



granted asylum and a higher chance of gaining permission to be joined by family members.

Authorities say that some unaccompanied refugees claim to be younger than they are. But the anatomical tests that are currently used in some countries to assess age have an error range of up to 3–4 years and rely on X-rays and magnetic resonance imaging. In Norway, refugees have sued authorities for being forced to submit to these medical tests.

The publication of the first reasonably accurate epigenetic clock in 2013 presented a simpler way of verifying age, because the test could be done using blood samples². Developed by biostatistician Steve Horvath at the University of California, Los Angeles, this clock measured an epigenetic mark called methylation at 353 DNA sites across the genome.

In July, Horvath and his team published a new clock that measures epigenetic marks at 391 DNA sites³. It was particularly accurate in buccal cells scraped from the inside of the cheek, which are easier to collect than blood samples. Testing these cells from 53 people aged between 3.5 and 18 years, he found a median error of just 1.03 years. However, there were many outliers — people whose age could not be accurately predicted — and the most extreme result was out by 5 years and 8 months. Horvath expects that epigenetic clocks, once refined, will help refugees by corroborating their age claims. “At the same time, the tests may help identify individuals who break the law,” he adds.

In the Hildesheim case, Zymo, which bought an exclusive licence to Horvath’s test in 2016, compared the refugee’s sample with those of five others who had similar ethnic backgrounds and whose ages were known. Keith Booher, project manager for Zymo’s epigenetic services, told *Nature* that the test determined the most likely age of the person to be between 26 and 29 years old. The Hildesheim authorities have declined to comment on the case.

Forensic scientists around Europe are now working to make an epigenetic clock that would be more accurate and less expensive than what is available — and that is applicable to the easily collected buccal cells. Studies are also under way to gauge how the diverse ethnic backgrounds of Europe’s refugees might influence the epigenetic clock. Another challenge to using the clock is dealing with the people who are statistical outliers. Wagner thinks that some of these people, for whom the method simply won’t work, could be identified using the right combinations of epigenetic markers, allowing scientists to discount the test’s results.

Even if the accuracy of the epigenetic clock cannot be improved to rival anatomical tests, it would still be attractive, says Morling. “Every time you add a new method, you improve overall precision of age estimation.” ■

1. Ritz-Timme, S., Schneider, P. M., Mahlke, N. S., Koop, B. E. & Eickhoff, S. B. *Rechtsmedizin* **28**, 202–207 (2018).
2. Horvath, S. *Genome Biol.* **14**, R115 (2013).
3. Horvath, S. *Aging* **10**, 1758–1775 (2018).

Around 4 million refugees have arrived in Europe since 2014, many of whom have no identity documents.

POLITICS

DNA clock may aid refugee age check

European forensic scientists want to find out whether epigenetics can help determine which refugees are under 18.

BY ALISON ABBOTT

When authorities in Hildesheim, Germany, didn’t believe an asylum seeker who claimed to be under 18 years old — and thus eligible for privileged treatment — police turned to a blood test sold by Zymo Research in Irvine, California.

The test uses chemical modifications to DNA that accrue over a lifetime, called an ‘epigenetic clock’, to determine a person’s age. Scientists — aware of its potential benefits but also of its current lack of precision — sounded an alarm.

In a paper published¹ in May, a team led by forensic-medicine specialist Stefanie Ritz-Timme of the University of Dusseldorf in Germany said that these tests were not ready for use in sensitive forensic evaluations.

But now, in the charged political atmosphere that has accompanied the arrival of millions of refugees in Europe, researchers are joining forces to improve epigenetic-clock-based tests — with a focus on whether they might be used to help determine the age of refugees whose claims to be under 18 are disputed.

“The race is now on to develop a more accurate clock that would be more predictive

than the anatomical tests — and also more practical,” says cell biologist Wolfgang Wagner at the University of Aachen, Germany.

The development of methods that could feed into decisions about who is granted asylum and how refugees are treated are likely to elicit criticism, says Denise Syndercombe-Court, a forensic geneticist at King’s College London. She says that some scientists, herself included, are wary of these efforts.

But Niels Morling, a forensic geneticist at the University of Copenhagen who is running a national epigenetic-clock programme, defends the research. Given that the law treats those under 18 very differently from adults, he says, “you have a duty to make sure that it can be implemented fairly”.

Philosopher Thomas Pogge, who specializes in global justice at Yale University in New Haven, Connecticut, says that, to keep rising anti-immigration sentiment in check, it is important for authorities to show that they can detect any refugees who pretend to be younger than they are.

Since 2014, around 4 million refugees have arrived in Europe, many without identity documents. Minor status usually leads to better care, an increased chance of being