Classifying
Outpatient Activity
by Function

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

Produced for the Midlands Decision Support Network
by The Strategy Unit

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Document control

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Foreword

The number of outpatient attendances in England is now approaching 100 million each year.[1] In 2017/18, the estimated cost of this care was over £9 billion - or 8% of the total NHS England budget. [2,3]

Such is the scale of outpatient activity that its impact is far-reaching. A Strategy Unit analysis for a single Integrated Care System (ICS) showed that, in 2018/19, patients travelled a total of 18.5 million miles to attend outpatient services. These journeys cost them and their families a total of £4.7 million and released 4,400 tonnes of CO_2 to the atmosphere. The cost to the local economy of workers travelling to, and attending, outpatient services was an estimated £18 million.

Of course, most journeys have been more difficult in the last 18 months. Among the many changes to outpatient services, we have seen a rapid move to virtual appointments and accelerated redesign (with consequences still to be fully understood). As an NHS, we are now looking to a future that embraces and consolidates such 'transformation'.

So, isn't it strange how little we know about outpatient activity and, in particular, the purpose, or function, of appointments? Without this knowledge, we will surely struggle to ensure that the billions spent on outpatient services are delivering the best value for the patient and for the public.

Having started from this observation, the Midlands Decision Support Network (MDSN) asked the Strategy Unit (which acts as its development centre) to create a new classification system for outpatient activity – one that would examine activity from the perspective of function, one that might be used to address real-world strategic questions.

This report therefore details the development of a set of rules that categorise outpatient attendances according to their implied function. The report goes on to examine the types of question that such a system can help address. For example, the system may be used to examine -

[1] Hospital Outpatient Activity 2019-20 (2020). NHS Digital.
[2] The Bigger Picture (2020). REAL Centre at the Health Foundation.
[3] NHS England Annual Report and Accounts 2017/18 (2018). NHS England.

specialty by specialty - the upper limit of virtual outpatient work. For those wishing to explore this question, and others, both the algorithm and a detailed appendix have been made freely available.

The report differs from our typical contributions to the Midlands Decision Support Network in that it offers a method, and a rationale for that method, rather than a set of analytical outputs. This is because the method lends itself to such a wide variety of questions, no single report could do justice to them all. Instead, we invite MDSN members (and the rest of the NHS) to test this method in practice. We hope that they will share - with each other, and with us - the new insights that it provides about this hugely significant area of health service activity.

Peter Spilsbury
The Strategy Unit

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1. The evolution of outpatient care

1.1 Motives for service redesign

Outpatient care might be defined as:

Medical attention provided by a clinical specialist, offered in the form of a short-duration appointment.

A conventional summary of outpatient care might suggest that it serves one of three functions: Patients visit specialists seeking an opinion, a diagnosis, or support to manage a long-lasting condition.[4]

While it may be true that these tasks still broadly describe the purpose of many attendances, in recent decades the precise functions of outpatient care have become more differentiated. Advances in technology; the expansion of the allied healthcare professions; and an aging population - among other factors - mean outpatient care now *can* and *must* fulfil an increasingly diverse set of functions.

Over this same period, we have seen opportunities to change how outpatient services are delivered. New paradigms of care are less hospital-centric, and much hope is pinned on virtual consultations: even before the arrival of COVID-19, there existed plans to move a considerable proportion of contacts to virtual platforms.[5]

As a consequence of this evolution, current outpatient service models are, in many cases, no longer fit for purpose. The NHS Long Term Plan thus promised a "fundamental redesign" of outpatient services in the coming years.[6]

1.2 Why consider the function of outpatient attendances?

All healthcare should serve a purpose. It is therefore natural for us to think about outpatient activity in terms of its purpose. Indeed, given the current necessity of service reform, understanding both the precise functions of outpatient care and the scale of each function becomes vitally important.

If we understand the function of an outpatient attendance, we can make a good guess as to the content of that care contact, the resources that may be required, and where it might be delivered. Furthermore, in most

[4] Outpatients: The Future (2018). Royal College of Physicians.
[5] The NHS Long Term Plan (2019). NHS England.
[6] ibid

cases, we will understand the steps that have led to that contact and what is likely to follow. All this information might be used to enhance our understanding of services and support redesign initiatives.

Unfortunately, a standard analysis of outpatient activity will miss this detail, since the function of an outpatient attendance does not form part of the routine commissioning and research datasets. [7] Using existing variables, we might notice that a particular outpatient appointment was a "follow-up", led by a single allied health professional. But we have no immediate way to tell if the function of that appointment was to manage someone's condition or to carry out checks prior to surgery. The nature of the appointment in each case is quite different.

Thus, to better understand how outpatient care is evolving and to inform discussion about service reform, we suggest that analyses consider the function of attendances. The objective of this work, then, is to develop a classification system that labels attendances according to their function.

[7] And integrating new variables is not a simple process.

2. A classification system for outpatient activity

2.1 What is a classification system?

A classification system is a set of rules.[8] These rules are used to label items in a given population (or group) based on the characteristics of each item.

2.2 Why create classification systems?

While classification systems may be developed for many purposes, in broad terms, an effective classification system helps us better understand a population or group. It might achieve this by reducing complexity, by highlighting item characteristics that are relevant to the problem at hand, or by helping us understand the relationships between items.

2.3 For what purpose was our classification system developed?

Our objective was to help the NHS better understand outpatient activity. We aimed to develop a system that would correctly reveal the scale of each of the current functions of outpatient care, whilst making sure the tool would be accessible to other researchers and analysts. This system has been designed specifically to support service redesign initiatives, but may also be of benefit to those conducting analyses for other purposes.

It is also important to note that we did not set out to design a system that would perfectly describe the purpose of every one of the millions of outpatient appointments each year. We stress that this resource has *not* been designed for contracting or performance management purposes, or to influence clinical decision making for individual patients.

2.4 How might one evaluate such a system?

Our answer to this question may be somewhat surprising. Each outpatient attendance will indeed have had a "true" purpose (function). However, when examining outpatient datasets, we have no means to uncover what the true function might have been.[9] We therefore have nothing against which to judge our algorithm, so the idea of "accuracy" is not relevant in this situation.

Thus, we proceed as if there were no existing notions of function. In this case, our function labels (e.g., "initial opinion") should be understood

[8] "A set of rules" is also the definition of "algorithm".
[9] If we did, there would be no need for this work.

only in terms of the rules that define them, rather than in terms of pre-existing ideas. It follows, then, that the rules produced by the classification system cannot be called, “incorrect”, yet they may be unhelpful. It is on this last point that we might ultimately evaluate the algorithm: This classification system might be considered effective if it is helpful.

3. Developing the activity function categories

3.1 Literature review (in brief)

This work began with a review of the literature (both scientific and grey) relating to:

- The functions of outpatient care;
- Classification schemes for outpatient activity; and
- Themes of current outpatient transformation programmes.

A publication by the Royal College of Physicians, "Outpatients: The Future",[10] outlines several of functions outpatient care, which we have recreated in Fig. 1.

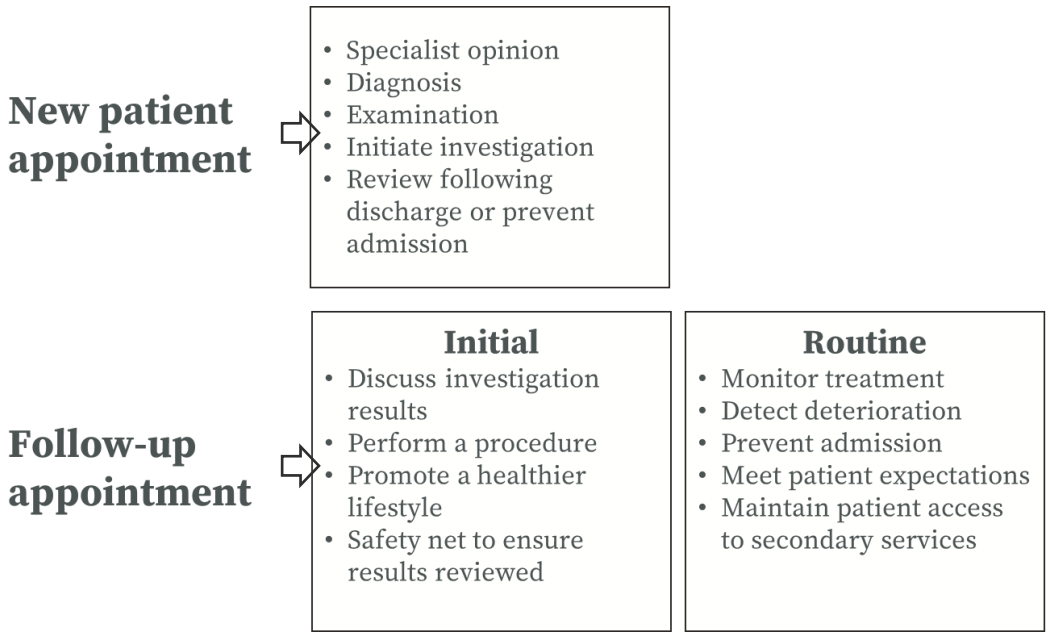


Figure 1. A reproduction of, "Functions of outpatient care", as outlined in the Royal College of Physicians' publication, "Outpatients: The future".

Whilst the review included papers on international reimbursement mechanisms, we found little on classification schemes that examined

[10] Outpatients: The Future (2018). Royal College of Physicians.

outpatient care from the perspective of "function". We were, however, able to collect key themes of current outpatient transformation projects. These are detailed in section 4.2.

3.2 Methods (in brief [11])

Supported by the literature, 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.

While our focus was outpatient activity, some of our function categories required us to link outpatient records to admitted patient data. Our data sources, in this case, were the Secondary Uses Service (SUS) tables[12] in the National Commissioning Data Repository (NCDR). These are patient-level datasets with national coverage. In addition, we employed both common and custom reference tables.

We required that variables display a high level of quality and completeness, whilst also providing clues as to the function of an attendance. We created a pool of variables that fulfilled these criteria and engineered several new variables that measured elapsed time between care contacts. We programmed our algorithm, in R,[13] using a subset of these pooled variables.

A detailed description of the methods may be found in the appendix to this report.

[11] A detailed description of the methods may be found in the (separate) appendix to this report.
[12] Whilst the rules developed therefore use SUS field names, the algorithm could be adapted for use with Hospital Episode Statistics (HES).
[13] R Core Team (2020). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria.

4. The function categories

4.1 Description of the function categories

We arrived at 10 function categories, which are described as follows:

4.1.1 Initial opinion

The function of these appointments (which are typically for patients new to the consultant/speciality) is either to provide an opinion or a diagnosis, or to conduct an examination. We gave this label to appointments with no (recorded ICD-10) procedure which were either:

- Reported as a "first" attendance;[14] or
- For patients who have had no previous outpatient contact (with the same specialty) in the study period, and no admitted patient episode (same specialty) within six months.

4.1.2 Structured review

These appointments allow specialists to monitor the treatment of an existing patient and/or manage a longer-term condition. The appointment will be one in a series of (typically) regularly spaced, follow-up attendances.

4.1.3 Diagnostic procedure

This label is given to non-urgent appointments in which the primary procedure was a diagnostic test or scan.

4.1.4 Discuss results

These are appointments that follow a diagnostic test or scan in which a clinical specialist will discuss the results with a patient.

4.1.5 Treatment

This label is given to non-urgent appointments in which the primary procedure was a medical/surgical/therapeutic treatment or a surgical investigation (i.e., non-diagnostic).

4.1.6 Urgent investigation

This group covers all attendances for which the service request was defined as urgent. These contacts may, or may not, involve a procedure.

[14] Attendances reported as "firsts" are not necessarily the patient's first contact with the consultant.

4.1.7 Pre-operative (pre-op) assessment

This is an appointment with a nurse or a consultant in the days/weeks prior to planned surgery or treatment. It typically involves questions about the patient's health, medical history, and home circumstances. There may be information shared and some discussion with the patient about what to expect. Tests may be carried out.

4.1.8 Post-operative (post-op) review

This is an attendance in the days/weeks following surgery or treatment. Typically, the purpose of such appointments is to assess the success of surgery, to identify complications or adverse effects and to support a patient's recovery. Tests may be carried out.

4.1.9 Review after a non-elective admission (Review NEL)

These appointments follow a non-elective admission in the same specialty. They allow clinicians to monitor a patient's health, to promote a healthier lifestyle, and to establish a medical regimen to prevent future emergency admissions.

4.1.10 Direct Access

These are appointments arranged by a patient's GP - usually for diagnostic services - following which the GP will process the results. The GP thus gains "direct access" to hospital resources, bypassing the traditional gatekeeper – the specialist in the OP clinic. This function is, in fact, a reform in itself: Direct access initiatives may lead to more efficient use of hospital resources and reduced waiting times for patients.[15]

4.2 Function categories and service redesign

Each of the function categories, outlined above, may be amenable to a range of service design interventions. Here, we summarise several broad classes of intervention and suggest which of these interventions may applied to the different function categories (see Table 1).

a. Referral reduction

This category covers interventions designed to reduce new patient demand for outpatient services. It includes initiatives targeting GPs, providing them with pre-referral advice and guidance.

[15] Direct access to diagnostic services (2009). Bonnie Sibbald. British Journal of General Practice.

b. Virtual consultations

Video or telephone outpatient consultations may improve access rates and offer greater convenience for patients. NHS-related road traffic is also reduced.

c. Group consultations

Group consultations can replace one-to-one appointments. They may work well in situations where clinician time is very limited, or where there is a high level of repetition (for example, when working with long term conditions).

d. Nurse/allied-health-professional -led care

Nurses and allied health professionals may have the expertise (or be trained) to lead appointments or group sessions, thereby freeing consultants' time.

e. Patient initiated follow-ups

This initiative gives patients and their carers greater flexibility and may also prevent unnecessary appointments. Follow-ups might be arranged in the event of a flare up or be deferred until need arises.

f. Other initiatives

These include transferring some services to a community setting, direct access initiatives, and triage or risk stratification schemes.

	Referral Reduction	Virtual Csltn.	Group Csltn.	Nurse/ AHP led	Patient initiated follow-ups	Other
Initial opinion	●	●	●	●		Direct access
Structured review		●	●	●	●	
Diagnostic	?			●		CDH* Direct access
Discuss results		●		●		
Treatment				●		
Urgent procedures				●		
Pre-op		●		●		
Post-op		●		●		
Review NEL		●		●	●	
Direct access						

*CDH = Community Diagnostic Hub

Table 1. Function categories and service interventions. Cells marked with a dot suggest that the outpatient function (shown in rows) may be amenable to the intervention (shown in columns).

5. Illustrating outcomes and uses

5.1 This tool has been created for others

A briefing by the Nuffield Trust entitled, "Rethinking outpatient services" observes,[16]

"[T]ransforming outpatient services is complex and is very often specific to particular clinics – and activities within them.

Each clinic is likely to require different design solutions and interventions. Generic planning assumptions about changes in outpatient services are likely to be misleading and, if not applied carefully and appropriately to each type of service and task, plans are likely to fail… "

It would follow, then, that analysis intended to support service reform should be conducted at the levels at which reform takes place - and it is far beyond the scope of any one report to carry out such work. Therefore, our aim has been to make this resource easily accessible to the analysts, managers, and clinical leads - across trusts and commissioning teams – who will carry out these investigations.

However, at this stage we do wish to:

1. Demonstrate that the algorithm produces sensible outcomes
2. Illustrate the types of question that may be addressed in trust-level or clinic-level analyses.

The remainder of this section serves these two purposes.

5.2 Demonstrating broad (ICS-level) outcomes

To produce the following graphics, we applied the rules to activity for patients registered within a Midlands ICS in the 2019/20 financial year.

We start by providing a sense of the relative scale of each of the functions at ICS level (Fig. 2). In this "treemap", each coloured tile represents a function, and the area of a tile is proportional to the number of attendances within that function.

[16] Rethinking Outpatient Services (2018). Nuffield Trust.

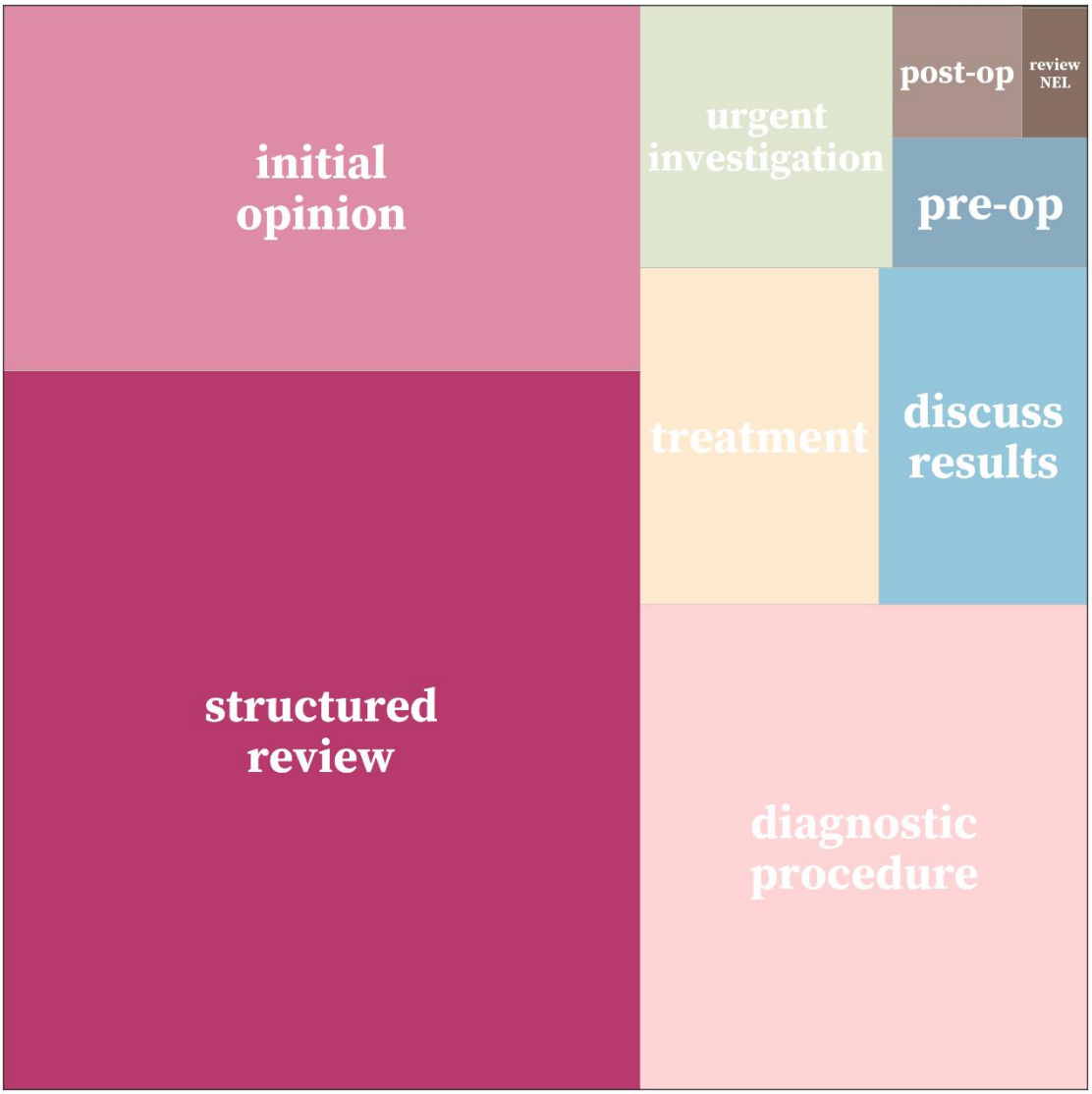


Figure 2. A treemap illustrating the relative scale of each of the function categories. This graphic covers patients registered within a Midlands ICS in 2019/20.

Another way to display the same information is with a bar. In Fig. 3, the bar is shaded according to the proportion of attendances in each function. To the left of the bar, we show a dot. The size of the dot is proportional to the number of attendances represented by the bar.

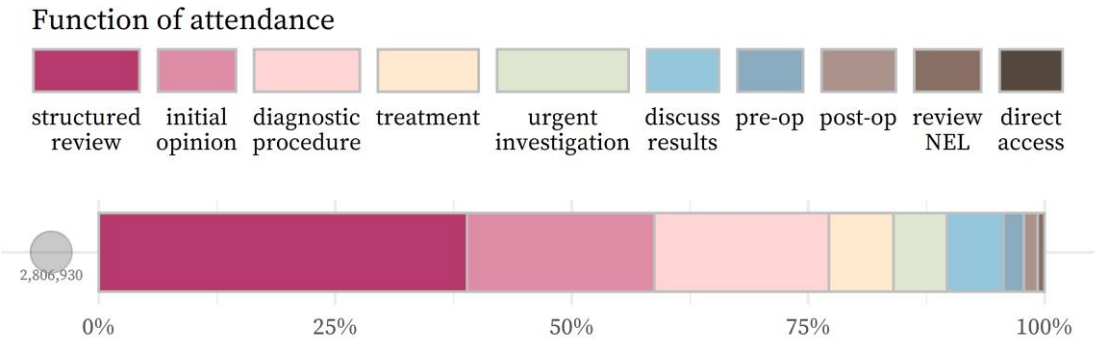


Figure 3. A bar graphic illustrating the relative scale of each of the function categories. This covers patients registered within a Midlands ICS in the 2019/20 financial year.

Using bars, we might visualise how function distributions change across specialties. Fig. 4 shows function distributions for the five *medical* specialties with the most attendances. Here we see that, for instance, a high proportion of attendances within the Diabetes specialty are structured reviews, whilst a low proportion are urgent investigations. For Dermatology, on the other hand, we have a far greater proportion of urgent investigations, which may be due to referrals for possible skin cancers.

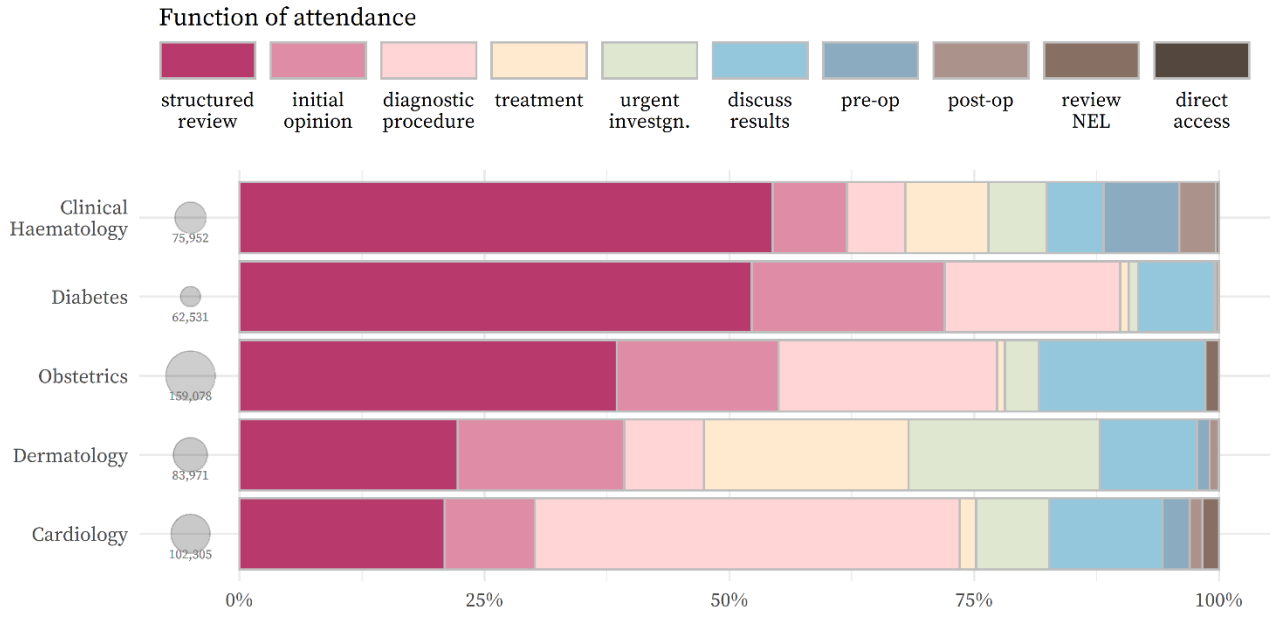


Figure 4. A bar chart showing how the distribution of functions varies across the 5 medical specialties with the most outpatient attendances. Again, the data shows the situation for patients registered within a Midlands ICS in the 2019/20 financial year.

5.3 Questions that may be explored with this resource

Discussions around service reform will involve service users, clinicians, and commissioners. At the heart of these discussions is likely to be the question, "Is there an opportunity to deliver outpatient care more effectively?". This question indeed invites many others – which is where this classification system can help.

In the remainder of this section, we provide several examples of questions that may be investigated using the tool. We will explore these questions at hospital level, using cardiology services at three Midlands hospitals to illustrate.[17]

5.3.1 Is the variation in function distributions, between hospitals, warranted?

Firstly, for context, we might wish to understand how function distributions for Cardiology at Hospital A compare to neighbouring hospitals (Hospital B and Hospital C). In Fig. 5 we see that, for instance, Hospital A had the highest proportion of structured reviews whilst having a similar proportion of "initial opinions" to Hospital B.

It would be important to understand whether this variation is expected, and explained by patients' needs and preferences, or whether it arises due to deviation from recommended clinical practices. If it is the latter, these discrepancies should be addressed in the process of service reform.

[17] Unless otherwise stated, we use data from the 2019/20 financial year.

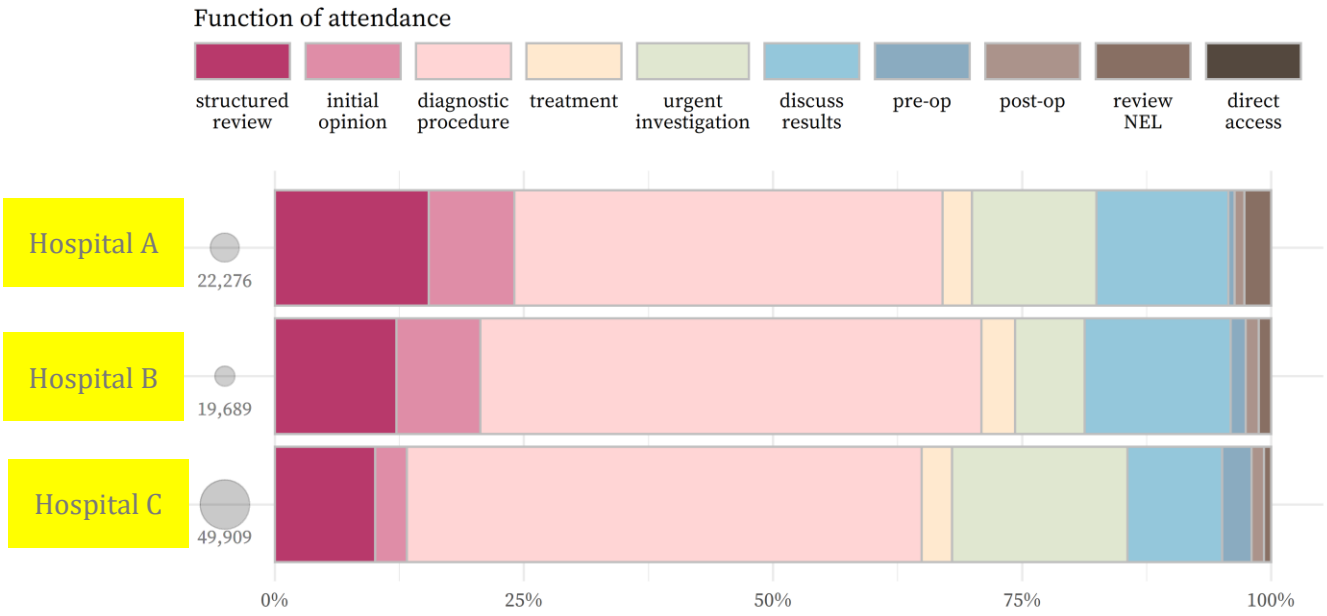


Figure 5. Function distributions for Cardiology at three Midlands hospitals. Data is from the 2019/20 financial year.

5.3.2 Can this service deliver more virtual consultations? What is the upper limit of virtual outpatient work?

The NHS Long-Term Plan set an aim of reducing face-to-face outpatient appointments by a third before 2025.[18] To inform discussion on this topic, we might start by examining the proportion of consultations that have been delivered "virtually" in recent years. It would be useful to investigate these trends in terms of function since some functions will be more amenable to virtual consultations (e.g., structured reviews) than others (e.g., treatment).

Figure 6 shows that, in some cases, the proportion of virtual consultations in these six selected functions jumped from zero to around 75% as a consequence of measures taken during the COVID-19 pandemic. With some caution, we might use Fig. 6, and other sources, to estimate an upper limit for the number of virtual consultations that could be offered for Cardiology at Hospital A (Table 2).

[18] The NHS Long Term Plan (2019). NHS England.

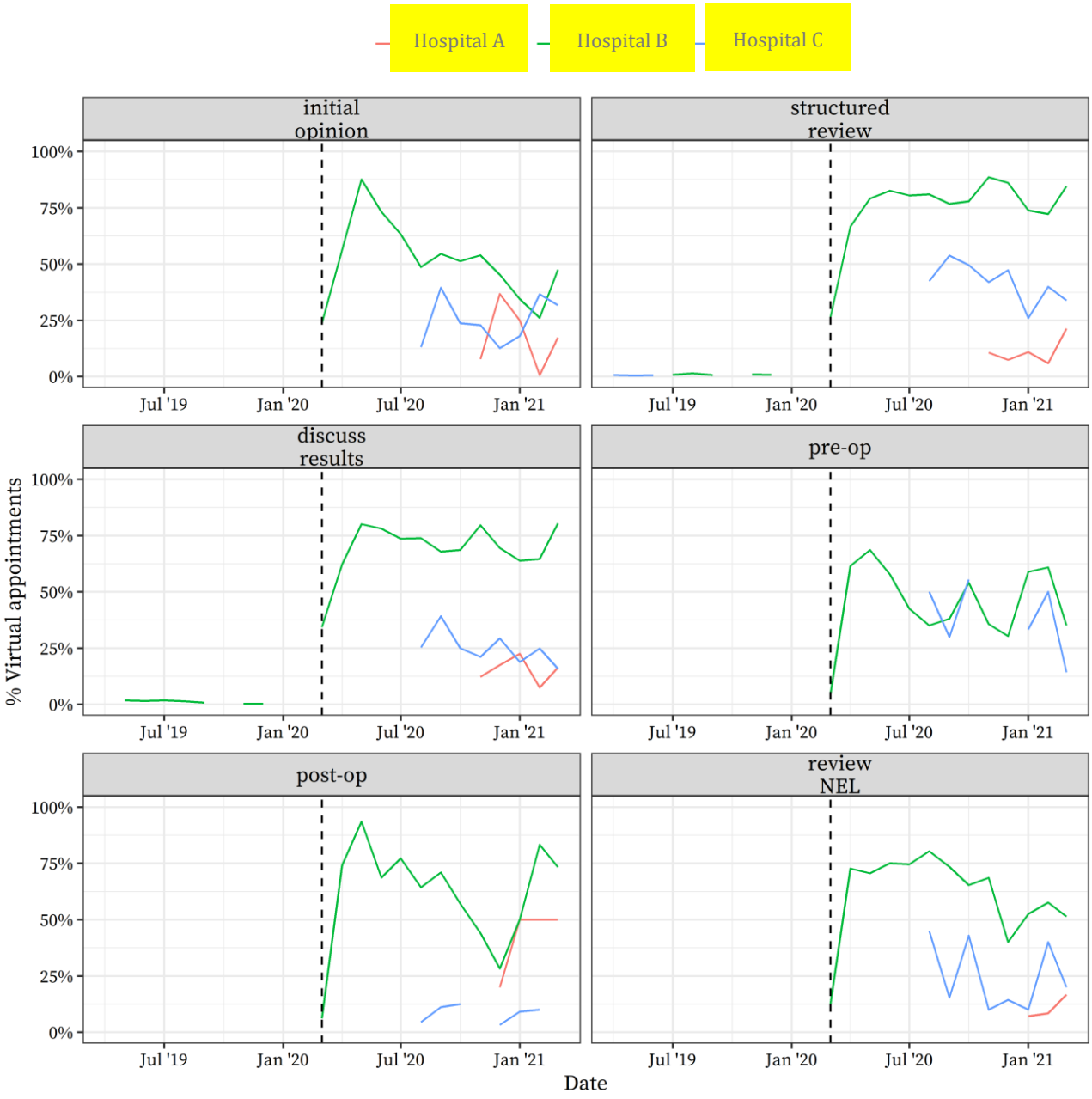


Figure 6. Proportion of virtual attendances for outpatient cardiology services, by month, at three Midlands hospitals. We display the results by function. The dotted vertical line (March 2020) indicates when the COVID-19 pandemic began to affect service provision.

Function	Maximum proportion virtual consultations	Attendances 2019-20[1]	Maximum number virtual consultations[1]
Diagnostic Procedure	0%	9,570	0
Structured Review	50%	3,445	1,722
Discuss Results	25%	2,953	738
Urgent Investigation	0%	2,782	0
Initial Opinion	25%	1,911	478
Treatment	0%	659	0
Review Nel	30%	601	180
Post-Op	50%	217	108
Pre-Op	50%	138	69
Total	NA	22,276	3,296

[1] For illustration only

Table 2. Suggested maximum proportion of attendances, by function, that could be offered as virtual consultations. These proportions been applied to 2019/20 activity for cardiology services at Hospital A. This produces an upper limit for the overall proportion of attendances within the specialty that could be virtual (3,296 / 22,276 = 14%).

Of course, we have seen (in Figs. 4 and 5) that a large proportion of outpatient Cardiology contacts involve diagnostic procedures. These appointments are less likely to be conducted virtually. Thus, the crude estimate in Table 2 – suggesting that a maximum of 14% of contacts could be virtual – is some way short of the national target of 33%. Specialties in which structured reviews (for example) make up a greater share of the activity may have to compensate for specialties like Cardiology if the Long Term Plan's target around virtual consultations is to be met.

5.3.3 How have previous attempts at service design affected activity levels? What levels might we expect in the future?

The "function" label offers a different lens through which to examine outpatient activity trends (Fig. 7). For cardiology services at Hospital A, the number of appointments for diagnostic procedures (and those related to discussion of the results) trebled in the decade before the onset of the COVID-19 pandemic. When thinking about service reform (and all future activities), trends must be considered.

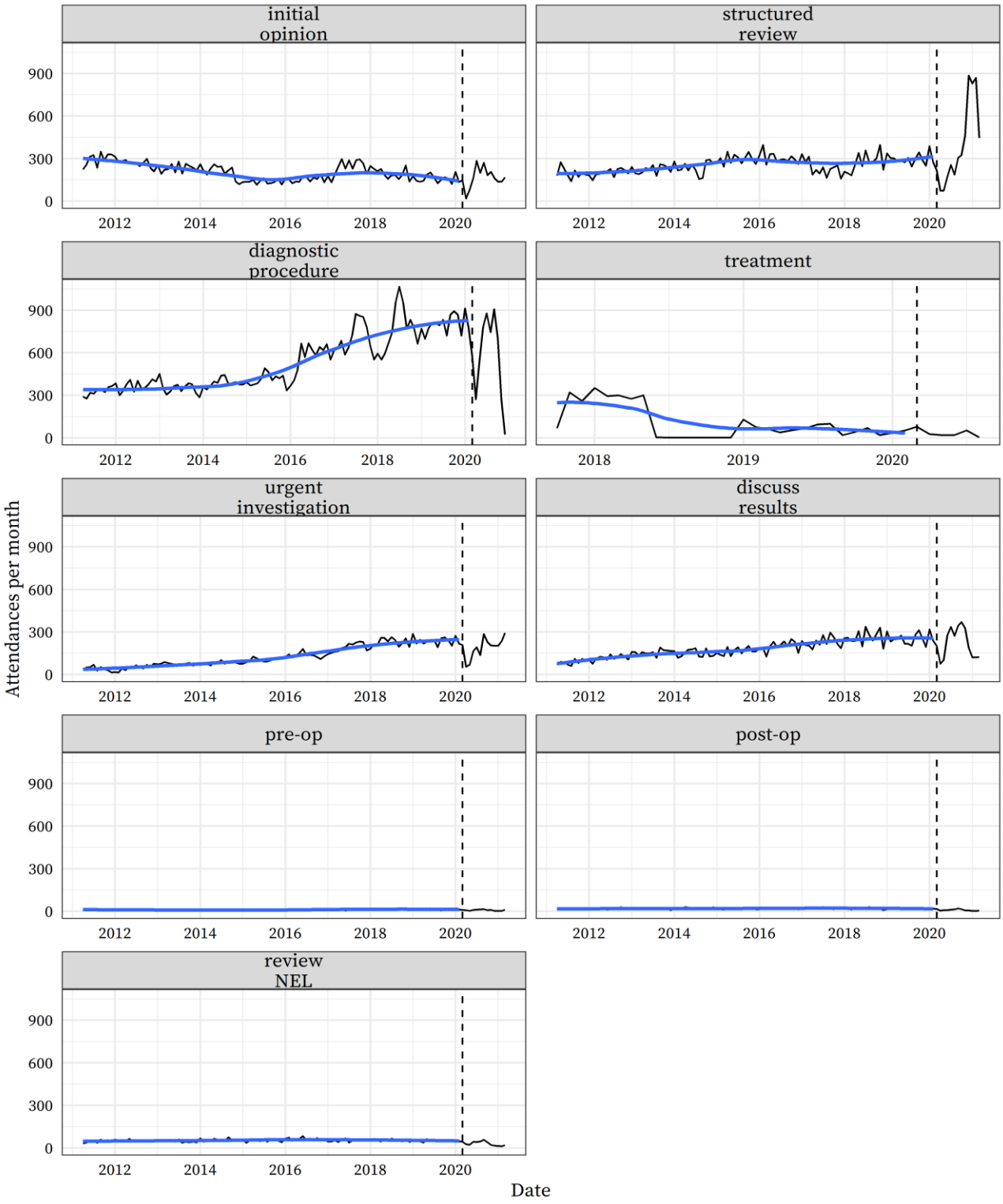


Figure 7. Number of attendances, by month, for outpatient cardiology services at Hospital A. We display the results by function. The dotted vertical line (March 2020) indicates when the COVID-19 pandemic began to affect service provision.

5.3.4 Might there be opportunities to transfer subsets of activity from outpatient clinics to the community setting?

In Fig. 8, we show function distributions for the 5 Primary Care Networks (PCNs) that account for the most attendances to cardiology services at Hospital A. This kind of illustration may interest both commissioners and providers for several reasons.

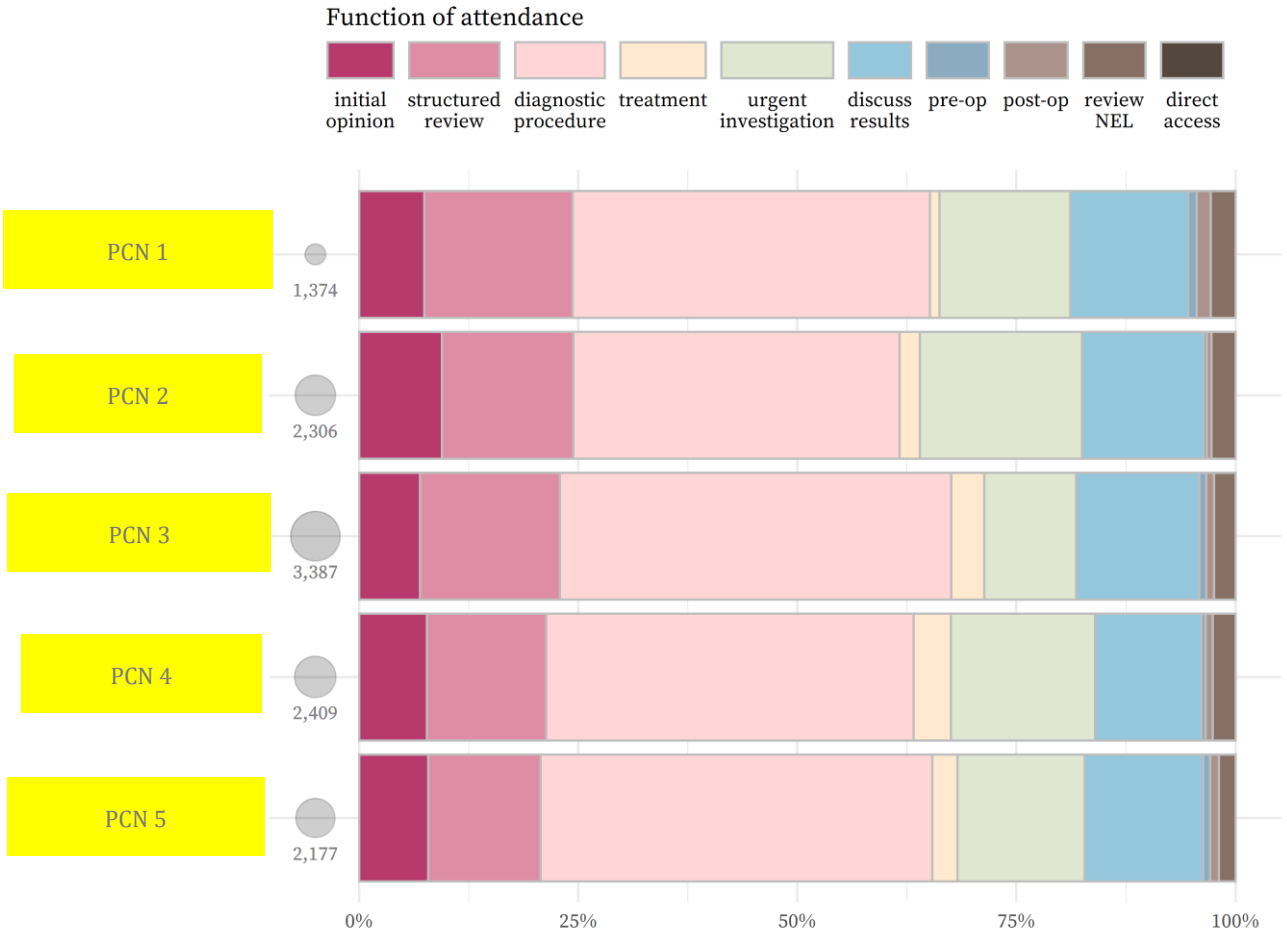


Figure 8. For cardiology services at Hospital A, how do function distributions differ according to Primary Care Network?

From a commissioner perspective, Fig. 8 may provide an opportunity to explore whether subsets of activity within certain function groups might be transferred from an outpatient to a community setting. This may also

be another chance to examine whether the variation we see is warranted. Here, as it happens, function distributions for these five PCNs are similar.

5.3.5 Other lines of investigation

Visualisations like Fig. 8 may be used to explore a multitude of questions:

- Commissioners may consider questions around inequity: Are there certain communities where access levels are low? When in the pathway, which functions account for the majority of this population's contacts, and is this what we would expect?
- A provider might see this as a planning tool that, when used at specialty level, could offer a different perspective on levels of supply. Questions might include, "Are the function distributions as we expected?" and, "Does this offer insights into how the workforce and resources may best be configured?"

We might imagine looking at differences in function distribution by level of deprivation, by ethnic group, or any combination of variables found in - or appended to - SUS outpatient tables. The tool simply creates an extra field in the record-level dataset, giving the user freedom to proceed as they wish.

6. On implementation and improvement

6.1 Implementation

The appendix to this report - produced as a separate document - provides details for the analyst/researcher/interested individual seeking to further understand and/or implement the algorithm. This resource can be found on the website of the Midlands Decision Support Network.[19]

We queried the SUS tables and implemented the algorithm in *R,* using the National Commissioning Data Repository (NCDR) Data Science Server. The algorithm run-time – based on labelling all activity within an ICS, for a single year (within this environment) - was approximately 45 minutes.

The R code and tables used in this project are available under a GNU GPLv3 licence on the Strategy Unit's GitHub page.[20]

Given the relative simplicity of the algorithm, we suggest it could - with moderate effort - be re-written in SQL or in Python. And, as we have noted, the algorithm might be applied to Hospital Episode Statistics. If individuals - or teams - chose to undertake such projects, we would encourage them to share their code, both to prevent possible duplication of effort and to help colleagues in the NHS.

6.2 Improvements

We have suggested that this classification system cannot strictly be labelled "incorrect", but there may be ways to make it more helpful.

One specific area for attention might be our (custom) list of ICD-10 codes covering diagnostic procedures. Those with particular knowledge of coding practices in this field may be able to contribute here. Moreover, given that this resource is designed to support service reform, there may also be some benefit in splitting "diagnostic procedures" into two or more functions (e.g., Imaging, endoscopy, other diagnostics…).

On a practical note, we must also highlight that calculating the time between care contacts was computationally expensive. There may be ways to improve the efficiency of the code, which would lessen run-time considerations and provide opportunities to explore longer time periods and greater volumes of activity.

[19] https://www.midlandsdecisionsupport.nhs.uk/regional-analysis/
[20] https://github.com/The-Strategy-Unit/752_classify_op_activity

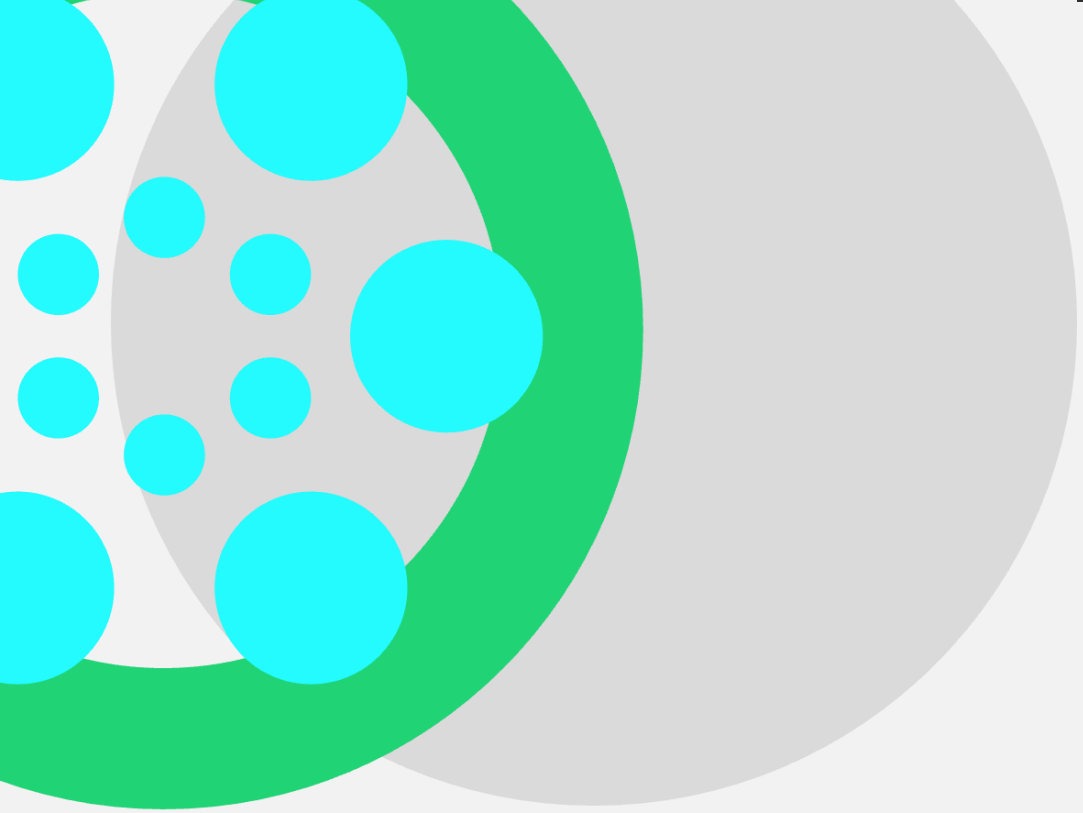
The authors would welcome your suggestions for improving the algorithm (having noted our intentions in Section 2.3). These suggestions may be communicated in two ways:

- Via email. Contact andrew.jones40@nhs.net

- By logging an issue or pull request on GitHub.

6.3 Modifications

It is likely that some clinics and trusts have highly specific functions and/or their own definitions for functions. In such cases, it may be that teams wish to modify the algorithm illustrated here or use the framework to develop their own.



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