

**SUPPLEMENTARY MATERIAL****Additional Tables**

Table S1. Variables used in this study with associated categories/units/timeframes.

| <b>Variables</b>                                                                      | <b>Categories/Units</b>                                                                                                                                                                              |
|---------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>Hospital Admissions (28<sup>th</sup> March 2016 to 29<sup>th</sup> March 2021)</i> |                                                                                                                                                                                                      |
| Patient Pseudo-ID                                                                     | Unique randomised integer                                                                                                                                                                            |
| Admission Type                                                                        | Planned/Unplanned                                                                                                                                                                                    |
| Patient LSOA                                                                          | Unique LSOA identifier                                                                                                                                                                               |
| Patient Sex                                                                           | male/female                                                                                                                                                                                          |
| Patient Age Group                                                                     | 0-4, 05-09, 10-14, 15-19, 20-24, 25-29, 30-34, 35-39, 40-44, 45-49, 50-54, 55-59, 60-64, 65-69, 70-74, 75-79, 80-84, 85-89, 90-94, 95 + year olds                                                    |
| Diagnosis of COVID-19                                                                 | 0/1 (absence/presence respectively)                                                                                                                                                                  |
| <b>Primary/ Secondary Diagnosis Type</b>                                              | 0/1 (absence/presence respectively)                                                                                                                                                                  |
| -Cardiovascular                                                                       | i. Hypertension, ii. heart disease, iii. Other.                                                                                                                                                      |
| -Renal                                                                                | i. chronic kidney disease, ii. Other failure, iii. Other disorders                                                                                                                                   |
| -Mental Health                                                                        | i. organic/symptomatic, ii. schizophrenic, iii. delusional/ mood affective, iv. Neurotic stress somatoform/ other, v. mental/ behavioural (substance use), vi. behavioural emotional/ psychological. |
|                                                                                       | Obesity                                                                                                                                                                                              |
|                                                                                       | Type I, Type II, Other                                                                                                                                                                               |
|                                                                                       | III-defined, unspecified, secondary sites, stated or                                                                                                                                                 |

|                                                                                                                          |                                                                                                                                                                                                                                                                                           |
|--------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| -Obesity                                                                                                                 | presumed primary lymphoid cancer, urinary tract, thyroid, skin, respiratory and intrathoracic, mesothelial, and soft tissues, male genital organs, female genital organs, lip oral cavity or pharynx, eye brain or central nervous system, digestive organs, breast, cartilage, or bones. |
| -Diabetes                                                                                                                |                                                                                                                                                                                                                                                                                           |
| -Cancer                                                                                                                  |                                                                                                                                                                                                                                                                                           |
| -Respiratory                                                                                                             |                                                                                                                                                                                                                                                                                           |
| discharge/death                                                                                                          | days (from admission)                                                                                                                                                                                                                                                                     |
| Mortality                                                                                                                | 0/1 (absence/presence respectively)                                                                                                                                                                                                                                                       |
| Total Readmission                                                                                                        | integer                                                                                                                                                                                                                                                                                   |
| Admissions previous 12 Months                                                                                            | integer                                                                                                                                                                                                                                                                                   |
| Pandemic Period                                                                                                          | 0/1 (pre/post)                                                                                                                                                                                                                                                                            |
| <i>Deprivation Indices (2019)</i>                                                                                        |                                                                                                                                                                                                                                                                                           |
| -Index of Multiple Deprivation, Housing Barrier, Health & Disability, Living Environment, Income, Employment, Education. | Deciles (where 1 is the most deprived and 10 the least deprived)                                                                                                                                                                                                                          |
| <i>Free School Meal Eligibility (1<sup>st</sup> January 2018-31<sup>st</sup> December 2021)</i>                          |                                                                                                                                                                                                                                                                                           |
| Monthly totals Female/Male/Both and eligibility/attendance:                                                              | Count data aggregated by LSOA                                                                                                                                                                                                                                                             |
| <i>Community Mental Health Service Referrals (1<sup>st</sup> January 2016 to 30<sup>th</sup> June 2021)</i>              |                                                                                                                                                                                                                                                                                           |
| <b>Male/Female total referrals</b>                                                                                       | count data aggregated by month and by category:                                                                                                                                                                                                                                           |
| Adults (> 18 years old)                                                                                                  | urgent, routine, total                                                                                                                                                                                                                                                                    |
| Children and Adolescents Mental Health Services (CAHMS)                                                                  | urgent, routine, total                                                                                                                                                                                                                                                                    |

Table S2: Incidence Rate Ratios (IRR), 95% Confidence Intervals (CI), and *p-values* (P) for fixed (linear) components of models describing male, female, and all pupil's monthly eligibility for free school meals.

| COEFFICIENT                                         | ALL PUPILS  |           |              | FEMALE PUPILS |           |        | MALE PUPILS |           |                  |
|-----------------------------------------------------|-------------|-----------|--------------|---------------|-----------|--------|-------------|-----------|------------------|
|                                                     | IRR         | CI        | P            | IRR           | CI        | P      | IRR         | CI        | P                |
| LOWEST INCOME DEPRIVATION                           | <b>2.25</b> | 1.20-4.22 | <b>0.011</b> | <b>1.60</b>   | 0.86-2.97 | 0.134  | <b>2.85</b> | 1.47-5.51 | <b>0.002</b>     |
| HEALTH AND DISABILITY DEPRIVATION DECILE            | <b>0.58</b> | 0.47-0.73 | <b>0.001</b> | <b>0.65</b>   | 0.52-0.81 | <0.001 | <b>0.52</b> | 0.41-0.66 | <b>&lt;0.001</b> |
| BARRIERS TO HOUSING AND SERVICES DEPRIVATION DECILE | <b>1.49</b> | 1.14-1.95 | <b>0.003</b> | <b>1.57</b>   | 1.21-2.04 | 0.001  | <b>1.36</b> | 1.03-1.80 | <b>0.03</b>      |

Table S3: Odds Ratio, 95% Confidence Intervals, and *p-values* for fixed (linear) components of models with different random effect components when predicting primary mental health hospital admissions.

| COEFFICIENT                          | ODDS RATIO   | CONFIDENCE INTERVAL | P-VALUE          |
|--------------------------------------|--------------|---------------------|------------------|
| SECONDARY CARDIOVASCULAR             | <b>2.29</b>  | 1.74-3.02           | <b>&lt;0.001</b> |
| SECONDARY RESPIRATORY                | <b>1.78</b>  | 1.33-2.38           | <b>&lt;0.001</b> |
| EMPLOYMENT DEPRIVATION DECILE        | <b>0.88</b>  | 0.82-0.95           | <b>0.002</b>     |
| NUMBER OF ADMISSIONS 12 MONTHS PRIOR | <b>0.62</b>  | 0.52-0.74           | <b>&lt;0.001</b> |
| UNPLANNED ADMISSIONS                 | <b>29.33</b> | 7.57-117.99         | <b>&lt;0.001</b> |

Table S4: Odds Ratio, 95% Confidence Intervals, and *p-values* for fixed (linear) components of models with different random effect components when predicting hospital admissions with a secondary mental health diagnosis.

| <i>COEFFICIENT</i>                   | <b>ODDS RATIO</b> | <b>CONFIDENCE INTERVAL</b> | <b>P-VALUE</b>   |
|--------------------------------------|-------------------|----------------------------|------------------|
| <i>CARDIOVASCULAR</i>                | <b>1.63</b>       | 1.41-1.88                  | <b>&lt;0.001</b> |
| <i>RESPIRATORY</i>                   | <b>2.79</b>       | 2.42-3.23                  | <b>&lt;0.001</b> |
| <i>EMPLOYMENT DEPRIVATION DECILE</i> | <b>0.90</b>       | 0.87-0.93                  | <b>&lt;0.001</b> |
| <i>PLANNED ADMISSION</i>             | <b>0.26</b>       | 0.16-0.42                  | <b>&lt;0.001</b> |
| <i>UNPLANNED ADMISSIONS</i>          | <b>0.35</b>       | 0.22-0.56                  | <b>&lt;0.001</b> |

Table S5: Mean referral rate per 1000 children in pre-March 2020 and post-March 2020 period. *p-value* generated in t-test of difference in group means

|                          | <b>SEX</b> | <b>JAN 2016-MARCH 2020<br/>(PRE- PANDEMIC)</b> | <b>MARCH 2020 – JUNE 2021 (POST-<br/>PANDEMIC)</b> | <b>P VALUE</b> |
|--------------------------|------------|------------------------------------------------|----------------------------------------------------|----------------|
| <b>ALL REFERRALS</b>     | Both       | 1.21                                           | 0.54                                               | <0.01          |
|                          | Female     | 0.98                                           | 0.58                                               | 0.02           |
|                          | Male       | 1.42                                           | 0.50                                               | <0.01          |
| <b>ROUTINE REFERRALS</b> | Both       | 1.04                                           | 0.49                                               | <0.01          |
|                          | Female     | 0.81                                           | 0.47                                               | <0.01          |
|                          | Male       | 1.26                                           | 0.50                                               | <0.01          |

|                         |        |      |      |       |
|-------------------------|--------|------|------|-------|
| <b>URGENT REFERRALS</b> | Both   | 0.16 | 0.05 | <0.01 |
|                         | Female | 0.17 | 0.10 | 0.21  |
|                         | Male   | 0.16 | 0    | <0.01 |

Table S6: Estimates of change in Children and Adolescent Mental Health Service referrals post-March 2020. Generated from regression with (2,1,0) autoregressive integrated moving average errors

|                   | <b>CHANGES TO REFERRALS POST-MARCH 2020</b> | <b>CONFIDENCE INTERVAL</b> | <b>P-VALUE</b> |
|-------------------|---------------------------------------------|----------------------------|----------------|
| <b>BOTH SEXES</b> | 0.76                                        | -9 to 0.99                 | 0.11           |
| <b>FEMALE</b>     | 0.05                                        | -2.74 to 2.85              | 0.97           |
| <b>MALE</b>       | -4.02                                       | -8.39 to 0.36              | 0.07           |

Table S7: Mean community mental health service referral rate per 1000 people in Fleetwood pre and post COVID-19

|                               | <b>PRE-COVID</b> | <b>POST-COVID</b> | <b>P- VALUE</b> |
|-------------------------------|------------------|-------------------|-----------------|
| <b>ALL REFERRALS</b>          | 0.97             | 1.36              | <0.01           |
| <b>ROUTINE CARE REFERRALS</b> | 0.79             | 1.09              | <0.01           |
| <b>URGENT CARE REFERRALS</b>  | 0.18             | 0.27              | 0.01            |

Table S8: Mean community mental health service referral rate per 1000 people in Fleetwood by year

|                               | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 |
|-------------------------------|------|------|------|------|------|------|
| <b>ALL REFERRALS</b>          | 0.80 | 0.77 | 0.87 | 1.35 | 1.28 | 1.55 |
| <b>ROUTINE CARE REFERRALS</b> | 0.67 | 0.67 | 0.70 | 1.08 | 1.05 | 1.20 |
| <b>URGENT CARE REFERRALS</b>  | 0.13 | 0.10 | 0.18 | 0.27 | 0.23 | 0.35 |

Table S9: Estimates of change in adult mental health referrals following a 'Pandemic Pulse' (March-April 2020). Regressions with autoregressive integrated moving average errors were fitted separately by referrals type

|                                  | REFERRAL TYPE   | CHANGES TO REFERRALS | CONFIDENCE INTERVAL | P VALUE |
|----------------------------------|-----------------|----------------------|---------------------|---------|
| <b>PANDEMIC</b>                  | Total referrals | 0.44                 | 0.33 to 0.58        | <0.01   |
| <b>PULSE (MAR-<br/>APR 2020)</b> | Routine care    | 0.42                 | 0.30 to 0.58        | <0.01   |
|                                  | Urgent care     | 0.71                 | 0.24 to 1.51        | 0.38    |

Table S10: Estimates of change in adult mental health referrals post-March 2020, after adjusting for any pandemic pulse effect in March-April. Regressions with autoregressive integrated moving average errors were fitted separately by referral type

|                            | PANDEMIC EFFECT                  | CHANGES TO REFERRALS | CONFIDENCE INTERVAL | P VALUE |
|----------------------------|----------------------------------|----------------------|---------------------|---------|
| <b>TOTAL<br/>REFERRALS</b> | Pandemic (March<br>2020 onwards) | 0.84                 | 0.62 to 1.13        | 0.24    |
|                            | Pulse (March-April<br>2020)      | 0.48                 | 0.35 to 0.66        | <0.01   |

|                     |                               |      |              |       |
|---------------------|-------------------------------|------|--------------|-------|
| <b>ROUTINE CARE</b> | Pandemic (March 2020 onwards) | 0.87 | 0.64 to 1.17 | 0.35  |
|                     | Pulse (March-April 2020)      | 0.45 | 0.32 to 0.64 | <0.01 |
| <b>URGENT CARE</b>  | Pandemic (March 2020 onwards) | 0.62 | 0.30 to 1.26 | 0.79  |
|                     | Pulse (March-April 2020)      | 0.90 | 0.40 to 2.02 | 0.19  |

Table S11: Hazard ratios of those variables in the selected survival model based on survival duration in days following admission to hospital between March 2016-2021 in Fleetwood, Lancashire.

| <i>COEFFICIENT</i>                              | <b>HAZARD RATIO</b> | <b>CONFIDENCE INTERVAL</b> | <b>P-VALUE</b>   |
|-------------------------------------------------|---------------------|----------------------------|------------------|
| <i>PATIENTS AGED 25-64</i>                      | <b>4.85</b>         | 1.16-20.32                 | <b>0.031</b>     |
| <i>PATIENTS AGED 65+</i>                        | <b>8.48</b>         | 2.05-35.14                 | <b>0.003</b>     |
| <i>ADMISSION FOR PRIMARY MENTAL HEALTH</i>      | <b>0.13</b>         | 0.05-0.34                  | <b>&lt;0.001</b> |
| <i>ADMISSIONS WITH CANCER AS A CO-MORBIDITY</i> | <b>2.09</b>         | 1.46-2.98                  | <b>&lt;0.001</b> |
| <i>UNPLANNED ADMISSIONS</i>                     | <b>7.17</b>         | 3.16-16.30                 | <b>&lt;0.001</b> |

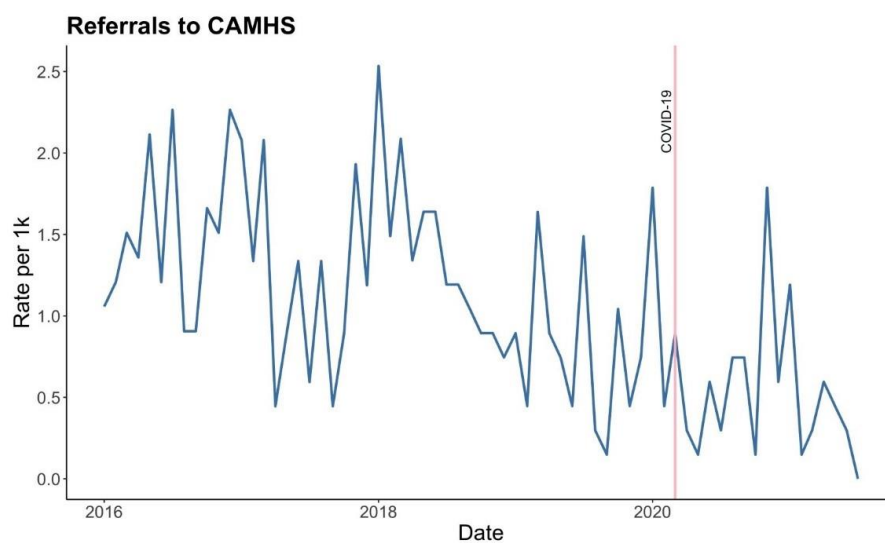
**Additional Figures**

Figure S1: Referral to Children and Adolescent Mental Health Services (CAMHS) 1<sup>st</sup> January 2016 to 30<sup>th</sup> June 2021. Red line indicates the start of the pandemic period as March 2020.



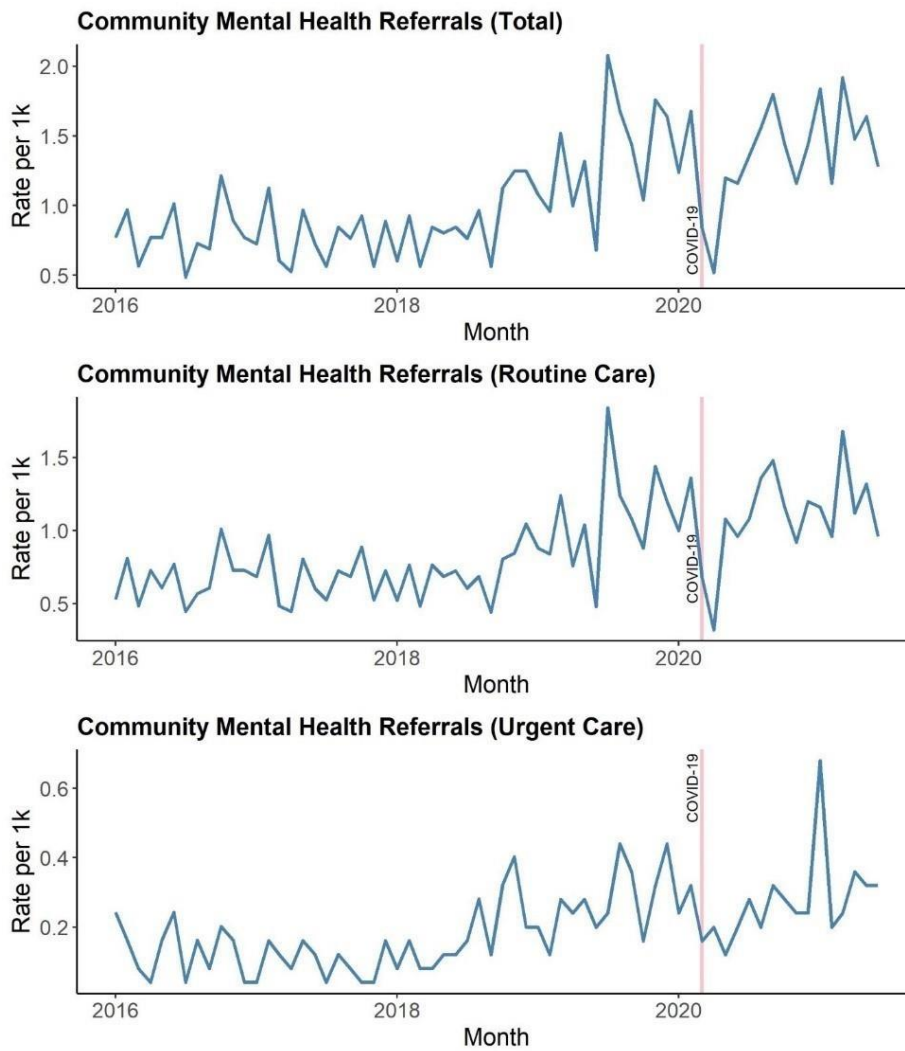


Figure S2: Total, routine, and urgent community mental health referral rates per 1K adults in Fleetwood, Lancashire, January 2016- June 2021.