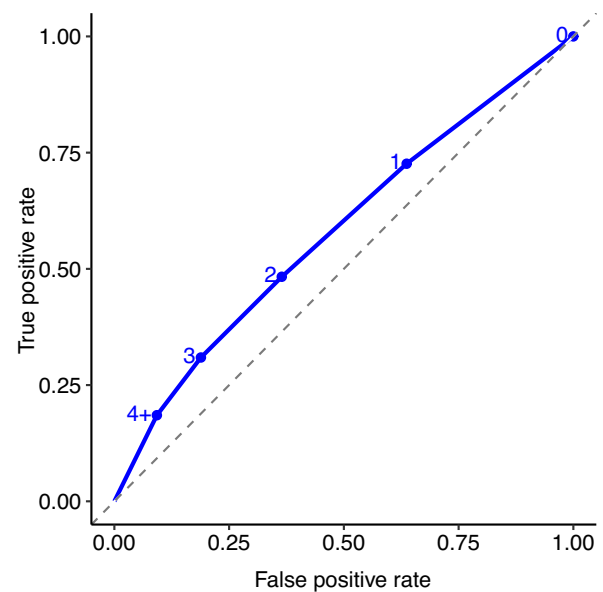
If ACE scores identify the same rates of true positives and false positives (the dashed diagonal line in Figure 2), then the prediction simply reflects chance with AUC = 0.5 – it's like flipping a coin. If ACE scores identify more true positives than false positives, then the prediction is progressively better than chance, with increasing AUC (up to AUC = 1 showing perfect accuracy).

We found that the AUC for having a mental health problem was 0.58 (95% confidence interval = 0.56-0.61; Figure 2). This AUC represents a 58% probability (i.e., only 8% above chance) that a random child who developed a mental health problem had a higher ACE score than a random child who did not. In other words, the ACE score couldn't accurately distinguish a child who developed a later mental health problem from a child who did not.

Predictive accuracy was generally poor across several physical and mental health outcomes in both cohorts.[1]

Implications for ACE screening

These findings suggest that a person's ACE score is not a good indicator of whether they will go on to develop health problems. Therefore, allocating health interventions based on ACE scores alone is a poor strategy: many people at risk of health problems would be missed because they didn't have high ACE scores, while others with high ACE scores but low risk of developing health problems would be offered unnecessary interventions (with potential harms and costs).

Of course, ACE screening might be useful in other ways, such as identifying vulnerable children who need safeguarding – assuming that effective interventions could be provided.

Our findings caution against the deterministic use of traditional ACE scores for individual risk prediction and clinical decision making. However, future research should test whether ACE screening could be adapted to better identify individuals at risk of health problems, for example by focusing on the most predictive adversities[5] or combining ACE scores with information about protective or vulnerability factors.[6]

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