Background Social care provision is vital for ensuring the health of ageing and vulnerable populations. The UK relies on informal care for 50% of care provision, meaning that social care policies have significant implications for health services sustainability in this context. We present an agent-based simulation of UK informal care provision, demonstrating how this framework captures troubling trends and inequalities in social care.

Methods We constructed an agent-based model in Python that simulates individual human agents in a virtual UK from the year 1860 to 2022. Population dynamics are driven by UK birth rates and mortality rates. Agents can form partnerships, reproduce, migrate domestically for work or other purposes, change jobs, and provide social care. Care decisions are taken based on employment status, salary, age, health status, geographical location, and their relationship to those in need of care. Simulated agents participate in a detailed economy, and are members of different socioeconomic status groups depending on their income.

Output files track agents’ socioeconomic status, social mobility, informal care provision, and payment for formal care services. Simulation output includes individual-level agent statistics and population-level analyses of care provision by age, sex, socioeconomic status, and employment status. Simulation results were calibrated against 2011 UK Census data for key population dynamics measures.

Results Simulation results in the year 2022 show significant inequalities in social care need and provision by gender and SES group. Agents in the lowest SES quintile (Group I) show a mean unmet care need of 19 hours/week, as compared to 12.5/week in the highest (Group V). Carers in Group I supply an average 8.6 hours/week of care, compared to 3.6 hours/week in Group V. Thus, agents in Group I not only make a lower wage, they also lose more hours of work to care provision, and need more care themselves. In addition, female agents provide 1.9 times more informal care than males, while receiving lower average wages. Finally, the simulation shows a trend of growth in unmet care need from 1.17 hours per capita in 1976 to 2.38 by 2022.

Conclusion This work demonstrates that a well-constructed agent-based simulation can provide a platform for investigating the influence of economic and social factors on social care provision. This framework thus provides a means to develop and test new social care policies which better account for the complexities and challenges facing informal carers across the country, and in turn better protect health services sustainability.