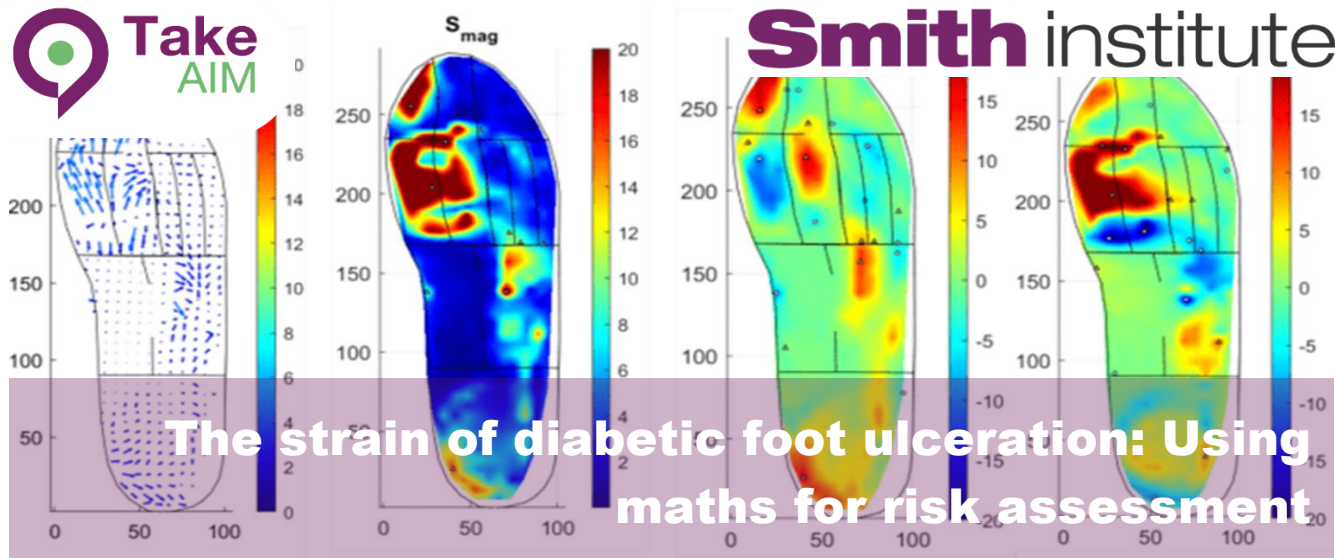




Smith institute



The strain of diabetic foot ulceration: Using maths for risk assessment

TakeAIM 2021 – 3rd Place

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Diabetes is rising significantly in prevalence, currently affecting an estimated 1 in 11 of the world’s adult population. With it associated health problems also increase such as diabetic foot ulcers (DFU). DFU are seen in up to 34 % of diabetics in their lifetimes. With average treatment times of 11 weeks, diabetic foot care costs of up to £962 million annually for the NHS alone and increased risk of amputation and mortality, it has a significant burden on both social and economic factors.

The Smith Institute, enabled by the generous sponsorship of our leading corporate partners, ran the TakeAIM competition in 2021 to make visible the crucial role that mathematics will increasingly play in all aspects of our lives. The competition, also celebrating its 11th anniversary this year, was open to undergraduate and postgraduate students working in the mathematical sciences. The first-place prize was £1000, the two second-place prizes were £500, and the two third-place prizes were £250.

Patients often present with DFU once a substantial ulcer has formed, this can often be due to lack of sensation in the feet due to diabetic neuropathy, so risk assessment and early intervention can play an important role in reducing occurrence. Current risk assessment pathways are pressure focussed and often use prohibitively expensive technology for global access, with shear stress contributions to ulcer formation neglected.

My research helps to bridge this gap, by developing a low-cost, efficient method of analysing strain. Mathematical models enable tracking of changes to an applied pattern on a deformable insole, before and after it is walked on. This analysis allows personalised heat maps to be created to highlight areas at risk of developing a DFU. Being able to spot areas of risk means interventions can be developed to improve diabetic foot care, they can be put in place earlier to reduce ulcer development, in turn improving patient quality of life and lessening the burden on the healthcare sector worldwide.

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