**Supporting Information**

**Table S1.** Table illustrating period effects for the data.

|  |  |
| --- | --- |
|  |  Decade (n) |
|  | 1980 (1) | 1990 (19) | 2000 (164) | 2010 (486) |
| BMI m(sd) | 35.21(1.47) | 27.43(4.50) | 30.01(7.39) | 28.16(6.66) |
| Psychotic (%) | 0 | 2 | 40 | 73 |
| Non-psychotic (%) | 0 | 14 | 91 | 301 |
| Functional (%) | 1 | 3 | 33 | 60 |
| Olanzapine | 1 | 9 | 13 | 45 |
| Sodium Valproate | 1 | 2 | 8 | 19 |

|  |  |
| --- | --- |
| Male (%) | 53.8 |
| Age at admission (years), Mean (SD) | 15.95 (1.09) |
|  Length of stay (months), Mean (SD) | 24.8 (18.7)  |
| **Ethnicity** | n(%) |
| Asian/Asian British | 12(1.79%) |
| Black/African/Caribbean | 40(5.97%) |
| Mixed/multiple ethnic | 5 (0.75%) |
| White | 497(74.18%) |
| Any other ethnic group | 7(1.04%) |
| Any other mixed, multiple ethnic group | 14 (2.09%) |
| Any other white | 9 (1.34%) |
| Not stated, not known | 86 (12.84%) |
| **Diagnosis at baseline** |  % |
| Psychotic mental health disorder | 16.20% |
| Non-psychotic mental health disorder | 69.0% |
| Functional/Behavioural Disorder | 14.30% |
| **Medication** |  |
| Olanzapine | 74 (11.3%) |
| Sodium Valproate | 35 (5.2%) |

**Table S2.** Demographic Information

**Table S3.** Multilevel model estimates of BMI trajectories for males and females. Associations are shown with time, age at admission, diagnosis, and medication*.*

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Males  |  | Females |  | Difference  |
| -2Log-Liklihood | 6034 |  | 6760 |  |  |
| Df(n) | 3281(3297) |  | 3831(3847) |  |  |
|  | β (95% CI) | p | β (95% CI) | p |  |
| constant |  25.0(21.9-28.1) | <.005 | 25.69 (22.85-28.54) | <.005 |  |
| Month (since admission) | .12(-.002-0.26) | 0.06 | .14(-.0009-.288) | 0.030 |  |
| Month squared | -.002(0.001- -0.007)  | 0.008 | -.001 (-.003-.001) | 0.235 |  |
| Age15 | 1.63(-1.40-4.73) | 0.385 | -.95 (-2.56-2.36) | 0.694 | 0.81 |
| Age16 | 0.46(-2.48-3.41) | 0.646 | -1.13 (-3.71-1.44) | 0.673 | 1.2 |
| Age17 | 1.15(-1.76-4.06) | 0.509 | .04 (-2.32-2.42) | 0.63 | 0.76 |
| Psychotic Disorders | 3.87(1.01-6.67) | 0.005 | 2.33 (-.44-5.12) | 0.108 | 2.73 |
| Non-psychotic disorders | 1.12(-1.11-3.36) | 0.26 | 1.03(-1.23-3.32) | 0.559 | 0.44 |
| Olanzapine | .55(-2.30-3.40) | 0.79 | 1.78(-.89-4.47) | 0.312 | 0.53 |
| Sodium Valproate | .53(-5.03-6.08) | 0.86 | -.50 (-3.66-2.65) | 0.982 | 0.52 |
| **Interaction Effects** |  |  |  |  |  |
| Age15\*month | (-.13-1.12) | 0.900 | .07(-.04-.18) | 0.451 | 0.034 |
| Age16\*month | .07 (.04-.19) | 0.241 | .001(-.22-.22 | 0.707 | 0.087 |
| Age17\*month | .04(-.068-.16) | 0.47 | -.04 (-.15-.06) | 0.340 | 0.092 |
| Psychotic Disorders\*month | .06(.053-.18) | 0.239 | .02 (-.10-.15) | 0.749 | 0.048 |
| Non-psychotic disorders\*month | -.01(-.10-.08) | 0.934 | -.03(-.13-.07) | 0.657 | 0.02 |
| Olanzapine\*month | -.077 (-.12-.03) | 0.243 | -.03(-.07-.17) | 0.375 | 0.116 |
| Sodium Valproate\*month | -.10(-.31-.09) | 0.315 | -.003 (-.14-.13) | 0.978 | 0.139 |
| **Random Part** |  |  |  |  |  |
| SD(month) |  .42(.37-.47) |  | 0.51 (.45-.56) |  |  |
| SD(month2) | .01(.01-.02) |  | .016(.014-.019) |  |  |
| SD(\_cons) | 7.10 (6.50-7.76) |  | 6.21 (5.70-6.75) |  |  |
| corr(month, month2) | -.85 (-.89--.78) |  | -.89(-.92---.84) |  |  |
| Corr(month,\_cons) | -.28(-.41--.15) |  | -.38 (-.49--.26) |  |  |
| Corr(month2,\_cons) | -.21 (-.41--.15) |  | .26 (.11-.39) |  |  |
| SD(Residual) | 1.01 (.98-1.04) |  | .96  |  |  |

**Table S4.** Comparison of model parameter estimates of those included in the final sample, versus those with less than three BMI measurements.

|  |  |  |
| --- | --- | --- |
|  | Included in final sample (n=670) | Excluded for <3 BMI measurements (n=86) |
|  | Female | Male | Female | Male |
| Month | .14 | .12 | .1451679  | .1253388  |
| Estimated Monthly BMI Change | -.001 | -.002 |  -.002  | .002 |
| Age15 | -.95 | 1.63 | .43 | 1.38 |
| Age16 | -1.13 | 0.46 | -.59  |  .93  |
| Age17 | .04 | 1.15 | .086 | 1.28 |
| Psychotic Disorders | 2.33 | 3.87 | 1.7 | 2.38 |
| Non-psychotic Disorders | 1.03 | 1.12 | -.26 | -1.22 |
| Olanzapine | 1.78 | .55 | 1.44 | -.241 |
| Sodium Valproate | -.50 | .53 | -.05 | .74 |
| Constant | 25.7 | 25.0 |  26.1  | 26.2 |

**Table S5.** Model Selection

|  |  |  |
| --- | --- | --- |
|  | **Males** | **Females** |
| **Model** | **AIC** | **BIC** | **AIC** | **BIC** |
| Linear Model | 14306 | 14324 | 16624 | 16643 |
| Random Intercept Model | 14172 | 14196 | 16334 | 16359 |
| Model with random intercept & random slope | 12779 | 12816 | 14473 | 14510. |
| Quadratic Model  | 12115 | 12269 | 13571 | 13727 |

**Appendix S1.** Disorder Categorisation

**FUNCTIONAL/BEHAVIOURAL**

* Neurodevelopmental Disorders *(atypical autism, childhood autism, aspergers)*
* Asperger’s
* Brain Damage/Chromosomal Disorders *(Anoxic brain damage, foetal alcohol syndrome, Chimera)*
* Conduct disorders *(hyperkinetic conduct disorder, unsocialised conduct disorder)*
* Other developmental disorders (*Mild/moderate mental retardation, cognitive disorder)*
* Social functioning disorders *(attachment disorders, adjustment disorders)*

**PSYCHOTIC DISORDERS**

* Schizophrenic Disorders (*Schizophrenia, schizoaffective disorders, schizoid disorder, schizotypal disorder, catatonic schizophrenia, schizoid personality disorder, paranoid schizophrenia)*
* Psychotic Disorders (*Transient psychotic disorders, schizophrenia-like psychotic disorders, persistent delusional disorders, unspecified non-organic psychosis)*

**NON-PSYCHOTIC DISORDERS**

* Personality Disorders (*Dissocial personality disorder, emotionally unstable personality disorder, anxious avoidant personality disorder, histrionic personality disorder, Paranoid personality disorder)*
* Depressive Disorders (*Recurrent depressive disorder, severe depressive episode, dysthymia, major depressive disorder)*
* Anxiety Disorders (*Specific isolation phobias, social anxiety disorder, organic anxiety disorder, anxiety disorder, obsessive compulsive disorder)*
* Bipolar Disorders *(hypomanic, manic, with depression)*
* Post-Traumatic Stress Disorder

**Appendix S2.** Formal description of mixed effects growth model

$y\_{ij}= β\_{0ij}+β\_{1j}x\_{ij} +β\_{2j}x\_{ij}^{2}$ + $β\_{3}\left(D\_{age15j}\right)+ β\_{4}\left(D\_{age16j}\right)+ β\_{5}\left(D\_{age17j}\right)+ β\_{6}\left(D\_{psychoticj}\right)+ β\_{7}\left(D\_{non-psychoticj}\right)+ β\_{8}\left(D\_{olanzapinej}\right)+ β\_{9}\left(D\_{SVj}\right)+ β\_{10}\left(D\_{age15}\right)\left(x\_{ij}\right)+ β\_{11}\left(D\_{age16}\right)\left(x\_{ij}\right)+ β\_{12}\left(D\_{age17}\right)\left(x\_{ij}\right)+ β\_{13}\left(D\_{psychotic}\right)\left(x\_{ij}\right)+ β\_{14}\left(D\_{non-psychotic}\right)\left(x\_{ij}\right)+ β\_{15}\left(D\_{Olanzapine}\right)\left(x\_{ij}\right)+ β\_{16}\left(D\_{SV}\right)\left(x\_{ij}\right)$

$β\_{0ij}=β\_{0}+μ\_{0j}+e\_{ij}$

$$β\_{1j}=β\_{1}+μ\_{1j}$$

$$β\_{2j}=β\_{2}+μ\_{2j}$$

$$\left[\begin{matrix}μ\_{0j}\\μ\_{1j}\\μ\_{2j}\end{matrix}\right] \~N\left(0,Ω\_{μ}\right): Ω\_{μ}= \left[\begin{matrix}σ\_{μ0}^{2}&&\\σ\_{μ01}&σ\_{μ1}^{2}&\\σ\_{μ02}&σ\_{μ12}&σ\_{μ2}^{2}\end{matrix}\right]$$

$$\left[e\_{ij}\right] \~N\left(0,Ω\_{e}\right): Ω\_{e}= \left[σ\_{e}^{2}\right]$$

$y\_{ij}$ is the BMI at month $i $of patient $j$. $β\_{0ij}$ and $β\_{1j}x\_{ij}$ have both fixed and random effects ( $μ\_{0j}$ and $μ\_{1j}$). $β\_{3}-β\_{16}$ are the regression coefficients. $D$ denotes the regression coefficient as a dummy variable. For example, $D\_{olanzapinej}$ is a dummy variable coded as 1 if a patient was receiving Olanzapine, and 0 if they were not.

$σ\_{μ0}^{2}$, $σ\_{μ1}^{2}$ and $σ\_{μ2}^{2}$ represent the variances of the random effects, with $σ\_{μ01}$, $σ\_{μ12}$ and $σ\_{μ02}$ being the covariances between the random effects.