

# ACESinEHRs

**Control documentation  
and instructions**

**Version 2**

**Date: 7 July 2023**

<https://acesinehrs.com/>

## Terms and conditions

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Users should cite the [www.ACESinEHRs.com](#) library and the accompanying [Lancet Digital Health publication](#) in all research outputs, presentations and reports.

All code is shared without investigator support.

## Acknowledgement

This research benefits from and contributes to the [NIHR Children and Families Policy Research Unit](#), but was not commissioned by the National Institute for Health Research (NIHR) Policy Research Programme. The views expressed are those of the author(s) and not necessarily those of the NHS, the National Institute for Health Research, the Department of Health and Social Care or its arm's length bodies, and other Government Departments.

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These files may be updated periodically, so we appreciate hearing feedback or additional information about how the library is being used.

## Documentation control sheet

Over time, it may be necessary to issue amendments to parts of this document. This form will be updated whenever changes are made by the original author team.

Version	Date	Affected Areas Summary of Change	Prepared By	Reviewed By
1.0	May 17, 2022	ACE indicators officially published	Shabeer Syed	CPRU team
1.1	June 15, 2022	Modified – added extra "flags" to aid with algorithm implementation	Shabeer Syed	CPRU team
1.2	July 11, 2022	Expanded code list – added & mapped codes for HES outpatient & HES A&E	Shabeer Syed	CPRU team



2	July 1, 2023	"Maternal" labels were amended to "parental", as we published a new study that applied indicators to linked fathers.	Shabeer Syed	CPRU team
2	July 1, 2023	Updated IPV algorithm to include additional A&E assault codes	Shabeer Syed	CPRU team

Abbreviations: CPRU= NIHR Children and Families Policy Research Unit

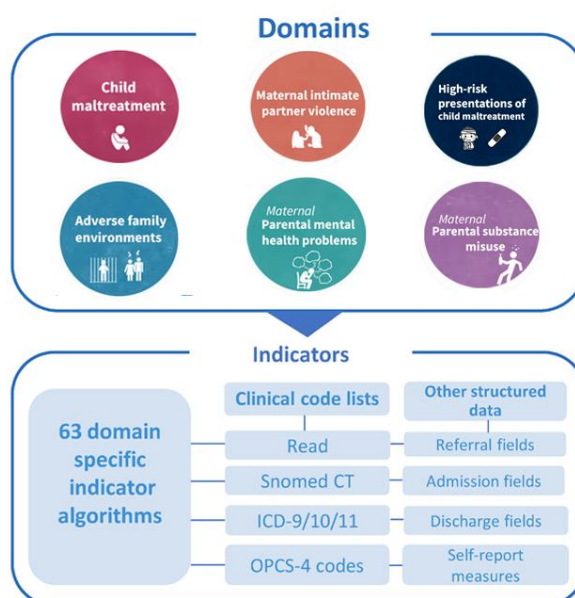
## ACEs in EHRs library

The ACEsinEHRs library is an open-access resource of validated indicators and algorithms for identifying ACEs in routinely collected non-identifiable healthcare data of mothers, fathers and children presenting to GPs and hospitals from two years before birth to 11 years after birth. The library accompanies the paper published in Lancet Digital Health, [\*"Identifying adverse childhood experiences with electronic health records of linked mothers and children in England: a multistage development and validation study, \(2022\). Shabeer Syed, Arturo Gonzalez-Izquierd, Janice Allister, Gene Feder, Leah Li, Ruth Gilbert."\*](#)

## Indicators and algorithms

We developed two measures of ACEs for electronic health records (EHRs):

- Domains (ie, grouped indicators) and;
- Indicators (ie, grouped codes or measures)



Most indicators are derived using algorithms that identify and extract information from EHRs using clinically coded healthcare information (for example, ICD-10, Read codes, SNOMED-CT). An overview of the algorithms are provided below in table 2 and described more in-depth at [www.acesinehrs.com/starterguide/](http://www.acesinehrs.com/starterguide/). Rule-based

algorithms are indicator specific (mainly HRP-CM) and prevent misclassification, including age restrictions, exclusions of accidental injuries, genetic predispositions (bone diseases), traumatic birth injuries or maternal-child transmissions during birth (see below).

For GP records, we define indicators by combining information recorded in Read codes, prescriptions, referral fields and validated self-report measures (continuous variables needing re-coding) routinely administered by GPs or nurses (e.g. alcohol use).

For hospital and death registration records, we define indicators by combining codes from the International Classification of Diseases 9th/10th edition (ICD-9/10), the Classification of Interventions and Procedures (OPCS-4) and HES-APC discharge/admission fields. We also provide cross-mapped unvalidated indicators for newer systems (ICD-11/SNOMED CT) for further evaluation. Browse code lists [here](#).

Unless specified, indicators refer to information recorded in both children's and parents' records.

## **Code lists**

We provide mapped codes for each ACE indicator stored in [code lists](#). Each data source will have different coding systems. The current ACEs indicators include ICD-9/10 codes (hospital/death records), Read codes, SNOMED-CT codes, medcodes, prodcodes, gemscripts (general practice), and codes for obtaining continuous data or coded information from speciality fields in CPRD GOLD, HES-APC, HES-A&E and HES-OP.

We have converted several original codes so the code lists contain one column of research-ready codes. This ensures efficient information integration from multiple coding systems without accidental deduplication. See the code list dictionary in table 1 below for more information.

## **File format**

Code lists are provided as six separate text files (.txt) or one overall file that can be imported into standard statistical software and merged with a prepared data set to enable analyses of ACEs. This format maintains the correct values of each and prevents programs like Excel from automatically converting values. The dictionaries are also available through the ACEsinEHR Code Browser and can be opened in Excel.

## Downloads

### All ACE indicators:

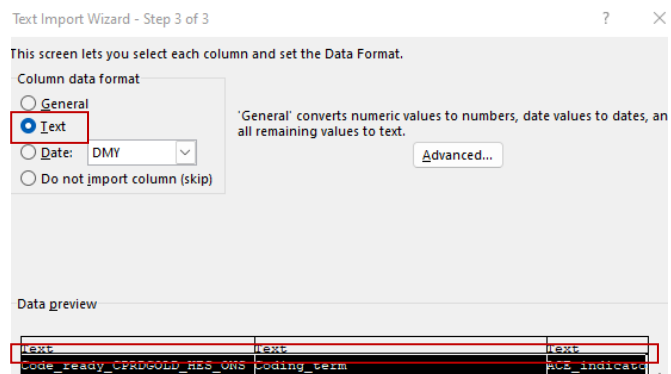
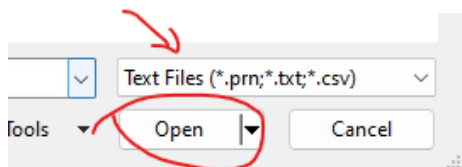
- [All ACEs \(8864\)](#)
- [All ACEs + crossmapped SNOMED CT \(8864\)](#)
- [All ACEs GP/CPRD only: medcodes, prodcodes, measures only \(6618\)](#)
- [All ACEs Hospital only: ICD, OPCS and HES-APC specific fields \(2246\)](#)

### By ACE domain:

- [Child maltreatment \(1312\)](#)
- [Intimate partner violence \(972 including 519 codes for assault algorithm\)](#)
  - [Intimate partner violence \(453 - excluding codes requiring algorithms\)](#)
- [High-risk presentation of CM \(801\)](#)
- [Adverse family environment \(977\)](#)
- [Parental mental health problems \(3711\)](#)
- [Parental substance misuse \(1091\)](#)

## How to open code lists (text files) in Excel

Please note that opening code lists ".txt" files in Excel requires you to go to: "file" → "open" → "text files" → import all columns as "text" in step 3 (see snippets below). This process ensures Excel retain the original code structure (e.g., otherwise excel removes leading zeros "0" from codes starting with 0).



**Table 1.** Code list dictionary

Provided variable	Description
<b>Code</b>	Data ready code. Contains CPRD GOLD medcodes and prodcodes (as used in the data provided by CPRD with added prefixes to prodcode), ICD-9/10 (removed punctuations for ICD), and OPSC-4 codes. Prefixes <i>d_</i> added to prodcodes and <i>p_</i> to OPSC-4 codes. Prefixes prevents de-duplication as different systems may use the same code for different descriptions.
<b>Code original</b>	Original code as entered into respective system (removed punctuations for ICD)
<b>Coding term</b>	Original code description
<b>Indicator code</b>	Indicator code name
<b>Indicator specific</b>	Most specific indicator
<b>Indicator 1</b>	Main ACE indicator combining multiple codes or measures as used in validation paper
<b>Indicator 2</b>	Broader ACE indicator combining multiple codes or measures
<b>Domain</b>	ACE domain grouping all indicators together (applicable for the overall code list)
<b>Severity</b>	Where applicable, this variable indicates the severity classification of the code description. <i>e.g. For alcohol misuse, mild, moderate, severe.</i>
<b>Scale</b>	1=Indicates that the code and severity classifications are dependent on extra clinical information (e.g. frequency of alcohol consumption). By default, this is set to <i>Mild</i> for alcohol. See rule-based algorithms.
<b>Reference</b>	1=code is part of family violence reference standard, 2=code can be used as a broader measure of family violence
<b>Individual</b>	1=code applies to child only, 2=code applies to mother only, 3=code applies to mother or child (i.e. either), 4=code only applicable to female children
<b>Coding systems</b>	GP/primary care: Read, OXMIS, Prodcode (prescriptions or items), CPRD REFERRAL FHSASPEC (field specific), CPRD REFERRAL NHSSPEC (field specific). HES-APC/secondary care/ONS: ICD-10, OPCS-4, ICD-9 (applies to ONS < year 2000), HES-APC DISDEST OR ADMISORC (field specific)

**Table 2.** Rule-based algorithms by ACE domains

ACE domain	Indicator(s)	Rule-based algorithms
<b>Parental SM</b>	Alcohol misuse Severe	<i>Include if continuous data meets the cut-off assigned to each code (see code list): e.g. AUDIT: <math>\geq 20</math>; AUDIT-PC: <math>\geq 10</math>; SADQ <math>\geq 31</math>; <math>\geq 35</math> alcohol units per week (analogous to higher-risk drinking/harmful drinking/alcohol dependence; see <a href="#">NICE guidelines</a>); <math>&gt; 200</math> mg alcohol per 100 ml blood is classed as potential high-risk offender when driving in England/Wales (see <a href="#">UK gov</a>) (applies to hospital admission codes in this study).</i>
	Alcohol misuse Moderate	<i>Include if continuous data meets cut-off assigned to each code (see code list): e.g. AUDIT: 8-19; AUDIT-PC: 5-9; SADQ 16-30; <math>\geq 15</math> to <math>&lt; 35</math> units per week; Men and women are advised not to drink more than 14 units per week (see <i>increasing risk drinking/Alcohol Use Disorders as described by NICE</i>);<sup>58, 59</sup> <math>&lt; 80</math> mg alcohol per 100 ml blood (Blood Alcohol Content) is the legal limit for driving in England/Wales (applies to hospital admission codes in this study).</i>
<b>Parental MHPs</b>	Depression	<i>Include if continuous data meets the cut-off assigned to each code (see code list): e.g. DASS-21 (sub-scales): <math>\geq 14</math>; EDPS: <math>\geq 13</math>; HADS (sub-scale): <math>\geq 11</math>; HDRS (sub-scale): <math>\geq 14</math>; PHQ-9: <math>\geq 10</math>; SDS (Zung's): <math>\geq 50</math></i>
	Anxiety	<i>Include if continuous data meets the cut-off assigned to each code (see code list): e.g. DASS-21: <math>\geq 10</math>; HADS (sub-scale): <math>\geq 11</math>; HDRS (sub-scale): <math>\geq 18</math>; SAS (Zung's): <math>\geq 45</math> score; GAD-7: <math>\geq 8</math>;</i>
	Anxiety or depressive symptoms, antidepressants or anxiolytics and mental health service referral/interventions received	<i>Codes referring to anxiety symptoms (e.g., worrying) or depression (e.g. "feeling low") were only considered a case of depression or an anxiety disorder when the patient was also given antidepressants and/or anxiolytic medication within 3-months or initiated psychological treatment within 2-years. Comparison estimates for mothers in CPRD-MBL with and without this algorithm are provided by Abel et al.<sup>60</sup></i>  <i>Rule: Include symptoms/medications as an anxiety or depression indicator if a previous diagnostic code or tier 3 intervention code exists (within 2-years), or if there is a co-occurrence of a prescription consistent with a symptom within 3-months (e.g. anxiolytics &amp; anxiety symptoms).<sup>61</sup></i>
<b>CM</b>	FGM	<i>Apply codes mentioning circumcision to female children only (e.g. CPRD medcode "54314 - routine or ritual circumcision"). The code list includes markers for rule-based inclusions.</i>
<b>Susp. IPV</b>	Assault NOS (algo); mIPV NOS (Assault and high-risk algo, 30/100 days)	<i>Include as IPV if the assault recording co-occurs with any "high-risk presentation recording" 30 days before the assault or in 100-days post the assault recording. High-risk recordings are a composite variable of recordings related to parental conflicts, health visitors being sent to the home, nurse partnership referrals, superficial head injuries and bruises. We developed the composite variable using results from our systematic review.<sup>50</sup> In the current study the algorithm showed PPVs ranging from 18%-30% of definitive mIPV (derivation cohort).</i>
<b>IPV</b>	Assault NOS (algo), mIPV NOS (Assault and preg. incident and CM algo, 45 days)	<i>Include as mIPV if assault recording co-occurs with any recordings of a safeguarding referral, child protection recording, definitive CM indicator, or "pregnant state, incidental" (marked in code list) within 45 days of the assault. UK guidelines state 45 days is the maximum timeframe for an initial outcome following a children's social care assessment from the date of received safeguarding referral (see point 82 in "HM government. Working together to safeguard children").<sup>48</sup></i>

<b>HRP-CM</b>	Child harm by undetermined intent; Lacerations, scars and abrasions; Thermal injuries; Unknown and unspecified causes of morbidity in child; Other and unspecified abdominal pain; Unspecified event in child; Obs for other suspected diseases and conditions in child	Include as HRP-CM when excluding co-occurring accident-related injuries recorded within +/-15 days of the event. The required time interval for co-occurrences was selected based on the median time difference between data sources for some accidental injuries. Indicators were developed using NICE Clinical guideline [CG89]: 1.1.1-1.1.8; 1.1.15; 1.2.4, 1.2.5; 1.2.13.
	Eye trauma, NOS; Subarachnoid haemorrhage other; Subdural haematoma/retinal haemorrhage	Include as HRP-CM when excluded co-occurring accident-related injuries recorded within +/-15 days of the event, and when excluded, birth-related injuries recorded <2 days post-birth. Indicators were developed using NICE Clinical guideline [CG89]: 1.1.11; 1.1.10
	Fractures, Intra-abdominal injuries, spinal injuries, intracranial	Include as HRP-CM when excluded co-occurring accident-related injuries recorded within +/-15 days of the event, when excluded birth-related injuries recorded <2 days post-birth, and when excluded children with fragile bone disease (Osteoporosis), unless definitive CM is recorded within +/-30 days. Indicators were developed using NICE Clinical guideline [CG89]: 1.1.9; 1.1.12; 1.1.13



### **Additional notes on indicator classifications:**

Please note that some indicators may contain codes with descriptions that do not match the overall indicator name or its overarching domain. Some indicators may also include codes with similar descriptions but are classified under different domains. This discrepancy occurs because codes were initially grouped into indicators based on the relevance of specific coding descriptions and iteratively re-classified based on frequency distributions, rule-based algorithms, intercorrelations and risk associations with the reference standard as described in [published paper](#). For instance, if the maternal record has a GP code termed "Assault", then the code is classified under the domain "*adverse family environments*" as an indicator labelled "*Mother assaulted, NOS (GP record only)*" because the mother's relationship status with the preparator cannot be determined, and because the code showed a relatively low risk association with the reference standard. By contrast, if the maternal record has an ICD-10 code termed "Assault in the home", then the code is classified under the domain "*maternal IPV*" as an indicator labelled "*Suspected IPV, Mother assaulted NOS (hospital admission)*", because the assault occurred in the home (i.e. preparator more likely to have a relationship with the family) and because the code showed a relatively strong risk association with the reference standard.