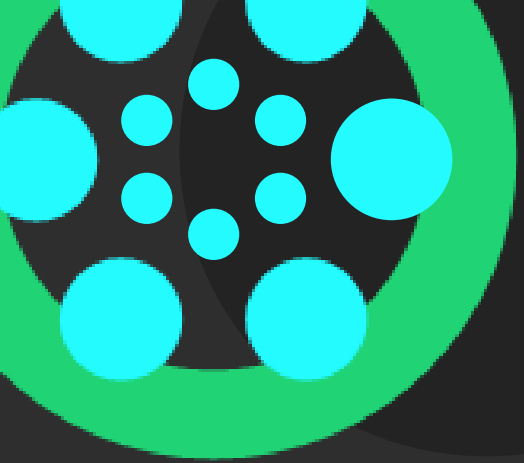

Classifying
Outpatient activity
by function

Introducing a tool to support service reform and enhance analyses of outpatient care

Appendix:
Methods in detail.

The Strategy Unit

Midlands Decision Support Network

Introduction

This appendix provides further detail of the methods used in the report, “Classifying Outpatient Activity by Function”. It has been written for analysts, researchers, and other interested individuals seeking to further understand and/or implement the algorithm.

A note on implementation

We both queried the SUS tables and implemented the algorithm in R programming language,[1] using the National Commissioning Data Repository (NCDR) Data Science Server.

The R code and reference tables used in this work are available under a GNU GPLv3 licence on the Strategy Unit’s GitHub page.[2]

1. R Core Team (2020). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria.

2. https://github.com/The-Strategy-Unit/752_classify_op_activity

Methods (extended)

Following our literature review (as summarised in the main report), we outlined our desired function categories *before* inspecting the datasets. Categories were formed based on our judgement as to their utility. Some of these categories were later re-formed following an examination of the dataset.

The data sources

Our data sources were the Secondary Uses Service (SUS) tables in the National Commissioning Data Repository (NCDR). While our focus was outpatient activity, some of our function categories required us to link outpatient records to admitted patient data, via patients' pseudonymised NHS number. We thus used both "Outpatient" and "Admitted Patient Care" tables.

The variable selection process

We began with a SUS outpatient dataset consisting of 170 variables. To narrow the field and ensure that our classification system would be robust, we created an initial pool of "useful" variables that - we believed - satisfied two criteria:

1. The variable might provide clues as to the function of an attendance.
2. The variable displayed a high level of quality and completeness (over several years).

To this pool we added a number of variables that we engineered from existing fields. These included variables that would provide details of previous and future patient care contacts, and the elapsed time between these contacts.

We built the algorithm following observations of, and tests on, many dozens of random records. Pooled variables that did not add value were discarded.

Our final algorithm estimated the function of an outpatient attendance either directly from or from derivatives of the 12 (or 11 unique) variables shown in Table 3.

Outpatient variables	Admitted patient variables
Der_Pseudo_NHS_Number	Der_Pseudo_NHS_Number
Direct_Access_Referral_Ind	Admission_Date
Priority_Type	Admission_Method
Appointment_Date	Der_Admit_Treatment_Function
Treatment_Function	Der_Dischg_Treatment_Function
First_Attendance	
Der_Procedure_All	

Table 3: SUS variables used in the algorithm

The algorithm is illustrated in Fig. 9, overleaf, in the form of a decision tree. For functions determined by a patient admission, a supplementary table (Table 4) is used to display the rules involved.

Note that the definition of “diagnostic procedure” relies on a custom reference table which lists a set of ICD-10 codes associated with diagnostic procedures. Our custom list is an expanded version of the list of procedures used to produce the monthly DM01 reports.[3]

3. https://digital.nhs.uk/about-nhs-digital/corporate-information-and-documents/directions-and-data-provision-notices/data-provision-notices-dpns/dm01-monthly-diagnostics-waiting-times-and-activity-data-provision-notice

Figure 9: the algorithm

For each outpatient record was the attendance:

Branches up signify — TRUE
Branches down signify — FALSE
in all cases except for where rules rely on elapsed times.

Urgent ? (note a.)
- T → URGENT PROCEDURE
- F → Direct Access? (note b.)
  - T → DIRECT ACCESS
  - F → Admission within 6 months? (same adm./disch. specialty as OP attendance) (note c.)

Elapsed times  (table overleaf)
- ASSESSMENT (PRE-OP)
- REVIEW (POST-OP)
- REVIEW AFTER NEL

Procedure? (note d.)
- Dominant procedure diagnostic? (note e.)
  - DIAGNOSTIC PROCEDURE
  - TREATMENT
- Procedure directly beforehand? (same clinical specialty) (note f.)
  - DISCUSS RESULTS
  - First? (note g.)
    - INITIAL OPINION
    - No record of previous appointment* (same TFC) (note h.)
      - STRUCTURED REVIEW

*within study period (and buffer)

a. Priority_Type in (2. 3)
b. Direct_Access_Referral_Indicator = Y
c. Calculated using: Der_Pseudo_NHS_Number, Appointment_Date, Treatment_Function_Code, Admission_Date, Der_Admit_Treatment_Function_Code, Der_Dischg_Treatment_Function_Code.
d. Der_Procedure_All is not NULL
e. Dominant (first) procedure in custom "diagnostic" list

f. Label of previous attendance was not "diagnostic procedure" or "treatment"
g. First_Attendance in (1, 3)
h. Calculated using: Der_Pseudo_NHS_Number, Appointment_Date, Treatment_Function_Code,

	Order of events (in time) →	Description	Function
1		NEL closest (BEFORE OP) and within 180 days	**REV NEL** Review after NEL
2		EL closest (BEFORE OP) and within 60 days	**POST OP.**
3		NEL closest (AFTER OP)	Look at next closest activity
4		EL closest a (AFTER OP) and within 90 days	**PRE OP.**
5	*OP CLOSEST AFTER* 	OP closest (AFTER). NEL next closest (BEFORE)	**As row 1**
6		OP closest (AFTER). EL next closest (BEFORE)	**As row 2**
7		OP closest (AFTER). OP next closest (BEFORE)	**Move on to "procedure"**
8	*CLOSEST BEFORE* 	OP closest (BEFORE). NEL next closest (AFTER)	No further loop so **Move on to "procedure"**
9		OP closest (BEFORE). EL next closest (AFTER)	**As row 4**
10		OP closest (BEFORE). OP next closest (AFTER)	**Move on to "procedure"**

Table 3: Permutations for attendances with an admission in the same specialty within 6 months. For all other permutations, move on to the "procedure" node.

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