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Investigating inflation, living costs and mental health service utilization in post-COVID-19 England

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This study investigates the association between price inflation and mental health conditions in the general population during the post-coronavirus disease 2019 (COVID-19) era in England, beginning from April 2022. Here, utilizing data from the Office for National Statistics and the National Health Service, we examined the association between price inflation, reflected by an official index 'Consumer Prices Index including owner occupiers' housing costs' and the number of people in contact with mental health services across different age groups. Our findings revealed that, compared with the pre-COVID-19 period (August 2016 to February 2020), significant associations emerged between specific living costs (including costs for 'food and non-alcoholic beverages', 'housing, water and fuels' and 'miscellaneous goods and services') and mental health service utilization during the post-COVID-19 era. This association was particularly noted for adults aged 19–64 years and the elderly population aged 65 years and over. The results highlight the importance of addressing the potential causes of mental health issues in the context of rising living costs and can inform targeted social and economic policies, such as financial subsidies for food and non-alcoholic beverages and the need to scale up mental health services.

In the aftermath of the coronavirus disease 2019 (COVID-19) pandemic, the United Kingdom has witnessed a gradual recovery in economic activity. However, the cost of living has continued to rise due to exacerbated price inflation. Data from the Office for National Statistics (ONS) indicate that the price inflation rate in England increased from 1.5% to 6.2% from March 2020 to March 2022, and is now up to 8.9% as of March 2023, in contrast to the relatively stable rate of 0.7–3% observed between August 2016 and February 2020[1]. This heightened price inflation has emerged as another crisis, profoundly impacting daily life.

Studies conducted during the 2008 economic recession revealed that it had adverse effects on mental health both in the United Kingdom and globally[2–9]. Previous research has also established associations between rising living costs and compromised mental health due to factors such as housing instability, fuel poverty and restricted access to food and transportation[10–12]. The potential consequences of rising living costs extend beyond those directly responsible for bill payments, with children in poverty facing an increased risk of adverse childhood experiences[13], which may impact their mental health.

The British government's primary response to alleviate the pressure resulting from increased living costs has been through various financial subsidies. However, there is a lack of empirical evidence to determine whether a statistically significant relationship exists between the mental health cases reported in the news and the rising cost of living in the current post-COVID-19 environment. Furthermore, it remains unclear which specific living costs are most closely associated with mental health in the general population.

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Table 1 | Moderating effects of the pre-and post-COVID-19 periods on the association between price index and mental health service contacts

	Children aged 0–18 years	Adults aged 19–64 years	Elderly population aged 65 years and over
CPI including owner occupiers' housing costs	31.77 (−1.90 to 65.44), 0.064	56.14 (20.89 to 91.39), 0.003	26.12 (16.16 to 36.08), <0.001
Food and non-alcoholic beverages	1.09 (−7.15 to 9.32), 0.789	8.89 (2.67 to 15.11), 0.005	3.58 (0.94 to 6.22), 0.008
One-lag, food and non-alcoholic beverages	0.89 (−6.01 to 7.79), 0.794	−0.89 (−16.44 to 14.65), 0.907	0.61 (−3.18 to 4.39), 0.745
Alcoholic beverages, tobacco and narcotics	−18.77 (−45.75 to 8.21), 0.166	−41.97 (−69.00 to −14.94), 0.003	−9.49 (−19.19 to 0.20), 0.055
Clothing and footwear	−2.48 (−18.05 to 13.10), 0.748	−0.33 (−17.38 to 16.72), 0.969	1.85 (−3.29 to 6.99), 0.469
Housing, water and fuels	16.03 (−12.30 to 44.36), 0.258	35.88 (8.36 to 63.40), 0.012	9.30 (−0.28 to 18.87), 0.057
Furniture, household equipment and repair of the house	2.66 (−5.08 to 10.40), 0.487	14.41 (−3.75 to 32.57), 0.115	1.65 (−4.39 to 7.70), 0.580
One-lag, furniture, household equipment and repair of the house	1.00 (−6.53 to 8.53), 0.787	4.93 (−12.75 to 22.61), 0.573	0.83 (−5.06 to 6.71), 0.776
Health	−10.41 (−46.37 to 25.55), 0.560	−1.12 (−41.26 to 39.01), 0.955	−4.22 (−17.32 to 8.89), 0.517
Transport	4.93 (−6.56 to 16.42), 0.389	−1.59 (−14.36 to 11.18), 0.802	0.01 (−4.32 to 4.34), 0.997
Communication	−0.14 (−14.87 to 14.59), 0.985	−9.75 (−25.68 to 6.17), 0.221	−3.49 (−8.88 to 1.89), 0.196
Recreation and culture	−27.33 (−65.53 to 10.88), 0.155	−23.10 (−67.88 to 21.68), 0.301	−1.35 (−16.56 to 13.87), 0.858
Education	−1.92 (−19.67 to 15.83), 0.827	−0.00 (−20.15 to 20.15), 1.000	1.25 (−5.43 to 7.93), 0.705
Hotels, cafes and restaurants	−1.61 (−19.31 to 16.10), 0.854	−50.55 (−88.30 to −12.80), 0.010	−16.39 (−28.55 to −4.23), 0.010
One-lag, hotels, cafes and restaurants	−5.02 (−21.68 to 11.65), 0.543	−41.04 (−76.56 to −5.52), 0.025	−11.20 (−22.64 to 0.25), 0.055
Miscellaneous goods and services[a]	1.91 (−14.32 to 18.13), 0.813	24.43 (8.55 to 40.31), 0.004	7.33 (1.83 to 12.82), 0.011

[a]'Miscellaneous goods and services' in the UK's Consumer Prices Index (CPI) includes items such as personal care products, personal effects such as jewelry, financial service fees and various professional service charges. We fitted a series of linear regressions with the number of people in contact with mental health services as the outcome and the corresponding price index as the key predictor, controlling for the month, year, unemployment rate, a binary variable indicating time period (pre-COVID-19 (reference) versus post-COVID-19), and an interaction term between time period and corresponding price index. Regressions were fitted for price index and subcategories separately. The table only shows the coefficient, its 95% confidence interval (CI) and the corresponding two-sided *P* value of the interested interaction item.

Evidence is needed to better plan mental health support services or to target subsidies more carefully for the things impacting mental health. In this Article, we have investigated the association between price inflation and mental health conditions among the general population in England during the post-COVID-19 era. Given the widespread price inflation, the evidence we provided could benefit countries worldwide.

Results

Before the pandemic, there was either no or a significant negative time trend for most price indices and the number of people in contact with mental health services (Supplementary Fig. 1 and Supplementary Table 1). In contrast, during the post-COVID-19 era, there was a strong and significant positive time trend for certain price indices and the number of people in contact with mental health services (Supplementary Fig. 1 and Supplementary Table 1). After controlling for month, year and unemployment rate, Supplementary Table 2 indicates that, pre-COVID-19, there was no significant association or significantly negative associations between the price indices (including subitems) and the number of individuals in contact with mental health services (across different age groups).

Table 1 presents the results of how the time period (pre-COVID-19 versus post-COVID-19) moderated the association between price indices and the number of people in contact with mental health services. For children aged 0–18 years, compared with pre-COVID-19, the price inflations during the post-COVID-19 have no significant change on their associations with numbers of contact with mental health services (all *P* values >0.05) (Table 1).

For adults aged 19–64 years, compared with pre-COVID-19, a 1% increase in the Consumer Prices Index including owner occupiers' housing costs (CPIH) during the post-COVID-19 period was associated with a 56.14 (95% CI 20.89 to 91.39) thousand increase in the number of adults in contact with mental health services (Table 1). By items post-COVID-19, a 1% increase in the 'food and non-alcoholic beverages', 'housing, water and fuels' and 'miscellaneous goods and services' indices were associated with an 8.89 (95% CI 2.67 to 15.11), 35.88 (95% CI 8.36 to 63.40) and 24.43 (95% CI 8.55 to 40.31) thousand increase in the number of adults in contact with mental health services, respectively. Conversely, post-COVID-19, a 1% increase in the 'alcoholic beverages, tobacco and narcotics' and 'hotels, cafes and restaurants' indices were associated with a 41.97 (95% CI 14.94 to 69.00) and 50.55 (95% CI 12.80 to 88.30) thousand decreases in the number of adults in contact with mental health services, respectively. Additionally, a 1% increase in the 'hotels, cafes and restaurants' index had a 1 month lagged association and a decrease of 41.04 (95% CI 5.52 to 76.56) thousand adults in contact with mental health services.

For the elderly population aged 65 years and over, compared with pre-COVID-19, a 1% increase in the CPIH, 'food and non-alcoholic beverages' and 'miscellaneous goods and services' indices during the post-COVID-19 period were associated with 26.12 (95% CI 16.16 to 36.08), 3.58 (95% CI 0.94 to 6.22) and 7.33 (95% CI 1.83 to 12.82) thousand increases, respectively, in the number of the elderly population in contact with mental health services (Table 1).

Discussion

This study investigates the association between price inflation and mental health conditions among the general population in England during the post-COVID-19 era. The findings revealed that, compared with the pre-COVID-19 period, the number of people in contact with mental health services increased significantly with the rise in price inflation during the post-COVID-19 era. This trend was most clear among adults aged 19–64 years and the elderly population aged 65 years and over. The associations were more pronounced for specific price indices such as 'food and non-alcoholic beverages', 'housing, water and fuels' and 'miscellaneous goods and services'. Perhaps surprisingly, a negative association was observed between the 'alcoholic beverages,

tobacco and narcotics' and 'hotels, cafes and restaurants' indices and the number of adults in contact with mental health services during the post-COVID-19 period.

The observed associations suggest that the rising cost of living during the post-COVID-19 era contributed to the increased demand for mental health services among adults aged 19–64 years and the elderly population aged 65 years and over. These findings align with previous research conducted during the 2008 economic recession, which demonstrated adverse effects on mental health both in the United Kingdom and globally[2–9]. Our study further expands on this evidence by examining the associations between specific price indices and mental health service use in the general population during the post-COVID-19 era. Some previous studies have reported associations between rising living costs and poor mental health due to housing instability, fuel poverty and limited access to food and transportation[10–12]. However, our study not only provides a more comprehensive assessment of these relationships across different age groups and price indices, but also clearly points out which price indices do and do not associate with the use of mental health services under the current situation. The findings are important to inform the design of possible policy interventions.

The observed associations between price inflation and mental health conditions could be attributed to multiple factors. Increased living costs may lead to heightened financial stress, which in turn can exacerbate mental health issues such as anxiety and depression[14]. Financial struggles might force people to change their spending habits, possibly affecting their access to essential goods and services. This could result in poor nutrition, lower-quality housing and a lack of essential services—conditions that can harm mental health[15,16]. Inflation can also heighten feelings of inequality as it often widens the wealth gap. The resulting social comparisons and perceived injustices can lead to feelings of shame and low self-esteem, further increasing the risk of mental health issues[17]. The general uncertainty and insecurity caused by inflation could potentially trigger anxiety disorders[18]. Finally, to cope with the rising cost of living, individuals might take on more work or longer hours, increasing their stress levels and potentially contributing to mental health problems[19].

The observed negative associations between the increase in prices for 'alcoholic beverages, tobacco and narcotics' and 'hotels, cafes and restaurants' and contacts with mental health services post-COVID-19 are both intriguing and counterintuitive. As costs for these items grow, individuals might reevaluate and reallocate their financial priorities. The elevated expenses related to potentially harmful substances such as alcohol and narcotics could deter their consumption, which may, in turn, reduce instances of immediate mental health crises. The finding concerning the association between the price of alcohol and tobacco products and mental health contacts raises pertinent questions about their treatment in economic considerations: Should alcohol and tobacco products be treated as ordinary commodities whose prices are susceptible to market fluctuations? Additionally, there is a pressing need to consider the broader implications of their pricing, especially given the potential impact on mental health. Similarly, as 'hotels, cafes and restaurants' become pricier, the reduced affordability could diminish individuals' engagement in these recreational avenues, which were traditionally perceived as stress alleviators. Contrary to expectations, this reduced engagement did not correspond to a spike in mental health service contacts. One interpretation is that amidst rising leisure costs, individuals might lean toward alternative, cost-effective coping mechanisms, such as physical exercise or online support forums. Moreover, the 1 month lagged association following the inflation in the 'hotels, cafes and restaurants' sector implies a temporal dimension to the effects; individuals might initially limit their spending in light of heightened costs, with the mental health consequences only emerging subsequently. Additionally, the broader economic strain resulting from inflation across sectors might compel individuals to defer formal mental health consultations in favor of informal support channels. Such complexities necessitate a deeper dive into research, aiming to untangle the multifaceted relationship between economic challenges and mental health outcomes.

The practical implications of this research are notably substantial, especially for policymakers. Our results show that the rising costs of living, including food, housing and miscellaneous goods and services, are strongly associated with an increased number of individuals seeking mental health services during the post-COVID-19 period. This suggests the necessity for targeted subsidies in these particular areas to protect the mental health of the population. The current measures taken by the British government, such as subsidies for energy costs, appear to be inadequate given the scope of the problem, suggesting the need for possibly more substantial financial aid. Furthermore, differential policy approaches might be required based on age-specific needs. For instance, subsidies or financial support schemes for housing could be prioritized for adults aged 19–64 years, demographics facing the brunt of employment challenges, while older populations might find greater benefit from discounts on essential goods. Such age-tailored strategies can ensure that the support provided is both relevant and effective. More than just economic relief, our findings underscore the urgent need for comprehensive strategies that also focus on scaling up mental health protection and treatment services. This comprehensive approach is especially critical in the post-COVID-19 era, which has witnessed an overall surge in mental health service use. Consequently, our study calls for a rethink of current strategies and emphasizes the need for evidence-based, multifaceted policies that not only alleviate financial stress, but also bolster mental health support, thereby building resilient communities in times of economic turbulence.

One of the key strengths of our study is the use of data from official sources such as the ONS and the National Health Service (NHS), which enhances the reliability and generalizability of our findings. Moreover, the study covers a relatively long time period, allowing for a comprehensive assessment of the associations between price indices and mental health service use.

However, our study also has several limitations. First, the observational nature of the study precludes the establishment of causal relationships between price inflation and mental health problems. Second, we relied on the number of people in contact with mental health services as a proxy for mental health status, which may not capture the full extent of mental health conditions in the population. Third, established studies consistently highlight that women often exhibit higher levels of mental health problems in comparison to men. This disparity is further magnified by societal roles, with many females predominantly engaged in family care, potentially making them more susceptible to the pressures of price inflation. However, gender-specific information was not available among children, adults and the elderly. Given the consequential role of gender in mental health research, it is imperative for future data release to encompass this dimension. Fourth, our study faces limitations regarding data granularity. We have regional mental health data, but lack regional price inflation data. This data mismatch may obscure regional nuances, limiting our ability to reveal potential regional differences in how mental health relates to price inflation. Fifth, although we controlled for the unemployment rate, other unmeasured factors related to the economic situation, such as personal income or debt levels, might have affected our findings, but these data are not available by month. Sixth, although we believe the measures we have taken, by excluding transition data from March 2021 to March 2022, help to disentangle the effects of price inflation from COVID-19's ramifications, the long-term mental health consequences of the pandemic remain uncertain. Finally, people living in deprived areas may be more suffering from price inflation, and sex and race could also moderate the associations we identified, but our outcome variable is also not available by sex by race and by socioeconomic status.

Conclusions

Our study offers substantial insights for policymakers by clearly identifying which living costs have a significant association with mental health service use during the post-COVID-19 era in England. By elucidating the relationships between specific price indices and mental health service utilization across different age groups, our research provides valuable guidance for the development of targeted social and economic policies to address the potential causes of mental health issues.

Methods

Study design

An ecological study design was conducted due to the key measures or indicators (as follows) only available at aggregated level.

Measurements and data source

Price inflation is assessed using the CPIH. This metric, employed by various offices in the United Kingdom, offers a comprehensive perspective on inflation, capturing fluctuations in consumer expenditures[1]. The CPIH expands upon the CPI by incorporating housing costs incurred by owner occupiers. This inclusion is essential as it accounts for an important portion of household expenses that the standard CPI does not typically consider. Consequently, the CPIH provides a more accurate representation of the average household's cost of living by including expenses such as mortgage interest payments, dwelling insurance, transaction costs and maintenance and repair expenditures. Values of the CPIH indicate the rate of inflation or deflation compared with the 2015 baseline. Monthly values of the CPIH in England were obtained from the ONS website[1].

Mental health status was measured using the number of people in contact with mental health services, an official index maintained by the NHS[20]. An individual is deemed to be 'in contact' with services if they have an open referral with secondary mental health, learning disabilities or autism services. This index is available for three age groups: 0–18 years, 19–64 years and 65 years and over. In this study, values of mental health service contacts denote the absolute number, expressed in units of thousands. Monthly data were extracted from the NHS's mental health services monthly statistics[20].

The unemployment rate was considered as a confounder with its potential influence on mental health. Monthly data of the unemployment rate was also obtained from the ONS website[21].

The study covers the period from August 2016 to February 2023. Due to the documented influence of COVID-19-related restrictions on mental health[22–24], we excluded data from March 2020 to March 2022. England initiated its phased relaxation of restrictions in March 2021, and fully resuming regular operations by 1 April 2022[25]. To circumvent the potential lagged impact of COVID-19, we also excluded data from March 2021 to March 2022. As a result, in our analysis, data from August 2016 through February 2020 represents the pre-COVID-19 period (serving as the control group), while data from 1 April 2022 onward constitutes the post-COVID-19 period.

The data are publicly available. The use of secondary deidentified data makes this study exempt from institutional review board review.

Data analysis

We have visualized the time trend of each price index and the time trend of the number of people in contact with mental health services in Supplementary Fig. 1. To test the influence of price inflation, we fitted the data by linear regression with the number of people in contact with mental health services as the outcome and the price index as the key predictor, controlling for the month, year, unemployment rate and a binary variable indicating time period (pre-COVID-19 versus post-COVID-19). Month and year were controlled due to the observable seasonal trend identified in the supplementary data. Considering the potential lagged influence of price inflation on mental health at the population level, we have added the lags of price inflation, and the optimal lag length was selected based on the Akaike information criterion[26]. To test the moderation of the time period on the association between price indices and the mental health service contacts, we also added an interaction between the price index as well as its potential lagged form and time period into the above linear model. Gauss–Markov assumptions for the linear model were tested extensively in Supplementary Table 3.

The above analyses were repeated for each price index and each outcome.

All analyses were finished in R (version 4.2.2), and packages stats (4.2.2), vars (1.5–9), AFR (0.3.4) and lmtest (0.9–40) were used. $P < 0.05$ was considered as significant.

Reporting summary

Further information on research design is available in the Nature Portfolio Reporting Summary linked to this article.

Data availability

The data are publicly available. Data on price indices can be accessed at https://www.ons.gov.uk/economy/inflationandpriceindices#:~:text=Consumer%20price%20inflation%2C%20UK%3A%20March%202023&text=On%20a%20monthly%20basis%2C%20CPIH,of%200.9%25%20in%20March%202022. Data on mental health services contacts can be accessed at https://digital.nhs.uk/data-and-information/data-tools-and-services/data-services/mental-health-data-hub/dashboards/mental-health-services-monthly-statistics.

Code availability

The code used in this study is accessible via GitHub at https://github.com/shanquan0301/inflation_mental.

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Author contributions

S.C. contributed to the concept and study design, conducted the analysis and interpreted the results. M.Y. and H.K. made a critical revision of the paper for important intellectual content. All authors edited and approved the final paper.

Competing interests

The authors declare no competing interests.

Additional information

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Reporting Summary

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Our web collection on statistics for biologists contains articles on many of the points above.

Software and code

Policy information about availability of computer code

Data collection	The data were obtained from regular government publications and downloaded from the relevant official websites. No specialized software was employed in the data collection process.
Data analysis	R (version 4.2.2) (stats (4.2.2), vars (1.5-9), AFR (0.3.4), and lmtest (0.9-40) packages were used).

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The data are publicly available. Data on price indices can be accessed here(https://www.ons.gov.uk/economy/inflationandpriceindices#:~:text=Consumer%20price%20inflation%2C%20UK%3A%20March%202023&text=On%20a%20monthly%20basis%2C%20CPIH,of%200.9%25%20in%20March%202022). Data on mental health

services contacts can be accessed here (https://digital.nhs.uk/data-and-information/data-tools-and-services/data-services/mental-health-data-hub/dashboards/mental-health-services-monthly-statistics).

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Reporting on sex and gender	Data only available at aggregated level. No sex and gender information.
Reporting on race, ethnicity, or other socially relevant groupings	Data only available at aggregated level. No information on race, ethnicity. We only reported data by age groups.
Population characteristics	Data only available at aggregated level. We only reported data by age groups.
Recruitment	Monthly values of the CPIH in England were obtained from the Office for National Statistics (ONS) website[1]. Monthly data were extracted from the NHS's Mental Health Services Monthly Statistics[20].
Ethics oversight	The data are publicly available. The use of secondary de-identified data makes this study exempt from institutional review board review.

Note that full information on the approval of the study protocol must also be provided in the manuscript.

Field-specific reporting

Please select the one below that is the best fit for your research. If you are not sure, read the appropriate sections before making your selection.

☐ Life sciences ☐ Behavioural & social sciences ☒ Ecological, evolutionary & environmental sciences

For a reference copy of the document with all sections, see nature.com/documents/nr-reporting-summary-flat.pdf

Ecological, evolutionary & environmental sciences study design

All studies must disclose on these points even when the disclosure is negative.

Study description	An ecological study design was conducted, due to the key measures or indicators (as follows) only available at aggregated level.
Research sample	Data only available at aggregated level. The study covers the period from August 2016 to February 2023. Due to the documented influence of COVID-19-related restrictions on mental health22-24, we excluded data from March 2020 to March 2022. England initiated its phased relaxation of restrictions in March 2021, and fully resuming regular operations by April 1, 202225. To circumvent the potential lagged impact of COVID-19, we also excluded data from March 2021 to March 2022. As a result, in our analysis, data from August 2016 through February 2020 represents the pre-COVID-19 period (serving as the control group), while data from April 1, 2022 onwards constitutes the post-COVID-19 period.
Sampling strategy	Our research is based on officially released aggregated data covering all England.
Data collection	Our research is based on officially released aggregated data covering all England. The study covers the period from August 2016 to February 2023. Due to the documented influence of COVID-19-related restrictions on mental health22-24, we excluded data from March 2020 to March 2022. England initiated its phased relaxation of restrictions in March 2021, and fully resuming regular operations by April 1, 202225. To circumvent the potential lagged impact of COVID-19, we also excluded data from March 2021 to March 2022. As a result, in our analysis, data from August 2016 through February 2020 represents the pre-COVID-19 period (serving as the control group), while data from April 1, 2022 onwards constitutes the post-COVID-19 period.
Timing and spatial scale	The study covers the period from August 2016 to February 2023. Due to the documented influence of COVID-19-related restrictions on mental health22-24, we excluded data from March 2020 to March 2022. England initiated its phased relaxation of restrictions in March 2021, and fully resuming regular operations by April 1, 202225. To circumvent the potential lagged impact of COVID-19, we also excluded data from March 2021 to March 2022. As a result, in our analysis, data from August 2016 through February 2020 represents the pre-COVID-19 period (serving as the control group), while data from April 1, 2022 onwards constitutes the post-COVID-19 period.
Data exclusions	Due to the documented influence of COVID-19-related restrictions on mental health22-24, we excluded data from March 2020 to March 2022. England initiated its phased relaxation of restrictions in March 2021, and fully resuming regular operations by April 1, 202225. To circumvent the potential lagged impact of COVID-19, we also excluded data from March 2021 to March 2022.
Reproducibility	Our research is based on officially released aggregated data covering all England, which is public available. Everyone can access the data and repeated the analysis.
Randomization	Not applicable.

Blinding	Our research is based on officially released aggregated data covering all England, which is public available. So, blinding is not applicable.

Did the study involve field work? ☐ Yes ☒ No

Reporting for specific materials, systems and methods

We require information from authors about some types of materials, experimental systems and methods used in many studies. Here, indicate whether each material, system or method listed is relevant to your study. If you are not sure if a list item applies to your research, read the appropriate section before selecting a response.

Materials & experimental systems

n/a	Involved in the study
☒	☐ Antibodies
☒	☐ Eukaryotic cell lines
☒	☐ Palaeontology and archaeology
☒	☐ Animals and other organisms
☒	☐ Clinical data
☒	☐ Dual use research of concern
☒	☐ Plants

Methods

n/a	Involved in the study
☒	☐ ChIP-seq
☒	☐ Flow cytometry
☒	☐ MRI-based neuroimaging