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Pathways

Alexander Gamble

Henry Scott-Green

Iustin Sibiescu

Access via: <https://mighty-castle-7537.herokuapp.com/>



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The Problem

What does Pathways solve?



- Guy's and St. Thomas' NHS trust is world-famous for cutting-edge research and innovation
- **1st Trust Value:** Put patients first
- **1st Trust Pledge:** Improve patient involvement in the decision making process

The Problem

Information Delivery



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- Guy's and St. Thomas' NHS Trust identified a weakness in information delivery
- Critical treatment, symptom and nutritional information was delivered via paper handouts
- Information was lost and patients were confused
- **The solution?** UCL Computer Scientists!



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Research

What do patients want?

Trust Research

Respondents to application survey



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Patient

Relative

Would you like an app:



Would you prefer a website:



Conclusion: Half of trust patients and 75% of relatives want a mobile app or website

Source: Guy's and St. Thomas' NHS Trust Internal Research

Platform Research

Clinic visit



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Response

Do you own a smartphone?



If yes, is it iOS or Android?



Do you have access to a laptop?



Conclusion: Smartphone ownership is mixed, laptop access is commonplace

Source: Development Team Clinic Visit; GSTT Research

Research Conclusions

What do patients want?



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Patients want:

- A replacement for paper handouts
- A product accessible to everyone with no technical requirements
- A product that is easy to use, even with minimal experience of technology

Source: Development Team Clinic Visit; GSTT Research



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Objectives

What were our priorities building Pathways?

Requirements

Pathways must...



- Help patients make informed treatment decisions
- Introduce no risk of data security issues
- Contain customisable information for every patient
- Place no financial strain upon patients
- Allow patients to view all treatment information ever assigned
- Allow professionals to add and edit information at any time
- Reduce patient stress
- Remove the need for inefficient paper based systems
- Offer logs of every action taken for accountability

Source: Interviews with the Guy's and St. Thomas' clinical teams



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The Solution

What is Pathways?

Welcome to your hub, Henry Scott-Green

Access your treatment information via the buttons below.

Information



Radiotherapy



Investigations and Procedures



Surgery



Trials



Systematic Anti-Cancer
Therapy



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[Home](#) / Category: Information

Stomach Cancer

[Types of stomach cancer](#)[The stomach](#)[12/01/2015](#)[06/04/2015](#)[28/04/2015](#)[Approximately 28/05/2015](#)[Approximately 11/08/2015](#)

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Stomach Cancer

⊕ Types of stomach cancer

Around 7,300 people are diagnosed with stomach cancer in the UK each year. There are different types but this section is about adenocarcinoma, which is the most common type and accounts for 95% of all stomach cancers.

Adenocarcinoma starts in the glandular cells of the [stomach lining](#).

Less common cancers that can start in the stomach include:

- [soft tissue sarcomas](#), including gastrointestinal stromal tumours (GISTs)
- [lymphomas](#), such as mucosa associated lymphoid tissue (MALT) lymphomas
- carcinoid tumours.

The tests and treatments for these cancers are different from the ones covered in this section.

⊕ The stomach

12/01/2015

06/04/2015

28/04/2015

Approximately 28/05/2015

Approximately 11/08/2015

Edit Account

Create Patient



NHS Number

Search

Manage Teams

Manage Medical Professional Accounts

Manage Treatment Information

Recently changed patients

Jon Dwight
29170031

Alexander Gamble
48204853

Iustin Sibiescu
92003142

John Smith
3582813924

Paul Keat
92832010

Henry Scott-Green
28391870

Alexander Gamble

Create new state

Edit Patient

This is the information Alexander Gamble will see:

Information dated 28/04/2015:

#	Module Name	Category	Subcategory	Edit	Delete
1	What is the oesophagus?	Information	Oesophageal Cancer		
2	Types of oesophageal cancer	Information	Oesophageal Cancer		
3	Patient advice	Investigations and Procedures	Comments and concerns		
4	Trials in stomach cancer	Trials	Stomach cancer trials		

Information dated 10/03/2015:

#	Module Name	Category	Subcategory	Edit	Delete
1	What is the oesophagus?	Information	Oesophageal Cancer		

Edit Patient:

Name**Email****NHS Number****Teams Assigned** Clinicians Chemotherapists

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Hub / Patient: Alexander Gamble / Edit treatment state

28/04/2015



Update date

Categories

Information	<input checked="" type="checkbox"/> 2
Radiotherapy	<input checked="" type="checkbox"/> 0
Investigations and Procedures	<input checked="" type="checkbox"/> 1
Surgery	<input checked="" type="checkbox"/> 0
Trials	<input checked="" type="checkbox"/> 1
Systematic Anti-Cancer Therapy	<input checked="" type="checkbox"/> 0

Subcategories

Stomach Cancer	<input checked="" type="checkbox"/> 0
Oesophageal Cancer	<input checked="" type="checkbox"/> 2

Information Modules

<input checked="" type="checkbox"/> What is the oesophagus?	Preview
<input checked="" type="checkbox"/> Types of oesophageal cancer	Preview
<input type="checkbox"/> Causes of oesophageal cancer	Preview
Update Treatment State	

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Types of stomach cancer

Preview

Edit

Delete

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- [lymphomas](#), such as mucosa associated lymphoid tissue (MALT) lymphomas
- [carcinoid tumours](#).

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The stomach

Preview

Edit

Delete

The stomach is a stretchy muscular bag, which stores food and helps to break it down (digestion).

The stomach is in the upper left-hand side of the tummy area (abdomen). An adult's stomach is about 10 inches (25 centimetres) long. It can expand to hold about a litre of food.

The upper part of the stomach joins to the gullet (oesophagus). The lower part of the stomach joins to the first part of the small bowel (the duodenum). The pancreas, gall bladder and liver are close to the stomach. They produce juices and enzymes (chemicals) that help us digest food.

After food is chewed and swallowed, it passes down the gullet into the stomach. The stomach churns up food and mixes it with acid and enzymes that help break it down into much smaller pieces. This is so our bodies can absorb the nutrients we need to give us energy and keep us healthy.


Semi-solid food then passes from the stomach into the small bowel. Enzymes from the stomach and pancreas help the small bowel absorb important substances from food, such as vitamin B12, iron and calcium.

Editing for Information

Which subcategory?

Stomach Cancer

Types of stomach cancer

 Upload or fetch images

Update module

Sans Serif ◆ Normal ◆ B I U ~~S~~ A      

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Clinicians

Clinicians at GSTT



Doctors

Jenny White

Delete

Radhika Chenyipat

Delete

Dean Mohamedally

Delete

Sarah Payne

Delete

Add Doctor



Patients

Jon Dwight

Delete

Alexander Gamble

Delete

Iustin Sibiescu

Delete

John Smith

Delete

Paul Keat

Delete

Henry Scott-Green

Delete

Add Patient

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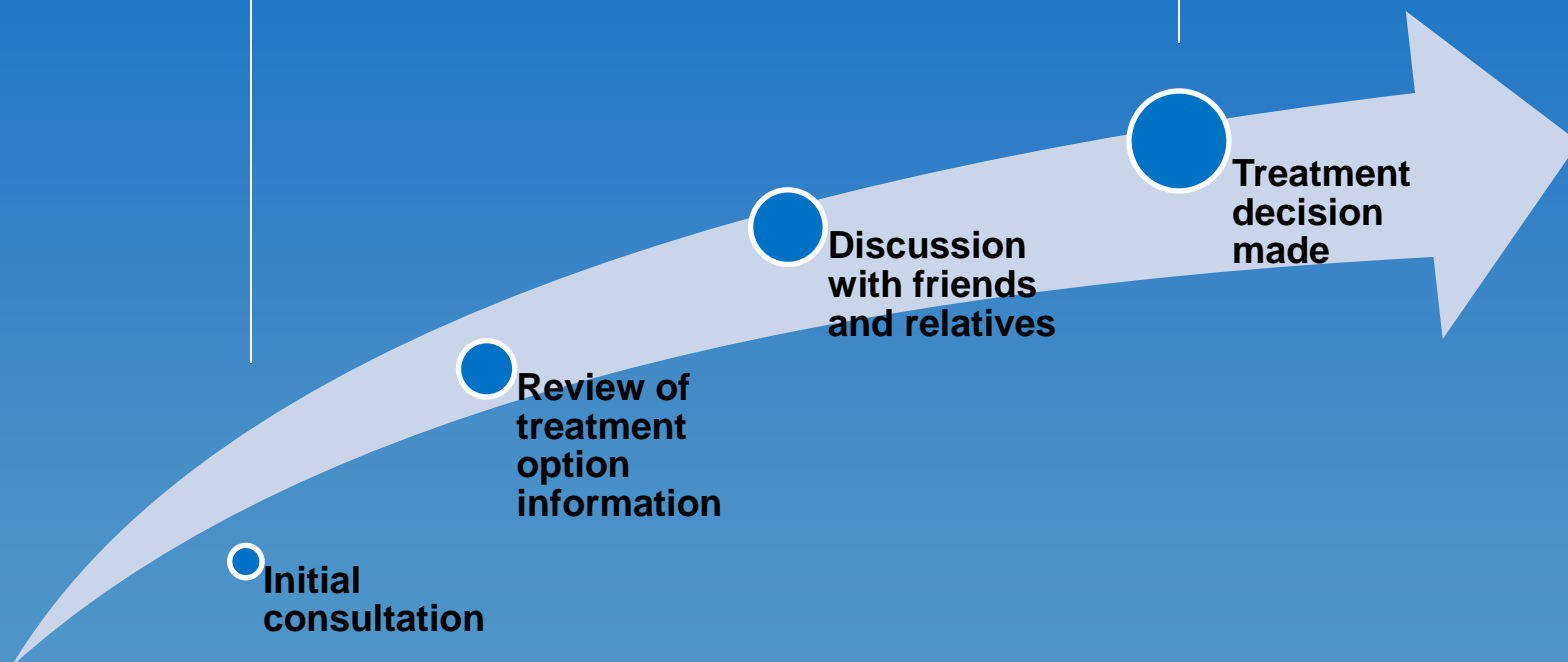
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Decision Making Process

Where does Pathways fit?



Pathways provides an end-to-end information delivery platform to assist patients throughout the decision making process



Key Features

Pathways features...



- Personalised treatment information
- Full treatment history
- Device agnostic
- Strict access controls
- Team management
- Live data set
- Action logs for accountability
- Intuitive user interface
- Extensibility via API



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Development

How did we make Pathways?

Project Management

Engineering Methodology



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Waterfall Management

- Step-by-step progress through deliverables
- Ineffective at handling requirements churn

Agile SCRUM Methodology

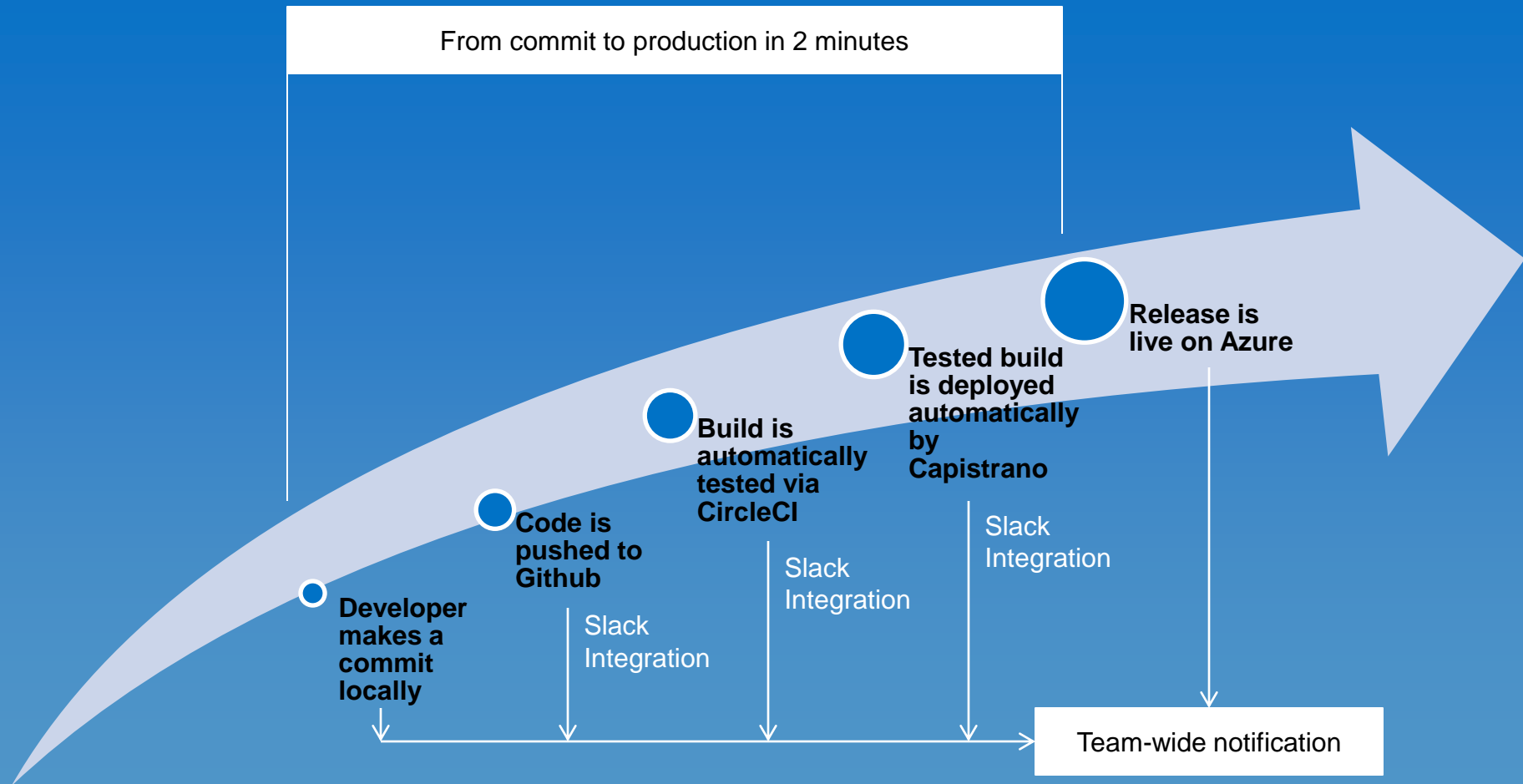
- Intensive 3-7 day SPRINT sessions
- Daily progress meetings on Slack
- Co-located team to improve communication

Continuous Integration

- Rapid product iteration
- Efficient identification and resolution of bugs
- Automated testing to validate builds

Tool Chain

Pathways deployment process



Collaboration Tools

Communication & Development



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GitHub

- Version control
- Internal bug tracker
- 'Git flow' methodology



Axosoft

- Client-facing issue tracker

Collaboration Tools

Communication & Development



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Slack

- Internal communication
- Standup team meetings
- Git & CircleCI integration



Dropbox

- File-sharing between the team

Technology Stack

Development Framework



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Framework: Ruby on Rails

- Large number of powerful gems to more easily implement features
- Rapid prototyping thanks to semantic syntax
- Excellent community support

Hosting: Microsoft Azure

- NHS data security compliant
- Toolchain integration for automated deployment via Capistrano & CircleCI
- Pay for what you use, cheap for beta tasting, easy to scale

Hosting: Heroku

- Saved the day when Microsoft turned off Azure
- No patient data – hosts demonstration only

Libraries

We used...



Rspec + Capybara

- Automated testing

Rubocop

- Code quality analysis

Faker

- Mass data generation for testing

Capistrano

- Automated deployment

Paperclip

- Image hosting

Bootstrap

- Front-end development

Slim HTML

- Rapid prototyping

CircleCI

- Continuous integration

Jquery

- Date section

RailRoady

- Automated system diagrams

Devise

- Authentication and access management

PG

- Gem for interfacing with Postgres database

Testing

How do we know Pathways works?



- Automated testing: Rspec + Capybara

```
1 require 'rails_helper'
2
3 RSpec.describe Patient, type: :model do
4
5   context 'associations' do
6
7     it { should have_one(:pathway) }
8     it { should have_many(:treatment_states) }
9     it { should have_many(:treatment_modules) }
10  end
11
12
13 end
~
~
```

Test cases

Results

```
λ kat gstt → λ git master* → rspec
Run options: include {:focus=>true}

All examples were filtered out; ignoring {:focus=>true}
.....

Finished in 0.52997 seconds (files took 2.25 seconds to load)
10 examples, 0 failures

Top 10 slowest examples (0.02856 seconds, 5.4% of total time):
  the categories view asserts the number of categories is correct
    0.00935 seconds ./spec/features/treatment_module_features_spec.rb:8
  DoctorsController should force you to login
```

User Acceptance Testing

Project evaluation



- We provided Pathways access to the trust team for user acceptance testing
- Issues, bugs and feature requests were raised by the clinical team through the client-facing ticket tracker
- Tickets were then tracked in the internal tracker and fixed

User Acceptance Testing

Bug management



Client facing ticket tracker

The screenshot shows a web interface for tracking issues. At the top, there are tabs for 'Issues', 'Pull requests', 'Labels', and 'Milestones'. A search bar contains the query 'is:issue is:closed'. Below the search bar, there are filters for '4 Open' and '9 Closed'. The main list of issues includes:

- Header URL broken - No client ticket** (bug) - #10 opened 16 hours ago by henrysg93 - In progress
- Doctor login page is displaying inconsistent formatting - Client ticket #16** (bug) - #8 opened 18 hours ago by henrysg93 - Resolved - Client ticket
- Password reset functionality down - Client ticket #15** (bug) - #7 opened 18 hours ago by henrysg93 - In progress
- Date selection broken when preview module has been pressed - Client ticket #14** (bug) - #6 opened a day ago by henrysg93 - Resolved - Client ticket
- Patient admin is missing - Client ticket #12** (bug) - #5 opened 2 days ago by henrysg93 - Resolved - Client ticket
- Patient timeline navigation errors - Client ticket #3** (bug) - #4 opened 2 days ago by henrysg93 - Resolved - Client ticket
- State update confirmation broken - Client ticket #9** (bug) - #3 opened 2 days ago by henrysg93
- Team access enforcement is broken - No client ticket** (bug) - #2 opened 2 days ago by henrysg93

ID	Title	Priority	Assigned To	Severity	Status
19	Clicking a future treatment option causes a crash	Medium	Iustin Sibiescu		In Progress
20	Users are unable to edit their own accounts	Medium	Henry Scott-Green		In Progress
1	Treatment state interface using American dates	Low	Alex Gamble		Closed
2	Formatting issue in page footer	Low	Henry Scott-Green		Closed
3	Patient navigation timeline broken	High	Alex Gamble		Closed
4	Inconsistent design - Medical Professional Hub	Low	Henry Scott-Green		Closed
5	Treatment state update functionality broken	Medium	Alex Gamble		Closed
6	Subcategory functionality incomplete	Medium	Alex Gamble		Closed
7	End User License Agreement Broken	Medium	Henry Scott-Green		Closed
8	Date selection save issue	Medium	Alex Gamble		Closed
9	Confirmation of state update missing	Medium	Alex Gamble		Closed
10	Back button formatting issue	Medium	Henry Scott-Green		Closed
11	Doctor State Password Protection Missing	Medium	Iustin Sibiescu		Closed
12	Patient admin missing	Medium	Iustin Sibiescu		Closed
13	New patient module assignment errors	Medium	Iustin Sibiescu		Closed
15	Password reset broken	High	Alex Gamble		Closed
16	Doctor login broken	Medium	Alex Gamble		Closed
17	When no modules are assigned no error messa...	Low	Henry Scott-Green		Closed
18	Main page formatting broken	Medium	Henry Scott-Green		Closed

Internal ticket tracker



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The Future

Where does Pathways go from here?

Extensibility

How can you use Pathways?



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- API for 3rd party applications to use the Pathways backend
- Any app or product may send a request to the Pathways API, and if authorised they will receive:
 - Patient names
 - Patient module assignment dates
 - Modules assigned
 - Full content of every module, with formatting preserved

The Future

Pathways 2.0 and beyond...



- Fully forward compatible with teams and database indexing, easy scaling across multiple NHS trusts
- Build upon the powerful backend and API to develop native applications, to allow:
 - Integration with wearable technology, to track data, deliver symptom information and send reminders
 - Analytics for doctors to access during consultations to determine activity levels and symptom tracking
- Publishing an academic paper



Summary

- Helping patients make better treatment decisions