

Data Analytics at the NHSBSA

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NHS Business Services Authority

NHSBSA Portfolio

- The NHS Business Services Authority is a Special Health Authority and an Arm's Length Body of the Department of Health and Social Care which provides a range of critical central services to NHS organisations, NHS contractors, patients and the public.



High level NHSBSA Performance Summary - 2017/2018

5.5 million



EHICs provided to UK residents in 2017/18

44,359,316



FP17 dental claim forms processed in 2017/18

2,380,681

Total Reward Statements and Annual Benefit Statements available for current and former NHS employees to view

14.7 million

the number of claims for free prescriptions and dental procedures checked by our loss recovery teams

88k followers on social media sites

74,216

responses to our surveys from our customers and stakeholders in 2017/18



69%

proportion of colleagues who completed the staff survey this year

Over **1,000,000,000** prescription items processed every year



Over **£34 billion**

the amount of money that flows through our books every year

£490 million

paid out in NHS Student Bursaries and Social Work Bursaries



£826 million

total amount of recurring savings the NHSBSA has delivered so far for the NHS and its patients

11 million

applications from patients for help with their NHS health costs

£300 million

saved so far through the NHS Supply Chain contract

£2.7 million

saved through improved childcare allowance reconciliation in Student Services



our contact centre handled

3,841,552

calls in 2017/18

and **784,565** emails

Over **209,430** monthly hits

on our 'Ask Us' online knowledge base

the engagement level of our staff was **78%** in 2017/18

We ranked **113th** out of 434 participating organisations in Stonewall's Workplace Equality Index

£1.9 billion

payments processed for dental providers 2017/18

Our Data Lab

What our Data Lab is used for?

- Insight
- Improving patient care
- Operational Improvements
- Fraud and Error detection
- Driving up data quality
- What if modelling
- Reducing waste
- Impact analytics
- Identifying potential savings

Our Customers



Case Study 1 – Forecasting Activity

What insights can we gather to plan our resources?



Electronic Prescription Service Utilisation

Background

- Electronic prescriptions introduced in 2009 and now represents just under two thirds of processed prescription items.
- GP's are able to send prescriptions electronically to dispenser, meaning it is more efficient and timely for both patients and staff.
 - We want to reach our target of 72% by 2020.
 - We want to target practices with potential to use more electronic prescribing to do so.
 - We want to understand how electronic prescribing is adopted.

Electronic Prescription Service Utilisation

Impact of improving EPS Prescribing

- A 1% increase in EPS can be attributed to £330,000 operational saving.
- Operational costs associated to 1,200 people are employed to scan, process, store and destroy paper prescription forms.
- Potentially £9M per annum total savings to be made.

NHSBSA Operational Savings

All practices to achieve EPS rate of 72%

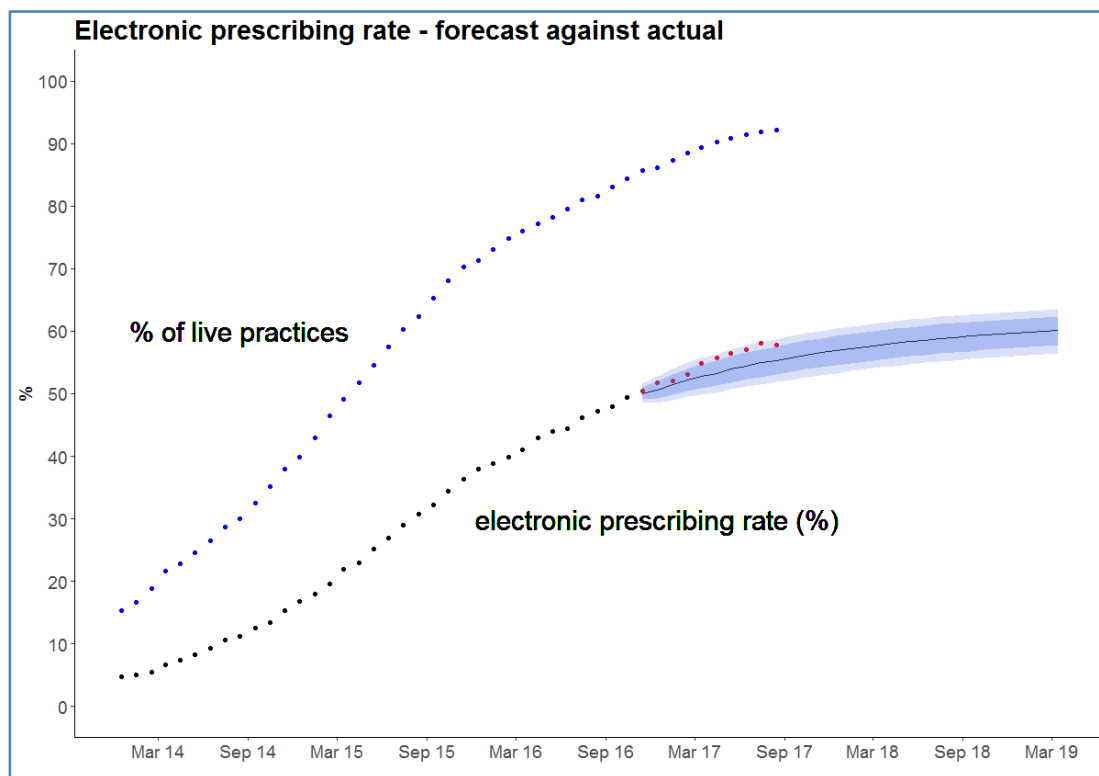
£3M

All practices to achieve EPS rate of 90%

£8.9M

Electronic Prescription Service Utilisation

- We used the ARIMA forecasting technique to predict the take up of electronic prescribing. The number of GP practices which were enabled to prescribe electronically was used as a regressor.



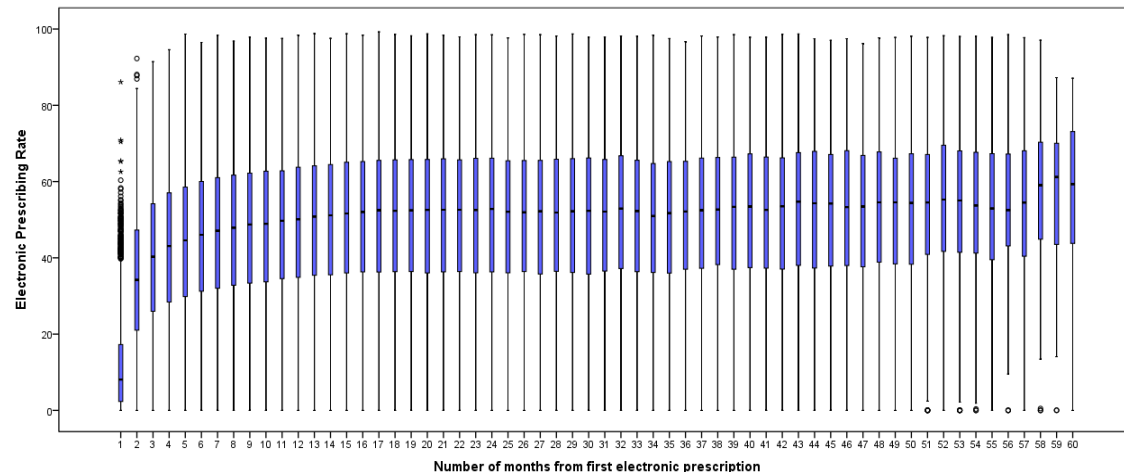
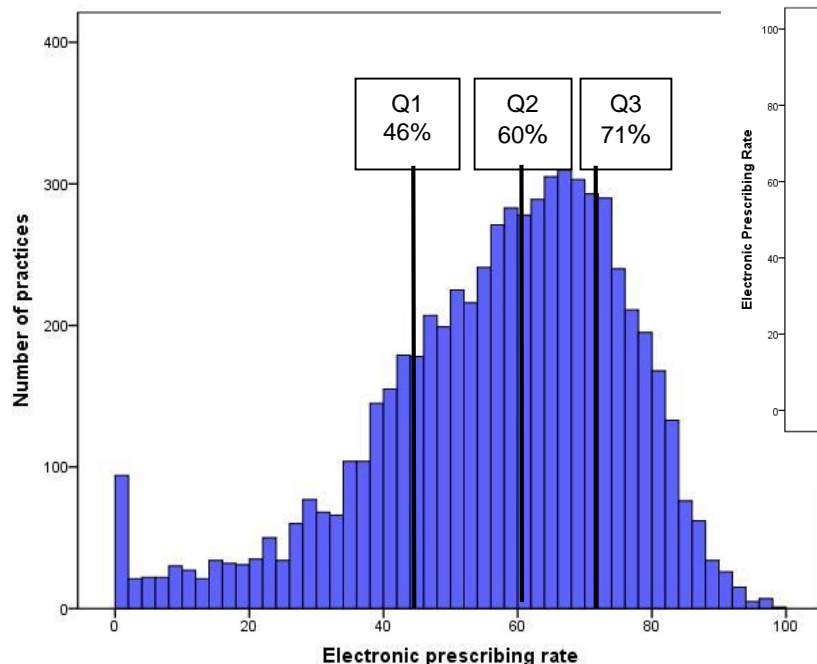
Analysis was based on:

- 3 years of prescription data
- Over 3 billion rows of data
- Over 47 million patients
- 8 different data sets
- Over 7 thousand GP practices

Electronic Prescription Service Utilisation

Key Findings

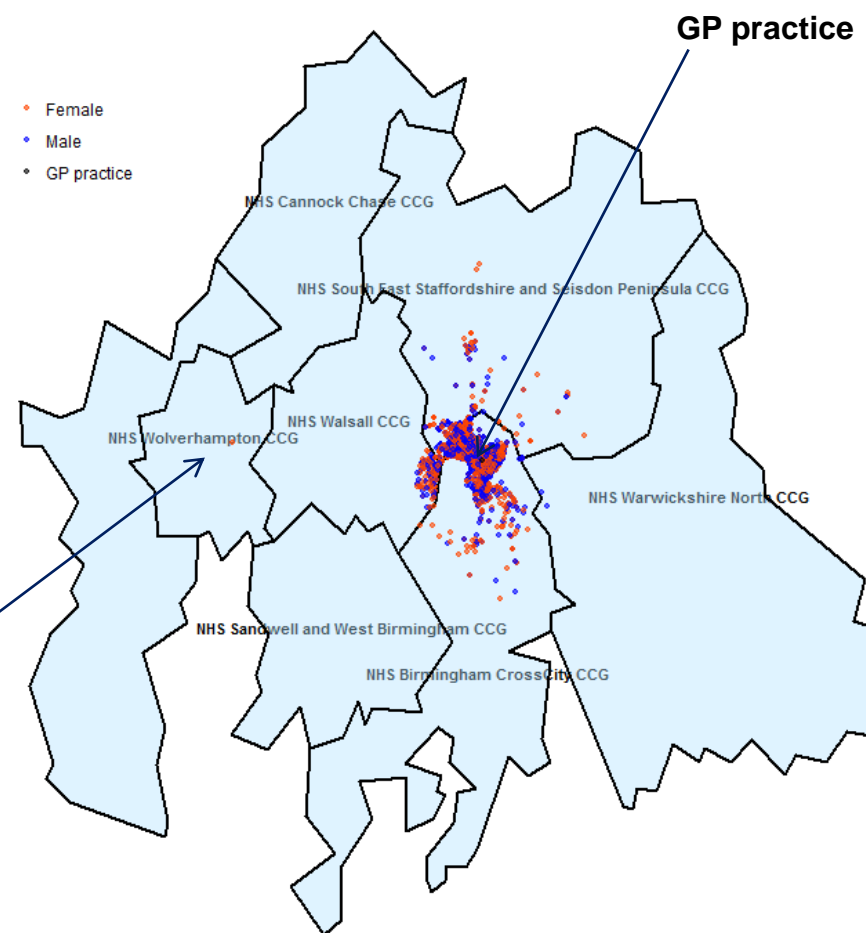
- It is not enough to rely on new GP practices becoming live to increase electronic prescribing. Almost one-third of their items are not eligible for electronic prescribing.
- EPS usage in a practice plateaus at six months from go-live so we need to focus on support and communications to increase the rate in these practices.



Additional insight – Birmingham CrossCity CCG

- With the additional data from electronic prescribing we can see where patients live in relation to GP practices and pharmacies. This can help with planning future services.
- As an example, here is the spread of male and female patients who receive electronic prescriptions for just one practice in Birmingham:

Location of patients in relation to one GP practice in Birmingham



Patients travel to this practice:

- an average of 0.8 miles
- as far as 11.3 miles
- as close as 0.1 miles.

Additional insight from electronic prescriptions - why is this useful?

More complete and additional data will help us to:

- Better understand patient journeys, behaviour and outcomes.
- Understand more about prescribing and dispensing practice.
- Identify variations across patients, prescribing and dispensing populations.

This in turn will help to:

- Inform prescribing guidelines and improve behaviour.
- Plan future healthcare services.
- Improve patient care.
- Identify potential savings for the NHS.



Case Study 2 – Fraud and Anomalies

Using data to find anomalies



Irregularities in the prescribing and dispensing of dependency forming drugs

- Drug abuse isn't just about recreational drugs. Besides marijuana, legal medicines are the most commonly abused drugs in the UK. Some prescribed drugs can be addictive and dangerous.
- Prescribing of addictive medicines has increased 3% over five years.
- One patient in eleven (8.9%) is prescribed one of these medicines.
- Antidepressant prescriptions in England have more than doubled in the past 10 years.
- A recent survey also found that 7.6% of adults had taken a prescription-only painkiller not prescribed to them.

Patient / Pharmacy Habits

Purpose

- To investigate the number of Prescribing Practices and Pharmacies that a single patient visits over a 6 month period and if this could indicate the misuse of drugs by a patient or prescriber.

Why?

- This may uncover potential fraud/error within the system.

How?

- Identify prescribing of drugs with known addictive or misuse properties and investigate any unusual quantities or prescribing patterns.

Patient / Pharmacy Habits

Findings

- Small number of patients received twice maximum dose of painkillers over a six month period.



- Some examples show patients registered at two different addresses, at two different GP practices, in two different CCG areas.

- As well as combinations of pre-paid / exempt prescriptions across practices.



Patient / Pharmacy Habits

Findings

- 2,000 patients (66,000 items) where patients had visited multiple prescribing practices and Pharmacies every month for 6 months, for drugs with known misuse or addictive properties.
- 11 cases of potential fraud have been highlighted.

Next Steps

- The findings have been escalated to the NHSBSA and NHS England Fraud teams for further investigation.

Case Study 3 – Text Analytics

What can we learn about our performance from our data?



Text Analytics for Customer Insight

Purpose

- To investigate how we can use Text Analytics to assist Customer Insight team.

Why?

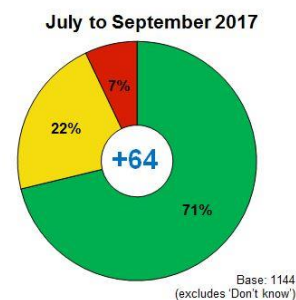
- A significant amount of time is spent by the team manually analysing survey results.

What?

- Using 5,600 responses to the on-going Prescription Prepayment Certificate Survey.
- Can we use Machine Learning to predict how the open-ended survey responses should be coded?

Overall satisfaction with PPC

- July to September 2017 mean score is **8.9** /10 and Net Promoter Score[^] is **+64**.



What promoters said (top mentions from 513 comments)

The process was easy/simple/stress free.
 The process was quick/efficient/convenient.
 Found no problems with the service/satisfactory.
 Excellent/good service.
 It makes it affordable/cost effective/working to a budget.

What detractors said (top mentions from 63 comments)

Too long to receive.
 Gap upon renewal between expiry of previous PPC and arrival of new card.
 Would like online service/application.

Net Promoter Score (NPS) is calculated by grouping the overall levels of satisfaction in terms of promoters, passive and detractors and deducting the percentage of detractors from promoters.

Text Analytics for Customer Insight

Two main approaches:

- **Supervised** – the algorithm learns from codes and applies that knowledge to categorise the remaining responses.
- **Unsupervised** – put all of the responses in the mix without any context and ask to the algorithm to categorise them.

How?

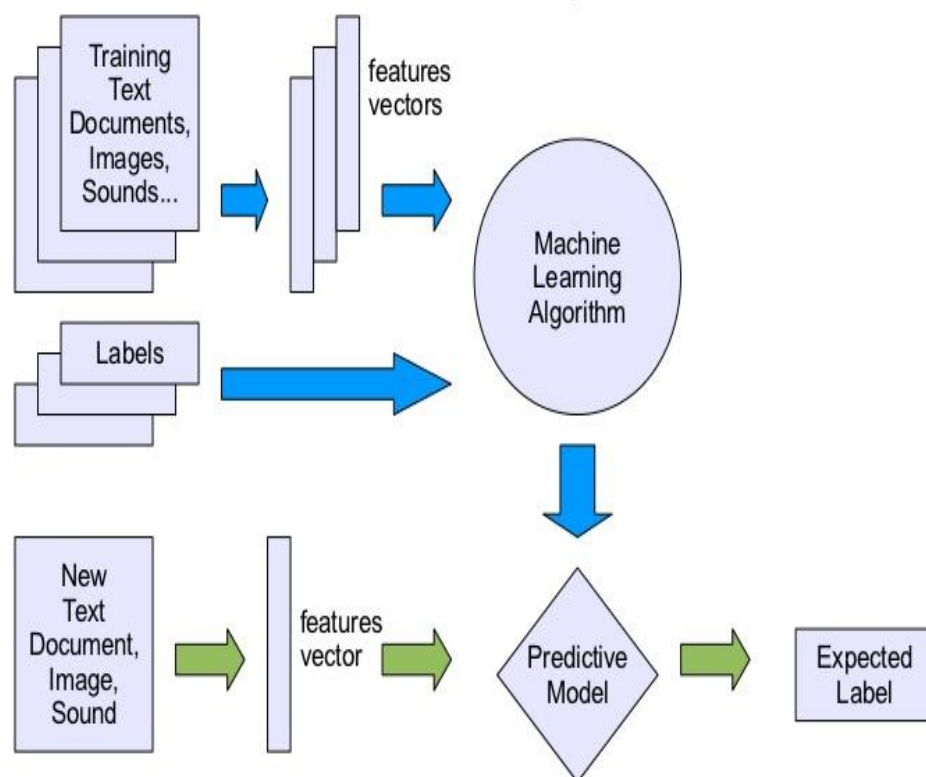
Supervised approach

- Model created based on 2,000 coded responses.
- Tested model on 700 text responses.
- Output compared to the labels assigned by the Customer Insight Team.

Text Analytics for Customer Insight

How?

- **Training Data** - Data is labelled by humans (CI Team).
- **Algorithm** - trained on a “bag of words” with labelled data from training data.
- **Prediction** – Prediction made on our test data.
- **Accuracy** - Accuracy of predictions compared to labels.



Case Study 4 – Patient Safety in ePACT2

What can we learn about patient safety from our data?

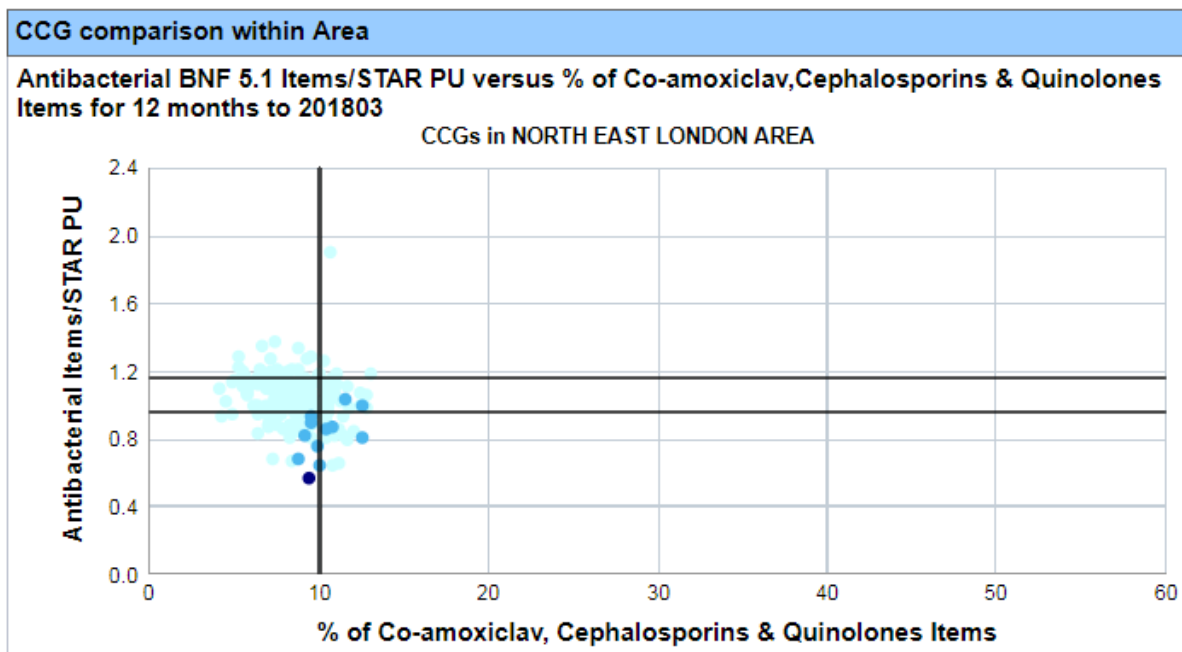


ePACT2

- Provides authorised NHS users with free access to a wide range of prescription data not available in the public domain due to its sensitivity.
- NHSBSA create a number of dashboards that allow CCG's to understand the variation in prescribing across GP practices, within a CCG and nationally.
- Dashboards are created in conjunction with cross-NHS working groups, Academic Health Science Networks (AHSN's) to ensure clinical appropriateness.

Antimicrobial Resistance

- The dashboard was created in conjunction with NHS England and a wider group of NHS colleagues and clinical specialists and clearly provides CCGs with information to establish how they and their GP practices are performing against their targets.
- The quadrants show how CCG's are performing against national NHS England targets. All CCG's are a blue dot on the plot.
- Camden CCG (highlighted dark blue) is one of the best performing.
- If all CCG's replicated the same rate of prescribing then 40% fewer antibiotics would be prescribed across the country.



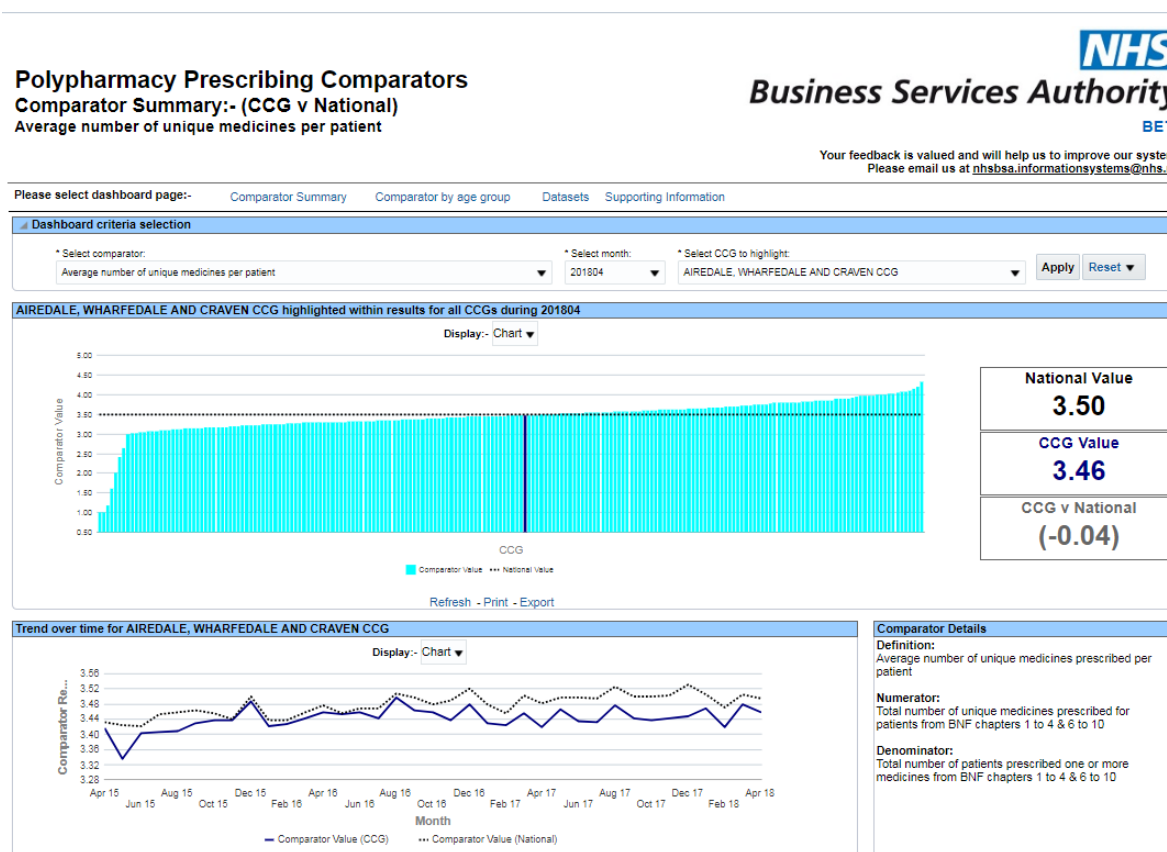
PolyPharmacy

Purpose?

- To provide insight into prescribing of multiple medicines for individual patients in primary care.
- To provide potential metrics to show the variation of Polypharmacy across England to help CCGs and others to target their work plans to address PolyPharmacy.

Why?

- Reducing the inappropriate use of multiple medicinal items by an individual will:
 - Reduce the risk of harmful interaction of drugs on individual patients.
 - Reduce spend of ineffective or harmful prescribing.
 - Reduce hospital admissions for adverse reactions to medicines that could be avoided.



Items which should not be routinely prescribed in Primary Care

- Introduced in November 2017, this dashboard reports on spend and volume of items prescribed on a list of 18 treatments, drawn up with family doctors and pharmacists, deemed to be ineffective, over-priced and of low clinical value.
- Based on our current drug mapping, the cost to the NHS is £24.4M in the latest quarter (February to April 2018).
- The data can be broken down to GP Practice level, making it as relevant as possible for care commissioners to use.

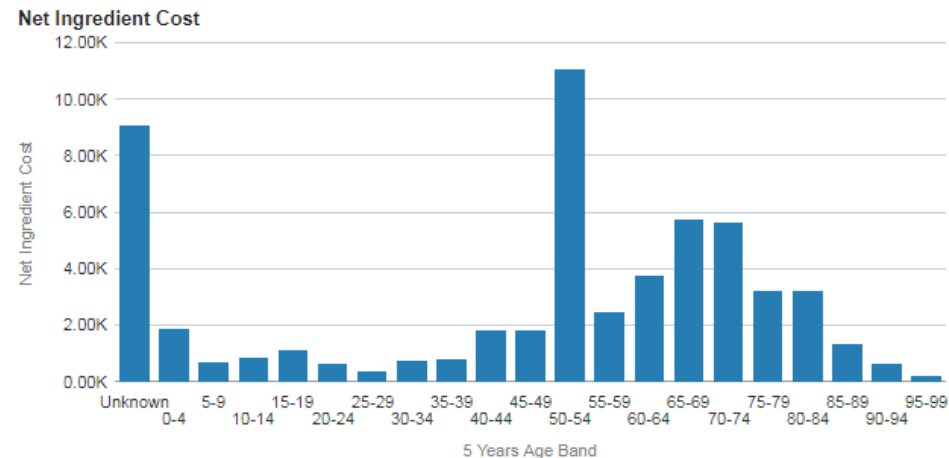
National Data (Feb 18 - Apr 18)

Medicine Category	Items	Net Ingredient Cost (£)	Actual Cost (£)	No. of identifiable patients
Co-Proxamol	5,590	977,908.57	907,858.43	1696
Dosulepin	170,114	348,059.94	328,193.45	55022
Glucosamine and Chondroitin	1,428	22,990.91	21,410.07	566
Herbal Medicines	1,174	17,885.57	16,667.69	602
Homeopathy	652	7,100.97	7,079.99	382
Immediate Release Fentanyl	7,261	2,149,841.49	1,995,044.49	1327
Lidocaine Plasters	48,755	3,720,706.97	3,453,977.86	24496
Liothyronine	14,288	6,054,176.86	5,618,161.81	6069
Lutein and Antioxidants	5,222	42,777.40	39,971.17	2002
Omega-3 Fatty Acid Compounds	34,414	1,074,103.22	997,847.82	13457
Once Daily Tadalafil	40,187	2,086,023.55	1,936,530.64	18316
Oxycodone and Naloxone Combination Product	13,021	939,746.40	872,335.41	3785
Paracetamol and Tramadol Combination Product	18,508	144,771.88	135,190.61	8007
Perindopril Arginine	22,554	282,757.73	262,575.13	9864
Prolonged-release Doxazosin	123,199	1,402,403.82	1,304,606.68	48043
Rubefaciants (excluding topical NSAIDs)	199,656	1,109,123.34	1,031,566.49	116084
Travel Vaccines	24,973	421,933.95	391,562.46	4151
Trimipramine	9,789	3,628,240.91	3,366,745.20	3091
Grand Total	740,785	24,430,553.48	22,687,325.39	312176

Homeopathic Analysis

- ePACT2 can be utilised to explore prescribing for particular medicines.
- Analysis shows unusual prescribing pattern in 50-54 year olds.
- Bristol CCG accounts for 77.3% of all 50-54 homeopathic prescribing.

How does the spend on homeopathic medicines vary by age?



How is each CCG contributing to the national totals?

Commissioner / Provider	Net Ingredient Cost	Items
BRISTOL, NORTH SOMERSET & S GLOS CCG	21,345.91	596
WEST KENT CCG	3,149.44	291
SHEFFIELD CCG	2,224.98	315
KERNOW CCG	1,930.99	47
HIGH WEALD LEWES HAVENS CCG	1,757.81	411
BIRMINGHAM AND SOLIHULL CCG	1,500.96	187
NORTH, EAST, WEST DEVON CCG	931.95	168
DORSET CCG	840.96	119
SOUTH WORCESTERSHIRE CCG	822.27	8
HERTS VALLEYS CCG	808.31	105
WIRRAL CCG	782.06	52
MANCHESTER CCG	777.05	37
WILTSHIRE CCG	599.87	55
GLOUCESTERSHIRE CCG	597.94	81
LEWISHAM CCG	552.24	14

What is the distribution of items and spend within the CCG by age?

Commissioner / Provider: BRISTOL, NORTH SOMERSET & S GLOS CCG

5 Years Age Band	Items	Net Ingredient Cost	Number of patients
Unknown	41	576.58	8
0-4	6	35.64	5
5-9	7	59.43	7
10-14	20	142.77	11
15-19	38	417.61	14
20-24	12	297.42	4
25-29	8	90.36	7
30-34	9	121.44	7
35-39	21	197.55	10
40-44	14	881.22	12
45-49	40	901.61	18
50-54	73	8,562.55	18
55-59	34	1,187.23	16

Drug Prices

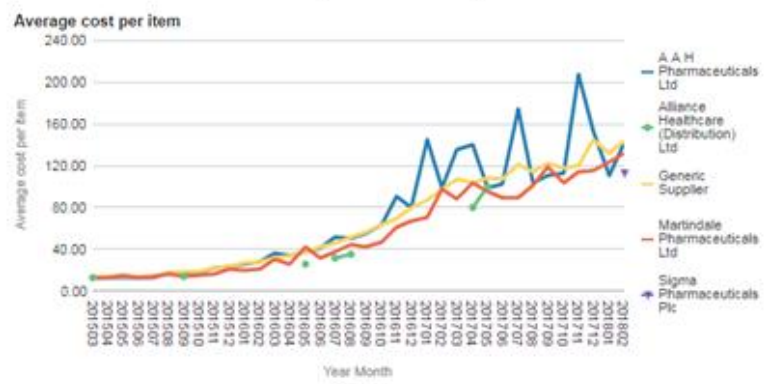
- A bespoke analyses of Atropine 1% eye drops exploring drug price variation over time.
- The price of this product has increased over 19,000% since 2004.
- We can use our data to understand how supplier behaviour could have impacted prices.
- This type of analysis can be produced for any drug, over a large time period.

Atropine 1% eye drops 36 month analysis

Pricing for Atropine Sulphate 1% Eye Drops 36 months to 2018-02

Items
139K
The number of times a product appears on a prescription form.

NIC
9.05M
The cost of the supplied item(s)

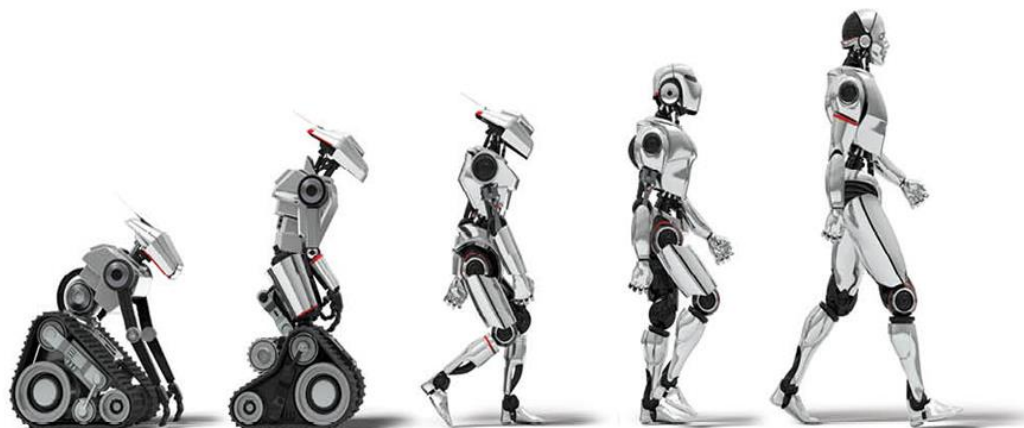


Supplier Name:

Year Month	Items	Net Ingredient Cost	Average cost per item
201611	10	907.53	90.75
201612	8	640.24	80.03
201701	6	871.50	145.25
201702	8	794.08	99.26
201703	4	542.35	135.59
201704	7	967.80	141.11
201705	11	1,090.54	99.14
201706	12	1,240.46	103.37
201707	9	1,575.99	175.11
201708	16	1,669.91	104.37
201709	13	1,444.69	111.13
201710	12	1,360.84	113.40
201711	16	3,333.90	208.37
201712	10	1,533.60	153.36
201801	10	1,111.30	111.13

The Future....

What next?



What next?

- Data governance – We will continue to improve the quality of our data and collect additional data where there is value in doing so.
- Voice to text – we are looking at technologies to create text from speech to analyse customer sentiment and our performance in dealing with queries.
- Deploying some of our data science insights into operational efficiencies and anomaly detection.
- Collaborations with other NHS organisations to expand the availability of NHS data for data science.

Any Questions?

