

Technical appendix: Improving children and young people's mental health services

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About this technical appendix

This appendix explains the data sources, inclusion criteria and methods used by the authors of this briefing for our analysis on children and young people's mental health.

Networked Data Lab partners and areas

The Networked Data Lab (NDL) is a collaborative network of five analytical teams across the UK working together using linked datasets on key issues facing health and care services today. This analysis was on children and young's people mental health. The geographical area covered by NDL partners had over 7.5 million residents in 2019 in total and the boundaries of each partner's local area are described below.

Table 1: Networked Data Lab partners and populations

Networked Data Lab partner	Boundaries	Population (2019)
Grampian	NHS Grampian Health Board	585,700
Leeds	NHS Leeds CCG	793,139
Liverpool and Wirral	NHS Liverpool CCG and NHS Wirral CCG	882,053
Wales	Wales (country)	3,152,879
North West London	North West London Health and Care Partnership STP, which includes eight CCGs: NHS Brent CCG, NHS Central London (Westminster) CCG, NHS Ealing CCG, NHS Hammersmith and Fulham CCG, NHS Harrow CCG, NHS Hillingdon CCG, NHS Hounslow CCG, NHS West London CCG	2,103,719

Federated analysis approach

The results presented in our briefing use a federated analytics model whereby analyses were carried out by each of the Networked Data Lab partners without any patient-level data leaving any of their research environments. While all partners researched similar topics, each partner designed and followed their own analysis plan, all of which are detailed here.

Analysis of open data

Access rate for children and young people's mental health services

We used publicly available data from NHS Digital and the Office for National Statistics to estimate the proportion of people under 18 with mental health conditions who are accessing mental health services.

Table 2: Access rates for mental health services

Year	Access rate (%):	Numerator:	Denominator:
	Estimated proportion of people younger than 18 years with mental health conditions who are accessing mental health services	Number of people 0–18 years old with at least two mental health contacts in the year	Estimated number of people between the ages of 6–18 years with a probable mental health condition
2021	27.2	420,579	1,548,997
2020	26.7	391,940	1,470,017
2017	24.6	235,653	958,246

Access rate

Estimated proportion of people younger than 18 years with mental health conditions who are accessing mental health services (Figure 3): Number of people 0–18 years old with at least two mental health contacts in the year / Estimated number of people between the ages of 6–18 years with a probable mental health condition

Numerator

The numerator, the number of people 0–18 years old with at least two mental health contacts in the year, comes from NHS Digital's yearly Mental Health Bulletins (metric 9a).¹

The figure for year 2021 comes from financial year 2020/21 and the figure for year 2020 comes from financial year 2019/20. For year 2017, we use the figure for financial year 2017/18 because this metric (9a) was not reported in the 2016/17 bulletin.

¹ <https://digital.nhs.uk/data-and-information/publications/statistical/mental-health-bulletin/>

Denominator

Estimated number of people between the ages of 6–18 years with a probable mental health condition: (population 6–16 years old)*(proportion of 6–16-year-olds with a probable mental health condition)+(population 17–18 years old)*(proportion of 17–19-year-olds with a probable mental health condition)

Population estimates come from the Office for National Statistics² and prevalence estimates come from the Mental Health of Children and Young People survey (Table 1.2).³ We use the proportion of 17–19-year-olds with a probable mental health condition instead of the proportion for 17–18-year-olds because the latter is not publicly available.

There have been three recent waves of this survey: in 2021, 2020 and 2017. These use a common methodology, which allows for comparisons between the three waves. The assessments are based on the Strengths and Difficulties Questionnaire (SDQ), a validated tool to assess different aspects of mental health, including problems with emotions, behaviour and hyperactivity.

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<https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationestimates>

³ <https://digital.nhs.uk/data-and-information/publications/statistical/mental-health-of-children-and-young-people-in-england/2021-follow-up-to-the-2017-survey/data-sets>

NDL North West London analysis

Inclusion criteria

Time period: March 2015 to September 2021

Ages: 0–25 years

People were included in the cohort if they were younger than 25 years during this time period, lived in the area covered by the eight North West London clinical commissioning groups (see Table 1), and satisfied any of the following conditions:

- a. GP-entered codes that refer to mental health
- b. GP prescriptions of mental health drugs
- c. GP referrals to mental health services
- d. Acute admissions for mental health reasons
- e. A&E or outpatient visits for mental health reasons
- f. Mental health appointments at any of the two mental health NHS trusts in North West London

For this analysis, the following MH conditions were considered: anxiety, bipolar disorder, depression, eating disorders, personality disorders, schizophrenia, self-harm and harmful thoughts and other severe mental health conditions.

The code lists to identify people with any of the conditions above, or satisfying other inclusion criteria related to mental health care, are supplied here as supplementary tables (Tables S1, S2, S3 and S4).

Data

Table 3: Datasets used by NDL North West London

Data	Source
North West London population	Discover Now: Patient Index
A&E attendances	Discover Now: SUS A&E
Outpatient attendances	Discover Now: SUS OP
Hospital admissions	Discover Now: SUS Episodes
GP visits	Discover Now: GP events
GP prescriptions	Discover Now: GP prescriptions

Attendances at mental health trusts (Central and North West London NHS Foundation Trust/West London Mental Health NHS Trust)	Discover Now: Mental Health PLD
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The Patient Index was used to identify the cohort and then this was linked to the other datasets (where the activity was related to MH) listed above using de-identified NHS Numbers. The GP referrals seen comes from the MH PLD dataset which is a locally agreed monthly feed from CNWL and WLMHT on the various MH services they provide for NWL.

Population estimates came from the Office for National Statistics.

Methods

Number of patients accessing mental health services per month (Figure 4): $\text{Unique number of patients accessing mental health services during year} / \text{Number of months available in data during year}$

This approach allows comparing complete years (where we have 12 months of data) to incomplete years (where we have fewer than 12 months of data). This metric is also computed separately for each setting, year and age band in Figure 5.

Percentage of population accessing mental health services per year: $\text{Unique number of patients aged 0–25 years accessing mental health services during year} / \text{Number of 0–25-year-olds living in North West London during year}$

Population number for each year and age come from ONS estimates at the CCG level. We compute this metric separately for each year, and we only do so for years where we have data for the whole year (12 months).

NDL Grampian analysis

Inclusion criteria

Table 4: Inclusion criteria used by NDL Grampian

	Analysis of prescription patterns	Analysis of referrals to Children and Adolescent Mental Health Services (CAMHS)
Time period	January 2012 to May 2021	January 2015 to October 2021
Ages	0–24 years	2–17 years
Conditions	<p>Prescriptions to any of the following British National Formulary (BNF) Chapter 4 drugs were considered. See Table S4 for more detail.</p> <ul style="list-style-type: none"> a. Hypnotics and anxiolytics b. Drugs used in psychoses and related disorders c. Antidepressant drugs d. Central nervous system (CNS) stimulants and drugs used for Attention Deficit Hyperactivity Disorder (ADHD) e. Drugs used in substance dependence 	All people with a referral to CAMHS, including rejected referrals

Data

Table 5: Datasets used by NDL Grampian

	Analysis of prescription patterns	Analysis of referrals to Children and Adolescent Mental Health Services (CAMHS)
Data	Prescription Information System (PIS) dataset, which covers all prescriptions filled in the community (ie outside hospitals)	Children and Adolescent Mental Health Services (CAMHS) dataset

Population estimates came from the National Records of Scotland.

Methods

Number of prescriptions (Figure 6): the number of prescriptions is taken from the PIS dataset, and disaggregated by year, age group and BNF section.

Mean population prescription rate per 100, by IMD decile: Average of prescriptions in a given decile between 2012 and 2020 / Average of population in a given decile between 2012 and 2020 * 100

Number of referrals to CAMHS (Figures 8a and 15): the number of referrals is taken from the CAMHS dataset and disaggregated by age at referral and sex.

Proportion of rejected referrals to CAMHS (Figure 12): Number of rejected referrals / Total number of referrals

NDL Liverpool and Wirral analysis

Inclusion criteria

Time period: January 2019 to June 2021

Ages: 0–25 years

People were included in the cohort if they were younger than 25 years during this time period, lived in Liverpool or Wirral (see Table 1), and had any of the following:

- a. Emergency and non-elective hospital admissions for self-harm, alcohol, and substance abuse, eating disorders and other mental health problems (from SUS dataset).
- b. Attendance to A&E for self-harm, alcohol, and substance abuse, eating disorders (from ECDS dataset).
- c. Referrals to mental health services (from MHSDS dataset).
- d. Elective or planned contacts with mental health services (from MHSDS dataset).

The code lists to identify people with mental health hospital admissions or A&E attendances are supplied here as supplementary tables (Tables S5 and S6).

Data

Table 6: Datasets used by NDL Liverpool and Wirral

Data	Source
Hospital admissions	Secondary Uses Service (SUS)
A&E attendances	Emergency Care Dataset (ECDS)
Referrals and contacts with Children and Adolescent Mental Health Services (CAMHS) and Adult Mental Health Services (AMHS)	Mental Health Services Dataset (MHSDS)

Population estimates came from the Office for National Statistics.

Methods

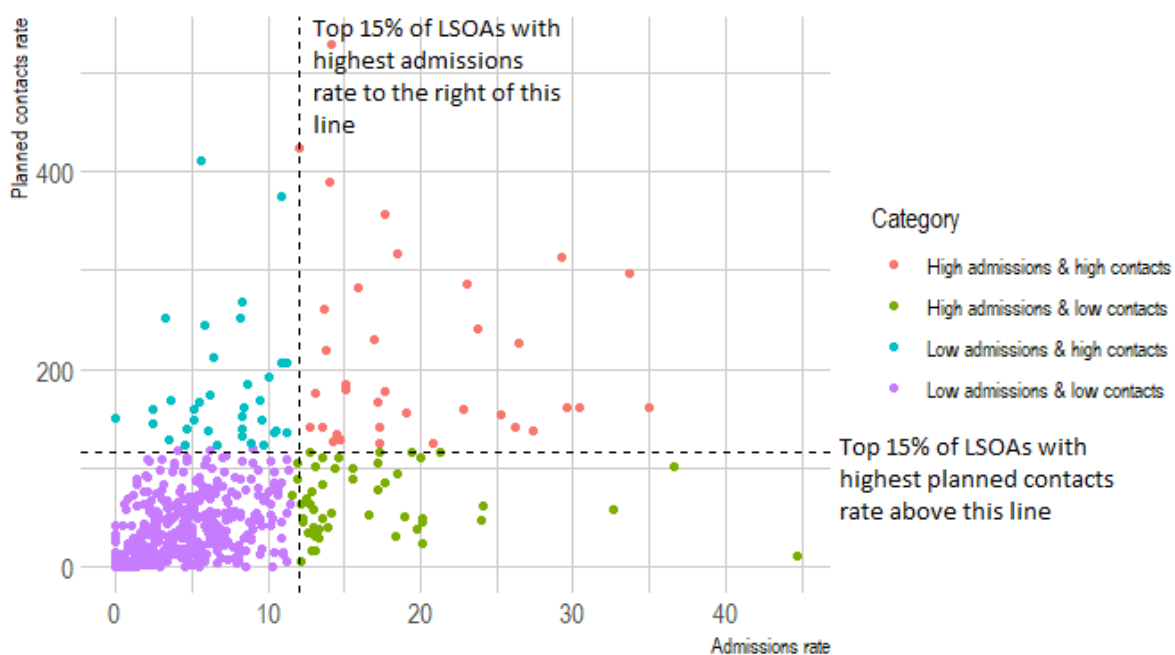
Number of patients accessing mental health services (Figure 8b): Unique number of patients accessing any mental health services over the 2.5 years study period (criteria a, b, c or d from the list above), stratified by age at contact

Bivariate classification of small areas (LSOAs) in Liverpool and Wirral into four categories according to the rates of planned contacts and admissions (Figure 16):

First, we computed the planned contacts and admissions rates for each small area (LSOA) in Liverpool and Wirral, by dividing the number of events by the population size in 2019. Then we used the Fisher algorithm to find optimal breaks in the data to classify all the LSOAs into one of the following exclusive categories:

1. High admissions and high contacts
2. High admissions and low contacts
3. Low admissions and high contacts
4. Low admissions and low contacts

As shown in the chart below, the breaks found by this algorithm are close in value to the 15th top percentile of each variable. This classification was done using the R package 'biscale'.



NDL Leeds analysis

Inclusion criteria

Time period: April 2016 to March 2021

Ages: 11–25 years

People were included in the cohort if they were younger than 25 years during this time period, lived in Leeds and were users of (or were referred to) mental health services. This final condition was met if people had contacts or referrals within this period in the Mental Health Services Dataset (MHSDS). Moreover, because this analysis required cross referencing between MHSDS and other healthcare records, only people with a valid Leeds Data Model (LDM) pseudonym were included.

Data

Table 7: Datasets used by NDL Leeds

Data	Source
Referrals and contacts with Children and Adolescent Mental Health Services (CAMHS) and Adult Mental Health Services (AMHS)	Mental Health Services Dataset (MHSDS)
Hospital admissions, outpatient attendances and A&E attendances	Secondary Uses Service (SUS)

Population estimates came from the Office for National Statistics.

Methods

Percentage of children and young people who are still in contact with services 1 year after their first contact, by age at first contact (Figure 9):

For each age:

Number of people: Number of people who remained in contact with mental health services 1 year (365 days) after their first contact / Number of people who had their first contact with mental health services at that age * 100

Percentage of population accessing mental health services per IMD quintile, per year (Figure 10):

For each year between 2017 and 2020 and deprivation quintile, we compute:

Unique number of patients aged 11–25 years accessing mental health services /
Number of 11–25-year-olds living in Leeds

Then, for each quintile, we compute an average over the 4 years. We only use years for which we have complete data (activity data covering all 12 months).

Referrals per 100 patients (Figure 11): Number of referrals to mental health services over the 5-year period in a given deprivation quintile / Unique number of patients over the 5-year period in a given deprivation quintile * 100

Crisis referrals per 100 patients (Figure 11):_Number of crisis referrals to mental health services over the 5-year period in a given deprivation quintile / Unique number of patients over the 5-year period in a given deprivation quintile * 100

NDL Wales analysis

Inclusion criteria

Time period: January 2016 to December 2020

Ages: 11–24 years

Data

Table 8: Datasets used by NDL Wales

Data	Source
Call details and responses to all ambulance calls in Wales	Welsh Ambulance Service Trust (WAST)
All emergency department attendances in Wales	Emergency Department Data Set (EDDS)
All inpatient admissions in Wales	Patient Episode Database Wales (PEDW)
All NHS Wales substance misuse service attendances and referrals (over 50 treatment providers in Wales ³⁴)	Substance Misuse Data Set (SMDS)
Data on demographics of the Welsh population from the Census	Welsh Demographic Service Dataset (WSDS)
Mortality register, containing data on all deaths in Wales within the study period	Annual District Death Extract
Patients' GP events in Wales	Wales Longitudinal General Practice (WLGP)

Individuals were included in the cohort for any period(s) between 1 January 2016 and 31 December 2020 if they met the following criteria:

- aged between 11–24 years old
- known sex ('male' or 'female')
- living in Wales
- had a valid anonymised linkage field (ALF) to enable the linkage across acute care system health records.

To avoid counting a MH crisis event multiple times across the acute health care system, MH crises which occurred within one calendar day between 1 January 2016 and 31 December 2020 were considered a single event.

Annual incidence MH crisis event rates and 95% confidence intervals were calculated using person years at risk (PYAR) as a denominator.

The code lists to identify mental health crises and determine patient outcomes are supplied here as supplementary tables (Tables S7 and S8).

Methods

Pathways of patients with an ambulance call-out (Figure 12):

This chart presents the pathways of all people aged 11–24 years presenting to the Welsh Ambulance Service NHS Trust (WAST) with mental health crises between 2018 and 2020 by outcome.

Crisis events per 1,000 years at risk, by age group (Figure 13):

For each age group:

Number of crisis events between 2016 and 2020 in age group / Total number of person years at risk in cohort between 2016 and 2020 in age group * 1,000

Crisis events per 1,000 years at risk, by Welsh Index of Multiple Deprivation (WIMD) quintile (Figure 14):

For each WIMD quintile

Number of crisis events between 2016 and 2020 in WIMD quintile / Total number of person years at risk in cohort between 2016 and 2020 in WIMD quintile * 1,000

Supplementary materials: Clinical code lists

Table S1: Primary care READ codes used by NDL North West London

Category	Code	Description	Type of code
Anxiety	8HHp.	Referral for guided self-help for anxiety	ReadCode
Anxiety	E2...	Neurotic, personality and other nonpsychotic disorders	ReadCode
Anxiety	E26..	Physiological malfunction arising from mental factors	ReadCode
Anxiety	E2781	Tension headache	ReadCode
Anxiety	E28..	Acute reaction to stress	ReadCode
Anxiety	E29..	Adjustment reaction	ReadCode
Anxiety	Eu4..	Neurotic, stress-related and somoform disorders	ReadCode
Anxiety	E28z.	Acute stress reaction NOS	ReadCode
Anxiety	E2900	Grief reaction	ReadCode
Bipolar disorder	Eu3..	Mood-affective disorders	ReadCode
Bipolar disorder	Eu31.	Bipolar affective disorder	ReadCode
Bipolar disorder	E11..	Affective psychoses	ReadCode
Depression	62T1.	Puerperal depression	ReadCode
Depression	8H49.	Psychiatric referral	ReadCode
Depression	8H4D.	Referral to psychogeriatrician	ReadCode

Depression	8H78.	Refer to counsellor	ReadCode
Depression	8H7A.	Refer to mental health worker	ReadCode
Depression	8H7T.	Refer to psychologist	ReadCode
Depression	8HC..	Referral to mental health team	ReadCode
Depression	8HHR.	Referral to child and adolescent psychiatry service	ReadCode
Depression	8HHt.	Referral to psychotherapist	ReadCode
Depression	8HHu.	Referral to primary care mental health gateway worker	ReadCode
Depression	8HkK.	Referral to improving access to psychological therapies prog	ReadCode
Depression	8HTc.	Referral to psychosexual clinic	ReadCode
Depression	8HVO.	Private referral to psychiatrist	ReadCode
Depression	9Nk6.	Seen in mental health clinic	ReadCode
Depression	9NN7.	Under care of mental health team	ReadCode
Depression	E2B..	Depressive disorder NEC	ReadCode
Depression	8HC0.	Referral to community mental health team	ReadCode
Depression	8Hc1.	Referral to mental health crisis team	ReadCode

Depression	8HC2.	Referral to primary care mental health team	ReadCode
Depression	9N6h.	Referral by mental health service	ReadCode
Depression	E2B1.	Chronic depression	ReadCode
Depression	Eu32.	Depressive episode	ReadCode
Depression	Eu321	Moderate depressive episode	ReadCode
Depression	Eu32211	Single episode agitated depression w'out psychotic symptoms	ReadCode
Depression	Eu32212	Single episode major depression w'out psychotic symptoms	ReadCode
Depression	Eu32213	Single episode vital depression w'out psychotic symptoms	ReadCode
Depression	Eu32311	Single episode of major depression and psychotic symptoms	ReadCode
Depression	Eu32312	Single episode of psychogenic depressive psychosis	ReadCode
Depression	Eu32313	Single episode of psychotic depression	ReadCode
Depression	Eu32314	Single episode of reactive depressive psychosis	ReadCode
Depression	Eu324	Mild depression	ReadCode
Depression	Eu326	Major depression, moderately severe	ReadCode

Depression	Eu328	Major depression, severe with psychotic symptoms	ReadCode
Depression	Eu32y	Other depressive episodes	ReadCode
Depression	Eu32z	Depressive episode, unspecified	ReadCode
Depression	Eu33.	Recurrent depressive disorder	ReadCode
Depression	Eu33z	Recurrent depressive disorder, unspecified	ReadCode
Depression	Eu341	Dysthymia	ReadCode
Eating disorder	E271.	Anorexia nervosa	ReadCode
Eating disorder	E2751	Bulimia (non-organic overeating)	ReadCode
Eating disorder	Eu50z	Eating disorder unspecified	ReadCode
Personality disorder	E21..	Personality disorders	ReadCode
Referral codes	8CY..	MH Care Programme Approach	ReadCode
Referral codes	9N2z.	Seen by CAMHS	ReadCode
Referral codes	9NoD.	Seen in CAMHS com drop-in clinic	ReadCode
Referral codes	9OI0.	MH monitoring first letter	ReadCode
Referral codes	9OI1.	MH monitoring second letter	ReadCode
Referral codes	9OL2.	MH monitoring third letter	ReadCode
Referral codes	9N2W.	Seen by psychologist	ReadCode

Referral codes	9N2W2	Seen by child adolesc psychol	ReadCode
Referral codes	9NN5.	Under care of psychiatrist	ReadCode
Schizophrenia	146H.	H/O: psychosis	ReadCode
Schizophrenia	E1...	Non-organic psychoses	ReadCode
Schizophrenia	Eu02z	Unspecified dementia	ReadCode
Schizophrenia	Eu2..	Schizoph, schizotyp, delusion	ReadCode
Schizophrenia	Eu25.	Schizoaffective disorders	ReadCode
Schizophrenia	E10..	Schizophrenic disorders	ReadCode
Schizophrenia	E12..	Paranoid states	ReadCode
Schizophrenia	E13..	Other nonorganic psychoses	ReadCode
Schizophrenia	E14..	Psychoses - origin in childhood	ReadCode
Self-harm	SL...	Poisoning	ReadCode
Self-harm	TK...	Suicide + self-inflict inj - SII	ReadCode
Self-harm	U2...	Intentional self-harm	ReadCode
SMI	Eu26.	Nonorganic psychosis in remission	ReadCode
SMI	Eu2z.	Unspecified nonorganic psychosis	ReadCode
SMI	Eu20.	Schizophrenia	ReadCode

SMI	Eu22.	Persistent delusional disorders	ReadCode
SMI	Eu220	Delusional disorder	ReadCode
SMI	Eu223	Paranoid state in remission	ReadCode
SMI	Eu232	Acute schizophrenia-like psychotic disorder	ReadCode
SMI	Eu32300	Severe depressive episode with psychotic symptoms	ReadCode
Suicidal risk assessment	1BD..	Harmful thoughts	ReadCode
Therapy	8G13.	Cognitive behaviour therapy	ReadCode
Therapy	8G62.	Samaritans advice	ReadCode
Therapy	8GR..	IAPT high intensity therapy	ReadCode
Therapy	8IER.	Referral to IAPT programme declined	ReadCode

Table S2: Secondary care ICD-10 codes used by NDL North West London

Category	Code	Description	Type of code
Anxiety	F41	Other anxiety disorders	ICD-10
Anxiety	F40	Phobic anxiety disorders	ICD-10
Bipolar disorder	F31	Bipolar affective disorder	ICD-10
Depression	F32	Depressive episode	ICD-10
Eating disorder	F50	Eating disorders	ICD-10
Obsessive compulsive disorder	F42	Obsessive compulsive disorder	ICD-10
Personality disorder	F603	Emotionally unstable personality disorder	ICD-10
Schizophrenia	F25	Schizoaffective disorders	ICD-10
Schizophrenia	F20	Schizophrenia	ICD-10
Self-harm	X79	Intentional self-harm by blunt object	ICD-10
Self-harm	X82	Intentional self-harm by crashing of motor vehicle	ICD-10
Self-harm	X71	Intentional self-harm by drowning and submersion	ICD-10
Self-harm	X75	Intentional self-harm by explosive material	ICD-10
Self-harm	X72	Intentional self-harm by handgun discharge	ICD-10
Self-harm	X70	Intentional self-harm by hanging, strangulation and suffocation	ICD-10

Self-harm	X80	Intentional self-harm by jumping from a high place	ICD-10
Self-harm	X81	Intentional self-harm by jumping or lying before moving object	ICD-10
Self-harm	X74	Intentional self-harm by other and unspecified firearm discharge	ICD-10
Self-harm	X83	Intentional self-harm by other specified means	ICD-10
Self-harm	X73	Intentional self-harm by rifle, shotgun and larger firearm discharge	ICD-10
Self-harm	X78	Intentional self-harm by sharp object	ICD-10
Self-harm	X76	Intentional self-harm by smoke, fire and flames	ICD-10
Self-harm	X77	Intentional self-harm by steam, hot vapours and hot objects	ICD-10
Self-harm	X84	Intentional self-harm by unspecified means	ICD-10
Self-harm	X65	Intentional self-poisoning by and exposure to alcohol	ICD-10
Self-harm	X61	Intentional self-poisoning by and exposure to antiepileptic, sedative-hypnotic, antiparkinsonism and psychotropic	ICD-10

		drugs, not elsewhere classified	
Self-harm	X62	Intentional self-poisoning by and exposure to narcotics and psychodysleptics [hallucinogens], not elsewhere classified	ICD-10
Self-harm	X60	Intentional self-poisoning by and exposure to nonopioid analgesics, antipyretics and antirheumatics	ICD-10
Self-harm	X66	Intentional self-poisoning by and exposure to organic solvents and halogenated hydrocarbons and their vapours	ICD-10
Self-harm	X69	Intentional self-poisoning by and exposure to other and unspecified chemicals and noxious substances	ICD-10
Self-harm	X64	Intentional self-poisoning by and exposure to other and unspecified drugs, medicaments and biological substances	ICD-10
Self-harm	X63	Intentional self-poisoning by and exposure to other drugs acting	ICD-10

		on the autonomic nervous system	
Self-harm	X67	Intentional self-poisoning by and exposure to other gases and vapours	ICD-10
Self-harm	X68	Intentional self-poisoning by and exposure to pesticides	ICD-10
SMI	F22	Delusional disorders	ICD-10
SMI	F30	Manic episode	ICD-10

Table S3: British National Formulary codes for prescription drugs used by NDL North West London

Reason for treatment	Drug name	Source
Schizophrenia	Amisulpride	BNFc
Depression	Amitriptyline hydrochloride	BNF for Adults
Schizophrenia, Mania	Aripiprazole	BNFc
Psychoses	Asenapine	BNF for Adults
Psychoses	Benperidol	BNF for Adults
Depression	Buspirone hydrochloride	BNF for Adults
Psychoses	Cariprazine	BNF for Adults
Schizophrenia	Chlorpromazine hydrochloride	BNFc
Depression	Citalopram	BNFc
Depression	Clomipramine hydrochloride	BNF for Adults
Schizophrenia	Clozapine	BNFc
Depression	Dosulepin hydrochloride	BNF for Adults
Depression	Doxepin	BNF for Adults
Depression	Duloxetine	BNF for Adults
Depression	Escitalopram	BNF for Adults
Depression	Fluoxetine	BNFc
Depression	Flupentixol	BNF for Adults
Schizophrenia	Haloperidol	BNFc
Depression	Imipramine hydrochloride	BNF for Adults
Depression	Isocarboxazid	BNF for Adults
Schizophrenia	Levomepromazine	BNFc
Depression	Lofepramine	BNF for Adults
Psychoses	Loxapine	BNF for Adults

Psychoses	Lurasidone hydrochloride	BNF for Adults
Depression	Mianserin hydrochloride	BNF for Adults
Depression	Mirtazapine	BNF for Adults
Depression	Moclobemide	BNF for Adults
Depression	Nortriptyline	BNF for Adults
Schizophrenia, Mania	Olanzapine	BNFc
Psychoses	Olanzapine embonate	BNF for Adults
Psychoses	Paliperidone	BNF for Adults
Depression	Paroxetine	BNF for Adults
Schizophrenia, psychoses	Pericyazine	BNFc
Depression	Phenelzine	BNF for Adults
Schizophrenia	Pimozide	BNFc
Depression	Pregabalin	BNF for Adults
Schizophrenia	Prochlorperazine	BNFc
Psychoses	Promazine hydrochloride	BNF for Adults
Schizophrenia	Quetiapine	BNFc
Depression	Reboxetine	BNF for Adults
Psychoses, bipolar	Risperidone	BNFc
OCD	Sertraline	BNFc
Schizophrenia	Sulpiride	BNFc
Depression	Tranlycypromine	BNF for Adults
Depression	Trazodone hydrochloride	BNF for Adults
Schizophrenia, psychoses	Trifluoperazine	BNFc
Depression	Trimipramine	BNF for Adults
Depression	Venlafaxine	BNF for Adults
Depression	Vortioxetine	BNF for Adults

Psychoses	Zuclopenthixol	BNF for Adults
Psychoses	Zuclopenthixol decanoate	BNF for Adults

Table S4: British National Formulary sections for prescription drugs used by NDL Grampian

BNF Section	Description
4.1	Hypnotics and anxiolytics (including barbiturates)
4.2	Drugs used in psychoses and related disorders: antipsychotic drugs, antipsychotic depot injections, drugs used for mania and hypomania
4.3	Antidepressant drugs: tricyclic and related antidepressants, monoamine-oxidase inhibitors, selective serotonin re-uptake inhibitors, other antidepressants
4.4	Central nervous system stimulants and drugs used for ADHD
4.10	Drugs used in substance dependence: alcohol, nicotine and opioid

Table S5: Secondary care ICD-10 codes used by NDL Liverpool and Wirral

Category	Code	Description	Type of code
Eating disorders	F50	Eating disorders	ICD-10
Eating disorders	F50	Anorexia nervosa	ICD-10
Eating disorders	F50	Atypical anorexia nervosa	ICD-10
Eating disorders	F50	Bulimia nervosa	ICD-10
Eating disorders	F50	Atypical bulimia nervosa	ICD-10
Eating disorders	F50	Overeating associated with other psychological disturbances	ICD-10
Eating disorders	F50	Vomiting associated with other psychological disturbances	ICD-10
Eating disorders	F50	Other eating disorders	ICD-10
Eating disorders	F50	Eating disorder, unspecified	ICD-10
Self-harm	X60	Intentional self-poisoning by and exposure to nonopioid analgesics, antipyretics and antirheumatics	ICD-10
Self-harm	X61	Intentional self-poisoning by and exposure to antiepileptic, sedative-hypnotic, antiparkinsonism and psychotropic drugs, not elsewhere classified	ICD-10
Self-harm	X62	Intentional self-poisoning by and exposure to narcotics and psychodysleptics	ICD-10

		[hallucinogens], not elsewhere classified	
Self-harm	X63	Intentional self-poisoning by and exposure to other drugs acting on the autonomic nervous system	ICD-10
Self-harm	X64	Intentional self-poisoning by and exposure to other and unspecified drugs, medicaments and biological substances	ICD-10
Self-harm	X65	Intentional self-poisoning by and exposure to alcohol	ICD-10
Self-harm	X66	Intentional self-poisoning by and exposure to organic solvents and halogenated hydrocarbons and their vapours	ICD-10
Self-harm	X67	Intentional self-poisoning by and exposure to other gases and vapours	ICD-10
Self-harm	X68	Intentional self-poisoning by and exposure to pesticides	ICD-10
Self-harm	X69	Intentional self-poisoning by and exposure to other and unspecified chemicals and noxious substances	ICD-10
Self-harm	X70	Intentional self-harm by hanging, strangulation and suffocation	ICD-10

Self-harm	X71	Intentional self-harm by drowning and submersion	ICD-10
Self-harm	X72	Intentional self-harm by handgun discharge	ICD-10
Self-harm	X73	Intentional self-harm by rifle, shotgun and larger firearm discharge	ICD-10
Self-harm	X74	Intentional self-harm by other and unspecified firearm discharge	ICD-10
Self-harm	X75	Intentional self-harm by explosive material	ICD-10
Self-harm	X76	Intentional self-harm by smoke, fire and flames	ICD-10
Self-harm	X77	Intentional self-harm by steam, hot vapours and hot objects	ICD-10
Self-harm	X78	Intentional self-harm by sharp object	ICD-10
Self-harm	X79	Intentional self-harm by blunt object	ICD-10
Self-harm	X80	Intentional self-harm by jumping from a high place	ICD-10
Self-harm	X81	Intentional self-harm by jumping or lying before moving object	ICD-10
Self-harm	X82	Intentional self-harm by crashing of motor vehicle	ICD-10
Self-harm	X83	Intentional self-harm by other specified means	ICD-10

Self-harm	X84	Intentional self-harm by unspecified means	ICD-10
Alcohol abuse	F10	Mental and behavioural disorders due to use of alcohol	ICD-10
Alcohol abuse	X45	Accidental poisoning by and exposure to alcohol	ICD-10
Alcohol abuse	X65	Intentional self-poisoning by and exposure to alcohol	ICD-10
Alcohol abuse	Y15	Poisoning by and exposure to alcohol, undetermined intent	ICD-10
Substance abuse	F11	Mental and behavioural disorders due to use of opioids	ICD-10
Substance abuse	F12	Mental and behavioural disorders due to use of cannabinoids	ICD-10
Substance abuse	F13	Mental and behavioural disorders due to use of sedatives or hypnotics	ICD-10
Substance abuse	F14	Mental and behavioural disorders due to use of cocaine	ICD-10
Substance abuse	F15	Mental and behavioural disorders due to use of other stimulants, including caffeine	ICD-10
Substance abuse	F16	Mental and behavioural disorders due to use of hallucinogens	ICD-10

Substance abuse	F17	Mental and behavioural disorders due to use of tobacco	ICD-10
Substance abuse	F18	Mental and behavioural disorders due to use of volatile solvents	ICD-10
Substance abuse	F19	Mental and behavioural disorders due to multiple drug use and use of other psychoactive substances	ICD-10
Other mental health	F00	Dementia in Alzheimer's disease (G30.-+)	ICD-10
Other mental health	F01	Vascular dementia	ICD-10
Other mental health	F02	Dementia in other diseases classified elsewhere	ICD-10
Other mental health	F03	Unspecified dementia	ICD-10
Other mental health	F04	Organic amnesic syndrome, not induced by alcohol and other psychoactive substances	ICD-10
Other mental health	F05	Delirium, not induced by alcohol and other psychoactive substances	ICD-10
Other mental health	F06	Other mental disorders due to brain damage and dysfunction and to physical disease	ICD-10
Other mental health	F07	Personality and behavioural disorders due to brain disease,	ICD-10

		damage and dysfunction	
Other mental health	F09	Unspecified organic or symptomatic mental disorder	ICD-10
Other mental health	F20	Schizophrenia	ICD-10
Other mental health	F21	Schizotypal disorder	ICD-10
Other mental health	F22	Persistent delusional disorders	ICD-10
Other mental health	F23	Acute and transient psychotic disorders	ICD-10
Other mental health	F24	Induced delusional disorder	ICD-10
Other mental health	F25	Schizoaffective disorders	ICD-10
Other mental health	F28	Other nonorganic psychotic disorders	ICD-10
Other mental health	F29	Unspecified nonorganic psychosis	ICD-10
Other mental health	F30	Manic episode	ICD-10
Other mental health	F31	Bipolar affective disorder	ICD-10
Other mental health	F32	Depressive episode	ICD-10
Other mental health	F33	Recurrent depressive disorder	ICD-10
Other mental health	F34	Persistent mood [affective] disorders	ICD-10
Other mental health	F38	Other mood [affective] disorders	ICD-10
Other mental health	F39	Unspecified mood [affective] disorder	ICD-10
Other mental health	F40	Phobic anxiety disorders	ICD-10

Other mental health	F41	Other anxiety disorders	ICD-10
Other mental health	F42	Obsessive compulsive disorder	ICD-10
Other mental health	F43	Reaction to severe stress, and adjustment disorders	ICD-10
Other mental health	F44	Dissociative [conversion] disorders	ICD-10
Other mental health	F45	Somatoform disorders	ICD-10
Other mental health	F48	Other neurotic disorders	ICD-10
Other mental health	F51	Nonorganic sleep disorders	ICD-10
Other mental health	F52	Sexual dysfunction, not caused by organic disorder or disease	ICD-10
Other mental health	F53	Mental and behavioural disorders associated with the puerperium, not elsewhere classified	ICD-10
Other mental health	F54	Psychological and behavioural factors associated with disorders or diseases classified elsewhere	ICD-10
Other mental health	F55	Abuse of non-dependence-producing substances	ICD-10
Other mental health	F59	Unspecified behavioural syndromes associated with physiological disturbances and physical factors	ICD-10
Other mental health	F60	Specific personality disorders	ICD-10

Other mental health	F61	Mixed and other personality disorders	ICD-10
Other mental health	F62	Enduring personality changes, not attributable to brain damage and disease	ICD-10
Other mental health	F63	Habit and impulse disorders	ICD-10
Other mental health	F64	Gender identity disorders	ICD-10
Other mental health	F65	Disorders of sexual preference	ICD-10
Other mental health	F66	Psychological and behavioural disorders associated with sexual development and orientation	ICD-10
Other mental health	F68	Other disorders of adult personality and behaviour	ICD-10
Other mental health	F69	Unspecified disorder of adult personality and behaviour	ICD-10
Other mental health	F70	Mild mental retardation	ICD-10
Other mental health	F71	Moderate mental retardation	ICD-10
Other mental health	F72	Severe mental retardation	ICD-10
Other mental health	F73	Profound mental retardation	ICD-10
Other mental health	F78	Other mental retardation	ICD-10
Other mental health	F79	Unspecified mental retardation	ICD-10
Other mental health	F80	Specific developmental	ICD-10

		disorders of speech and language	
Other mental health	F81	Specific developmental disorders of scholastic skills	ICD-10
Other mental health	F82	Specific developmental disorder of motor function	ICD-10
Other mental health	F83	Mixed specific developmental disorders	ICD-10
Other mental health	F84	Pervasive developmental disorders	ICD-10
Other mental health	F88	Other disorders of psychological development	ICD-10
Other mental health	F89	Unspecified disorder of psychological development	ICD-10
Other mental health	F90	Hyperkinetic disorders	ICD-10
Other mental health	F91	Conduct disorders	ICD-10
Other mental health	F92	Mixed disorders of conduct and emotions	ICD-10
Other mental health	F93	Emotional disorders with onset specific to childhood	ICD-10
Other mental health	F94	Disorders of social functioning with onset specific to childhood and adolescence	ICD-10
Other mental health	F95	Tic disorders	ICD-10
Other mental health	F98	Other behavioural and emotional disorders with onset usually	ICD-10

		occurring in childhood and adolescence	
Other mental health	F99	Mental disorder, not otherwise specified	ICD-10

Table S6: A&E Snomed codes used by NDL Liverpool and Wirral

Category	Code	Type of code
Eating disorders	54, 105	Snomed
Self-harm	1465	Snomed
Alcohol abuse	24, 29, 36, 37, 1253	Snomed
Substance abuse	1492	Snomed

Table S7: Advanced Medical Priority Dispatch System (AMPDS) codes used to define mental health crises presenting to the ambulance service (WAST) used by NDL Wales

AMPDS code	Description
09E30	Hanging
17D02J	Falls, long fall
17D03J	Falls, unconscious or not alert “-“ Jumper
23B00	Override
23B01	OVERDOSE (without priority symptoms)
23B01I	OVERDOSE (without priority symptoms) - Intentional
23B01V	OVERDOSE (without priority symptoms) - Violent or combative
23B01W	OVERDOSE (without priority symptoms) - Weapons
23C00I	Override - Intentional
23C00V	Override - Violent or combative
23C01	Not alert
23C01I	Not alert - Intentional
23C01V	Not alert - Violent or combative
23C01W	Not alert - Weapons
23C02	Abnormal breathing
23C02I	Abnormal breathing - Intentional
23C02V	Abnormal breathing - Violent or combative
23C02W	Abnormal breathing - Weapons
23C03	Antidepressants (tricyclic)
23C03I	Antidepressants (tricyclic) - Intentional
23C03V	Antidepressants (tricyclic) - Violent or combative

23C03W	Antidepressants (tricyclic) - Weapons
23C04	Cocaine, methamphetamine (or derivatives)
23C04I	Cocaine, methamphetamine (or derivatives) - Intentional
23C04V	Cocaine, methamphetamine (or derivatives) - Violent or combative
23C04W	Cocaine, methamphetamine (or derivatives) - Weapons
23C05	Narcotics (heroin, tramadol, methadone, (dihydro)codeine, etc)
23C05I	Narcotics (heroin, tramadol, methadone, (dihydro)codeine, etc) - Intentional
23C05V	Narcotics (heroin, tramadol, methadone, (dihydro)codeine, etc) - Violent or combative
23C05W	Narcotics (heroin, tramadol, methadone, (dihydro)codeine, etc) - Weapons
23C06	Acid or alkali (lye)
23C06I	Acid or alkali (lye) - Intentional
23C06V	Acid or alkali (lye) - Violent or combative
23C06W	Acid or alkali (lye) - Weapons
23C07	Unknown status/Other codes not applicable
23C07I	Unknown status/Other codes not applicable - Intentional
23C07V	Unknown status/Other codes not applicable - Violent or combative
23C07W	Unknown status/Other codes not applicable - Weapons
23C08	Poison control request for response
23C08I	Poison control request for response - Intentional

23C08V	Poison control request for response - Violent or combative
23C08W	Poison control request for response - Weapons
23D00	Override
23D00I	Override - Intentional
23D00V	Override - Violent or combative
23D01	Unconscious
23D01I	Unconscious - Intentional
23D01V	Unconscious - Violent or combative
23D01W	Unconscious - Weapons
23D02	CHANGING COLOUR
23D02I	CHANGING COLOUR - Intentional
23D02V	CHANGING COLOUR - Violent or combative
23D02W	CHANGING COLOUR - Weapons
23O01	POISONING (without priority symptoms)
23O01I	POISONING (without priority symptoms) - Intentional
23O01V	POISONING (without priority symptoms) - Violent or combative
25A00	Override
25A01	Non-suicidal without 1st party verification (alert and awake)
25A01B	Non-suicidal without 1st party verification (alert and awake) - Both violent and weapons
25A01V	Non-suicidal without 1st party verification (alert and awake) - Violent
25A01W	Non-suicidal without 1st party verification (alert and awake) - Weapons

25A02	Suicidal (not threatening) without 1st party verification (alert and awake)
25A02B	Suicidal (not threatening) without 1st party verification (alert and awake) - Both violent and weapons
25A02V	Suicidal (not threatening) without 1st party verification (alert and awake) - Violent
25A02W	Suicidal (not threatening) without 1st party verification (alert and awake) - Weapons
25B00	Override
25B00V	Override - Violent
25B01	SERIOUS haemorrhage
25B01B	SERIOUS haemorrhage - Both violent and weapons
25B01V	SERIOUS haemorrhage - Violent
25B01W	SERIOUS haemorrhage - Weapons
25B02	Non-SERIOUS or MINOR haemorrhage
25B02B	Non-SERIOUS or MINOR haemorrhage - Both violent and weapons
25B02V	Non-SERIOUS or MINOR haemorrhage - Violent
25B02W	Non-SERIOUS or MINOR haemorrhage - Weapons
25B03	THREATENING SUICIDE
25B03B	THREATENING SUICIDE - Both violent and weapons
25B03V	THREATENING SUICIDE - Violent
25B03W	THREATENING SUICIDE - Weapons
25B04	Jumper (threatening)
25B04B	Jumper (threatening) - Both violent and weapons

25B04V	Jumper (threatening) - Violent
25B04W	Jumper (threatening) - Weapons
25B05	Near hanging, strangulation, or suffocation (alert without difficulty breathing)
25B05B	Near hanging, strangulation, or suffocation (alert without difficulty breathing) - Both violent and weapons
25B05V	Near hanging, strangulation, or suffocation (alert without difficulty breathing) - Violent
25B05W	Near hanging, strangulation, or suffocation (alert without difficulty breathing) - Weapons
25B06	Unknown status/Other codes not applicable
25B06B	Unknown status/Other codes not applicable - Both violent and weapons
25B06V	Unknown status/Other codes not applicable - Violent
25B06W	Unknown status/Other codes not applicable - Weapons
25D00	Override
25D00B	Override - Both violent and weapons
25D00V	Override - Violent
25D00W	Override - Weapons
25D01	Not alert
25D01B	Not alert - Both violent and weapons
25D01V	Not alert - Violent
25D01W	Not alert - Weapons
25D02	DANGEROUS haemorrhage
25D02B	DANGEROUS haemorrhage - Both violent and weapons
25D02V	DANGEROUS haemorrhage - Violent

25D02W	DANGEROUS haemorrhage - Weapons
25D03	Near hanging, strangulation, or suffocation (alert with difficulty breathing)
25D03B	Near hanging, strangulation, or suffocation (alert with difficulty breathing) - Both violent and weapons
25D03V	Near hanging, strangulation, or suffocation (alert with difficulty breathing) - Violent
25D03W	Near hanging, strangulation, or suffocation (alert with difficulty breathing) - Weapons
25O01	Non-suicidal with 1st party verification (alert and awake)
25O01V	Non-suicidal with 1st party verification (alert and awake) - Violent
25O01W	Non-suicidal with 1st party verification (alert and awake) - Weapons
25O02	Suicidal (not threatening) with 1st party verification (alert and awake)
25O02V	Suicidal (not threatening) with 1st party verification (alert and awake) - Violent

Table S8: Classification of outcomes for patients presenting to the ambulance service (WAST) with a mental health crisis, based on discharge and incident stop codes

WAST cases were assigned outcomes based on the following steps:

If a WAST case links to an ED record, then the case outcome is based on discharge code³⁸:

Discharge code	Discharge description	Outcome
01	Admitted to same Hospital within Local Health Board	ED -> admitted
02	Admitted to other Hospital within Local Health Board	
03	Transferred to different Trust / Local Health Board	
04	Referred to Outpatient Department	ED -> discharge
05	Referred to GP	
06	Referred to Other Healthcare Professional	
07	No Planned Follow-Up	
08	Planned Follow-Up at Accident and Emergency Department	
09	Patient Self-Discharged without Clinical Consent	ED -> self-discharge
10	Died in Department	[not in dataset]
11	Patient Dead on Arrival	
NULL	NULL	ED -> Unknown

If a WAST case does not link to an ED case then the case outcome is based on WAST incident stop code:

Incident stop code	Incident stop code description	Outcome
PRTR	Pt Ref Treatment After Amb Arrival	Refused treatment
PIMP	Patient Improved	No need to transfer
PRSP	Refd To Specialist Prac	
ROLE	ROLE Policy Implemented	
SOCI	Refd Social Care Pathway	
P136	Police Conveyed (Section 136)	
HCAR	Refd To Other Healthcare Prof	
PSYC	Refd To Mental Health Pathway	
PMON	Own Trans After Amb Arrival	
PCON	Police Conveyed (Other)	
PROH	Refd To GP Out Of Hours	
PREF	Referred To GP	
PDET	Patient Deteriorated	
CCCD	Clinical Desk Dealing	
RNCO	Patient Treated At Scene	
POLD	Police Dealing	
SICAT	Sicat Dealing	
NREQ	Cancelled Pre-Arrival	Unknown
NOTH	No Patient Found On Scene	
PCRT	Planned Clinician Req Transport	
HOAX	Hoax / Malicious	

DGER	Downgraded - Emergency To Routine	[not in dataset]
GPAT	Not Reqd. GP Attending *	
NS	No Send	
PTAS	Physician Triage and Streaming	
NHSD	Dealt With By NHS Direct	
AUTO	Automatically Closed Call	
UTRC	Unable To Return Call	
AS1TOAS3	Downgrade AS1 to AS3	

If a WAST case does not link to ED and has no incident stop code then the outcome is 'Unknown'.