Teams and reproducibility - collected perspectives

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Thank you!

- All the fantastic interviewees!
- Serenay Ozalp and Public Health Wales

Original idea

- Training tends to focus on reproducible methods to learn at an individual level, but my work happens in teams.

- When teaching reproducibility, I don't have good advice to give on team factors.

- How typical are my experiences of reproducible approaches in teams?

- We want to share code, but maintaining code for others doesn't really fit into our current job roles.

- Could a differently-shaped team help capitalise on some of the opportunities of reproducibility?
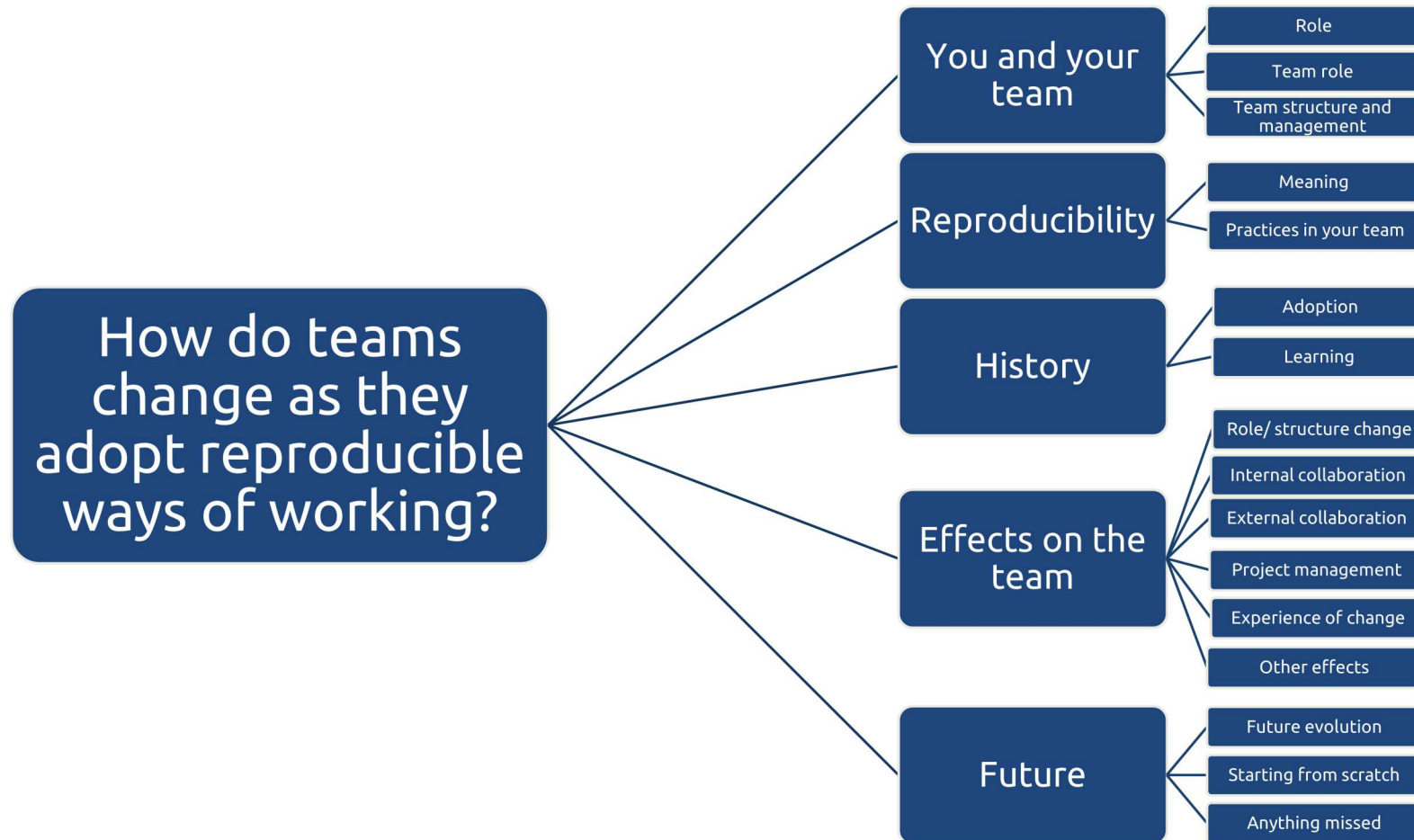

Rhian's talk at NHS R Pycom: slides

Image from: Cautionary Tales podcast episode How Britain Invented, Then Ignored, Blitzkrieg

Turning it into a research question

How do teams change as they adopt reproducible ways of working?

- You and your team
  - Role
  - Team role
  - Team structure and management
- Reproducibility
  - Meaning
  - Practices in your team
- History
  - Adoption
  - Learning
- Effects on the team
  - Role/ structure change
  - Internal collaboration
  - External collaboration
  - Project management
  - Experience of change
  - Other effects
- Future
  - Future evolution
  - Starting from scratch
  - Anything missed

Doing the research

- Informal summer project

- Participants:

  - Recruited unscientifically through contacts and community forums (NHS R, Wales Modelling Collaborative)

  - 7 participants

  - Limitation = my capacity

  - All in analytical roles of some kind

  - Mix of Public Health Wales (2), wider NHS Wales (2), wider health and care community (3)

- Half hour conversations

- Recorded (automatically/manually based on participant preference)

- Reviewed and coded afterwards

- Themes extracted and organised

Findings

- Teams in context

- Make up of the team

- What reproducibility means to us

- Impulse to change

- Making change happen

- What hasn't happened yet?

Findings: Teams in context

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- How projects are contracted/ who owns them/ how long they are

- Wider context – competition, collaboration, COVID etc

- Role of the professional community

How projects are contracted/ who owns them/ how long they are

"[my team] are quite weird in the NHS because we're a consultancy and a lot of the data science products that we build are products" [rty]

"It was very much 'that's a commercial product and we will produce it' and then the output is for the customer or end user and the process that produces it is is more closed. But that's something that's shifted." [qwe]

"Take all that lovely raw data that we have and turn that into meaningful information, stories, intelligence for policy makers, decision makers across the public health system" [uio]

"Different ways [for work to come in]: I am very much linked with some teams and often it can be 'Can you create a new pipeline for that?' […] or I get very frustrated about manual tasks that don't need to be manual" [dfg]

"My role mainly focuses around the helping increase the capability" [zxc]

Wider context – competition, collaboration , COVID etc

"[our relationship with other organisations of the same type] moved from enforced competition, 'you must compete', to 'you must work together'" [qwe]

"There is a lot of change going on in NHS back office at the moment in England […] So we don't actually know where we're going to be." [qwe]

"These last six or seven years it's all mixed in with COVID as well. So it's all mixed in with what was also a big change." [uio]

"And then the COVID pandemic hit. I think that was the big accelerator because we were being asked for so much and the data set became so big and our pipelines became so messy." [dfg]

Role of the professional community

"the RAP standards that have been published by NHS Digital, from the RAP Community of Practice, are something that we are aspiring to now" [qwe]

"We were just looking around speaking to different people and we came across people using R to produce dashboards. That was kind of random. And then there was a bit of a groundswell happening at that time. It was quite exciting actually. We went to visit a guy who was working in local government […] he was one of the early adopters and had a little team." [uio]

"this is something […] I had heard of for a while from NHSR" [qwe]

Findings: Make up of the team

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- Who's in the team

- Division of labour

Who's in the team

- Very wide range of team size (lone analyst to 20+)

"One big analysis team […] We all have a similar role" [uio]

"we're about 10 or 11 people at the moment" [rty]

"We have two managers who do very little coding [..] We've recently had a product person join the team as well" [rty]

"We've always been a department of epidemiologists." [dfg]

"our team is a group of about 5 modellers, data scientists, data engineers, project managers. We all wear all of those hats." [hjk]

"It's been built up with answering public health questions in mind by people whose background is answering public health questions" [hjk]

Division of labour

"We've always opted for more of an all rounder role. We have talked before about more specialised roles, but we've ended up always staying with the all rounder roles because we think it gives people more interesting work and more prospects for progression." [uio]

"There's a little bit [of division of labour]. So like one person or one or two people are more on the data engineering side, one who's very much a modeller, and then I'm a jack of all trades" [hjk]

"[the manager] has hired people so that we've got a range of different skills" [rty]

"So there are some project management people, some people who do some of the tasks with me such as business support" [zxc]

"if you go work at a big tech company, like Amazon, you probably have somebody who's job is just to write unit tests" [hjk]

"[If setting up a new team] I would try and set it up as a development-like team rather than 'one person does this [subject area], one person does that [subject area]'" [dfg]

Findings: What reproducibility means to us

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- Definitions

- Whole process, not just code

- Current reproducible practices

Definitions

"It's the end to end workflow. […] Basically you can click 'go' on this script or something and then it will produce this piece of analysis in the same way as it was produced the first time, ideally." [qwe]

"It means being able to run models or run modelling pipelines in an efficient, relatively stress-free way. […] It means using tools that other people have written as much as possible. […] Using targets, a package but also a framework for writing code which can be run in a simple reproducible way and is in some sense modular. It means having robust R pipelines which we understand and which we maintain. It also means not just being nice to each other, but having good standards which make it easy to maintain code" [hjk]

"what it really means to me is to be able to say goodbye to horrible Excel spreadsheets" [uio]

"we talk a lot about bus factor, about whether someone else could run the code if someone gets hit by a bus" [rty]

Whole process, not just code

"Could somebody else run this pipeline if I wasn't here? That includes everything from the code to the documentation." [rty]

"if you're running a process, you've got to make sure that you know what that process is doing each and every time, especially when you get some weird things going through it. […] Data sets often come up with new and wonderful ways to be more messy and you've got to catch them. And that's part of the reproducible pipeline: if you're letting machines do it, you've got to put in checks to make sure is the data looking right? Are my functions going to handle some odd and strange results?" [dfg]

"A lot of it might be structural as well, like understanding where your product fits in with the stakeholders and what they need - making sure that that knowledge is also reproducible" [rty]

"So it's not that any one individual owns the code. And quite often as well, part of the review process is actually getting people who don't know the code to review it, just so they've seen it, if they have to fix it" [hjk]

Current reproducible practices

- Tools that came up included coding (R, Python), functions, version control (git), GitHub, testing, pipelines, standard operating procedures, documentation

- Varying levels of adoption of reproducible practices (even in self-selecting group)

"we do use some bits and pieces of it, but not in a consistent way" [qwe]

"for us it was about just like getting something in place, which is structured. […] It's not about what rules. As long as they're kind of sensible and stuck to, that's 90% of it" [hjk]

Findings: Impulse to change

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- "Visionary" recognising benefits

- Disadvantages of old ways

- Advantages of new ways

- Looking from a new angle

"Visionary" recognising benefits

"I'm going to scream as loud as I can to my colleagues that we need to do this because it frees up time and it's a good use of public funds" [dfg]

"I've been advocating for more use of git because I recognise it's very useful" [qwe]

"I think it's gone with the philosophy because by nature I am a data professional." [zxc]

"When I started, we weren't using GitHub in the best way possible, and I'm not saying we changed it overnight, but within a few months […] I suggested maybe we could have some guiding principles on code review and a little bit of a system." [hjk]

Disadvantages of old ways

"gets rid of the bus problem to some extent […] you want resilience" [qwe]

"You would pick up someone's Excel file and the job would be to update with the new year's worth of data. […] you would open up that Excel file and you just had no idea how the person had got to the answer." [uio]

"it was the bus factor thing basically. […] [the manager] realised that this was a huge risk for the team" [rty]

"A good example […] is the COVID-19 outputs. They were a nightmare to produce. They would take multiple people the whole day to produce each and every day." [dfg]

"People are scared of introducing human error." [bnm]

Advantages of new ways

"It just takes away the bits that are not thinky […] we should be spending time looking at the data, thinking about it, and its real world implications." [dfg]

"And now those model scripts take very little time to run. […] So what used to take four people a full day takes two people half a day now." [hjk]

"we're probably a bit less frustrated with each other at times because I think just to have that audit trail, to be able to see what's happened to produce the work, has been fantastic. So I think it has made it easier to work with colleagues." [uio]

"I don't like doing manual things if I could help it. I'm not very good at them. I make mistakes. I'm human. I'm not a very good human at that rate. So if I can get a computer to do it for me, I will." [dfg]

"This allows us to work as a team" [zxc]

Looking from a new angle

"working a little bit more like a tech team because 90% of what we do is writing code, so working a little bit more like people who write code all day is not a bad idea" [hjk]

"I mean, we always talk about buses. […] It's a lens." [rty]

"Why can't we have a development framework in for learning material?" [zxc]

Findings: Making change happen

Findings: Making change happen

- Team taking it on

- Time and space to change

- Learning by doing

- Formal learning

- Culture of learning

- Seeing different ways

- Navigating tensions and concerns

- Interaction with project management

Team taking it on

"We said […] we're going to try and turn 1 project into a reproducible analytical pipeline. And if it doesn't go very well, we've just wasted a little bit of time and that's fine." [uio]

"There [wasn't] a consistent approach, up until this point where we've got a project internally which is we're going to do RAP. So we have a more consistent centralised approach there." [qwe]

"we had a bit of a group discussion. Like here's the idea, and with the line of, unless there's any strong objections, we're going to do it, but also it doesn't mean other people can't say how they want to do it. […] What do you think? What's going to work?" [hjk]

Time and space to change

"I think the key thing about that was being given the time to do that by senior colleagues that we were allowed more time […] we could extend our deadlines" [uio]

"And then depending on how big a change it was, we might do a pilot for two to six weeks." [hjk]

"to be able to have the space to do it is a fantastic thing and it makes you more ambitious to do something" [zxc]

Learning by doing

"So generally, by having things to do. We've identified 'oh, we've got this new idea, let's try and use it in this project' if it's appropriate. And so you kind of learn by doing" [qwe]

"then people that worked on [the initial project] then split off and worked on other projects to implement the same thing with their knowledge. And we did it bit by bit like that" [uio]

"It just took sitting down virtually and going through it, just creating a test case, this is how you do it. Bringing her [a colleague with no experience in this area] through step by step." [zxc]

Formal learning

- Challenges getting access to formal learning (cost, fixed-term contracts)

- Varied feelings on usefulness of formal learning

"Some people have done training courses online or other things, but it's very, very varied." [qwe]

"We have a session called coffee and coding that we do internally" [rty]

Culture of learning

"also just moral support and being there for people in their frustration, because it's frustrating, isn't it? When you're learning something new like that." [uio]

"I've just got lovely and nerdy colleagues who like finding things out and then sharing the stuff that they learn with the rest of the team. So I think that culture of openness and and sharing has been really important" [rty]

"And then have a round table, evaluate what's working, what's not, and all of this is done with the idea that none of it is set in stone and it's by us and for us." [hjk]

"Just talking and just messing around too. Now when I say messing around, I don't mean just having a mess. I mean actively, purposely: 'Let's try this. It doesn't work. We won't do it then. What works for us?'" [zxc]

"It's not that we're given uncontrolled freedom, it's more we are given the opportunity to test these things out." [zxc]

"we've set up a Teams channel for questions for openness." [bnm]

Seeing different ways

"People were getting their code reviewed. But if you've not seen how other people do it, how would you know [how to do it]?" [hjk]

"I think the way forward is to demonstrate work" [bnm]

Navigating tensions and concerns

"I think it has caused tension as well. I have to surface that. I think because there's definitely been varying levels of enjoyment of it. For those of us who enjoy working with code generally it's wonderful. But for those of us who are not so naturally that way inclined, I think it's been tough." [uio]

"we're quite a psychologically safe team. So we have a lot of opportunities for group reflection and discussion on how we're feeling […] It's not always been smooth sailing, obviously, we've had disagreements" [rty]

"It's something else to learn that deviates from what people want to do. People want to do epidemiology. That's what they've come to do this job for. […] but a lot of the CPD time is now being pushed towards learning to code, learning good coding practices, learning how to do RMarkdown, how to do this RAP stuff and they are two separate jobs" [dfg]

"Some people really didn't like the linting because it didn't go with their code style […] But also to make that easier, I took it upon myself to lint a lot of the core code so that it wasn't getting flagged on CI" [hjk]

""There was some hesitation for bringing this sort of stuff in to a capability cycle."
[zxc]

Interaction with project management

"I don't think [reproducibility] currently interacts very much with project management in the way we work" [qwe]

"It's all linked up with agile really. We've gone through that change as well and I think it's hard for me now to unpick what is agile and what is reproducibility" [uio]

"We moved to a different way of working, […] towards sprints as a way of working. I think this is related to reproducible analytical pipelines because we found […] where we just worked on a thing for an unspecified amount of time it was really hard to be accountable to the stakeholders and to each other" [rty]

"we started doing sprint planning which is really nice" [hjk]

"any needs that are known, we put them on the backlog to try and determine when to do them" [zxc]

"I think there is [an interaction with project management]. I think it's one way for the project managers to be able to see what's going on. […] And it helps to see are we meeting the correct deadlines? Are we meeting everything we need to do?" [zxc]

Findings: What hasn't happened yet?

Findings: What hasn't happened yet?

- Gap between reality and ideal

- Opportunities not yet exploited - collaboration

- Opportunities not yet exploited - packaging

- Opportunities not yet exploited - testing

- Ongoing journey

Gap between reality and ideal

"There are differences between the ideal of RAP versus the practical realities of it, or parts of it." [qwe]

"There is a kind of gold standard to this which I'm trying to aim for, but it's one of those ideals that is quite difficult to get" [dfg]

Opportunities not yet exploited - collaboration

"external focused RAP is not something we've done a lot of" [qwe]

"It's affected collaboration, though I think probably not as much as it should have done. […] maybe because we're still in an organisation that's quite siloed and maybe again partly COVID time" [uio]

"[our repositories] are open source, and occasionally someone's made a pull request, but it's generally been really small stuff like documentation or something rather than actual changes to the code." [rty]

"I think that might be one of the barriers to people reusing other people's stuff: it's always so org specific" [rty]

"what if you have amazing material that we can just pull in and share it across everywhere? […] wouldn't it be amazing to create this development cycle of bringing all that material and all that knowledge?" [zxc]

Opportunities not yet exploited - packaging

"developing functions to packages. I think in terms of reproducibility, the more functions that we have that everyone is using the same" [uio]

"So for example for me, whilst this could be a single script, it should be a functional system. And by that I mean all the code is written in functions, tested, preferably in a package." [dfg]

Opportunities not yet exploited - testing

"there's some stuff like unit testing and some of the more automated quality control that we'd like to do more of" [uio]

"The idea of trustworthiness, how can we say that our data is trustworthy? And for me if we can say all of our all of our scripts go through unit testing […] that will add further trustworthiness to our data." [dfg]

"We're not very good at unit testing and so we could do a little more on that. […] And we are going to do more of it, but I think a lot of it is 'what do unit test?' How testable is the code is quite a tricky one. How do you test a graph? There are things you can test on a graph, but a lot of it is a visual check. Or I'm not really sure how you check things. It might be that I don't understand and that's why I've not done it." [hjk]

Ongoing journey

- New platforms (FDP in England, NDR and specifically NDAP in Wales)

- Organisational changes

"we're just going to keep trying. It's always just a work in progress, isn't it?" [rty]

"people think […] it's such a binary thing, but it's a scale and we're just all taking really small steps in the right direction" [rty]

"we're pretty much at the start […] So the journey can go really anywhere." [zxc]

Wrapping up

Useful taxonomies and patterns

- Developing products, maintaining products, delivering services

- Analysts, tech team, research

- Bus factor

- Reproducible processes vs reproducible code

Where next?

- Let's talk more about team factors in reproducibility

- Could we collect more information on teams and reproducibility? Or is this out there already?
  - Could include information on different models for analytical team structures, challenges and tensions to adoption etc
  - For example, via Coding in Analysis and Research Survey

- Develop resources/ training?
  - Facilitated workshop?
  - Collection of "team patterns"?
  - Collection of frequently encountered issues?
  - Something else?

- More exploration of the opportunities not yet exploited?
  - Deeper dive on *why* we're not doing more external collaboration, packaging, testing etc
  - Could we make changes to how we work to enable these areas to develop?

Over to you

https://forms.office.com/e/yqqJPhVbdr

Reproducibility and teams - follow up survey