How modelling changing demand for mental-healthcare and provision can help planning and delivery

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1. Background and requirements
2. A minimal demo of demand-v-supply for mental-healthcare
3. A staged build-up of a more complete model, playing out realistic scenarios

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Purpose of the model …

To provide a clear, quantified picture of how *mental-illness-levels* develop over time

… depending on the factors *driving* that development

… and the availability of *capacity* to slow that demand and accelerate recovery from mental illness

Desired *benefits* to gain from such a model:

… *understand why* the level of mental illness, at each level of severity, rises or falls over time at the observed rate

… assess alternative *strategies and resource-levels* for improving those rates of change (*slower growth, faster recovery*) – and the resulting *costs*

… provide a *shared, evidence-based* model for all relevant agencies to agree co-ordinated strategies

… especially, but not limited to, the impact of *COVID-19*

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Challenges …

1. Expressed demand for mental health care exceeds demand at all levels of severity, causing …
   - too-slow reduction in cases
   - faster progression of cases to more severe levels
   - under-presenting by a large fraction of sufferers
   - over-prescribing of drugs -v- non-drug therapies
2. Both expressed and unexpressed demand will continue to grow, accelerated by the community stresses due to COVID-19 …
   - stress increases the rate of new cases, and the development to more severe levels of illness, and slows the rate of reduction and recovery from illness
   - … most of the increased illness levels will remain un-reported
3. Staff capacity is inadequate and cannot be fixed quickly …
   - long-term under-recruitment has led to current shortages
   - training and experience-time cannot be shortened
   - over-work causes staff stress and turnover
   - … worsening the staffing shortage
4. Modelling mental illness in children features similar challenge, but needs separate attention

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Requirements

INITIALLY …

The model must encompass the entire *demand-side* of mental illness and *all supply-side factors*, both NHS and non-NHS (*because issues in any part of the system unavoidably affect all other parts*)

… but must be *simple enough* to understand and use (*e.g. treat all illnesses as one, minimal split of staff-groups and capacity …*)

Must show implications for *skilled-staffing*, *financial* outcomes and needs ...

Time-scale must be long-enough for planning goals, with short-enough time-units to capture real-world rates-of-change

LATER ...

Must *split out* significant details – *types of mental-illness, supply-side groups*

Capable of calibration and use at all geographic levels – GP-practice to all-England

FIRST

… a proof-of-concept model, with the initial scope required, but with illustrative data

… to show that such a model is practically possible and to seek funding.

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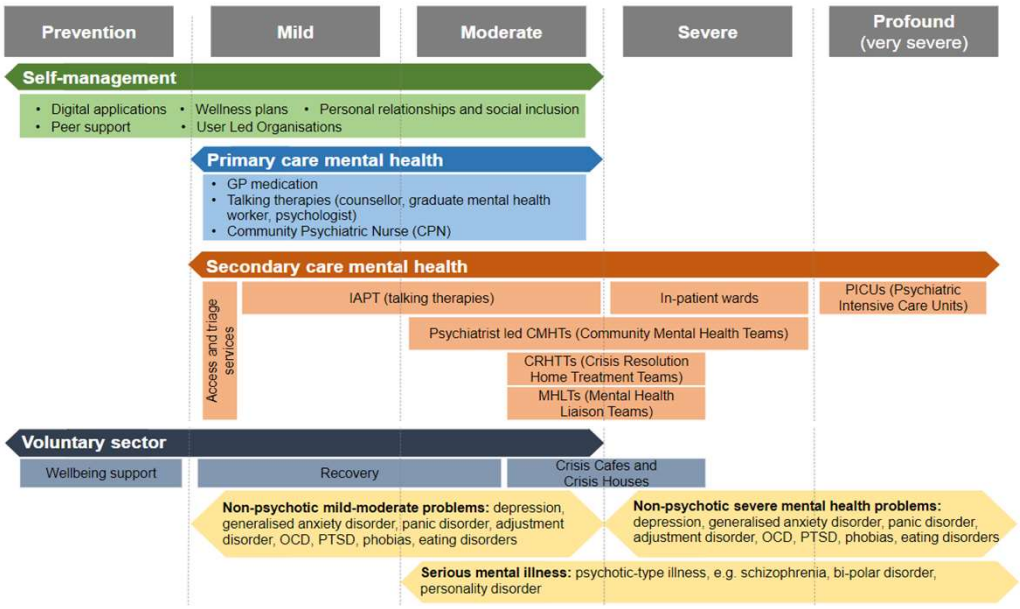
Who does what along stages of increasing illness (PB)



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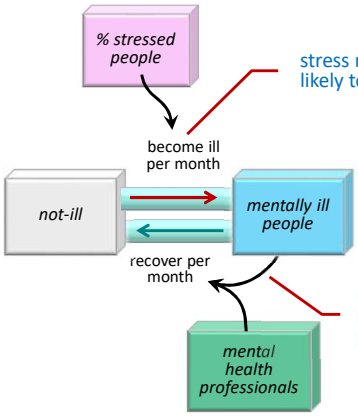
Essence of the mental-health challenge, 2018-2028 *.
1 – Stress increases the rate of people getting mental illness



stress makes people more likely to get mentally ill

mental-health professionals help people recover

For example, a region of 500,000 people …

with ***no COVID***, little change in the % of over-stressed people

numbers of mentally ill people rise slowly

mental-health professionals remain somewhat over-loaded

* *Illustrative numbers shown run from April 2018 to April 2028*

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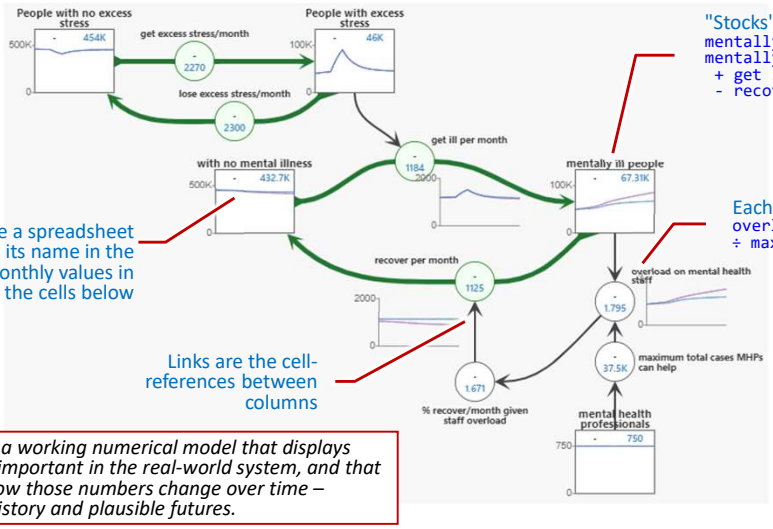
The working model plays out the causal mechanisms
Imagine this diagram is on top of a spreadsheet …



"Stocks" have a different kind of formula

```
mentally ill people (today) =
mentally ill people (last month)
 + get ill per month
 - recover per month
```

Each item holds a simple formula

```
overload = mentally ill people
÷ maximum cases MHPs can help
```

Each item is like a spreadsheet column, with its name in the top cell and monthly values in the cells below

Links are the cell-references between columns

We aim for a working numerical model that displays everything important in the real-world system, and that plays out how those numbers change over time – matching history and plausible futures.

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Expand the simple model to be more comprehensive and realistic

The simple model *(see above)* …

1 – Stress adds to the mental health (MH) problem

2 – COVID makes more people over-stressed

3 – Staff overload slows recovery, making matters worse

Developed model …

A. Stress drives new mental illness cases, progression to more severe levels, and slows recovery

B. Support from GPs, therapy, drugs and nursing support speeds recovery from mild and moderate illness

C. Cases getting therapy depend on the number of therapists, which takes time to build

D. Cases getting MH-nursing support depend on the number of psychiatric nurses, which takes time to build

E. Secondary-level care, including MH-doctors capacity, is needed for some moderate cases and all severe cases

F. Severe cases drive demand for in-patient places, and any shortage is out-placed to 3rd parties while additional places are built

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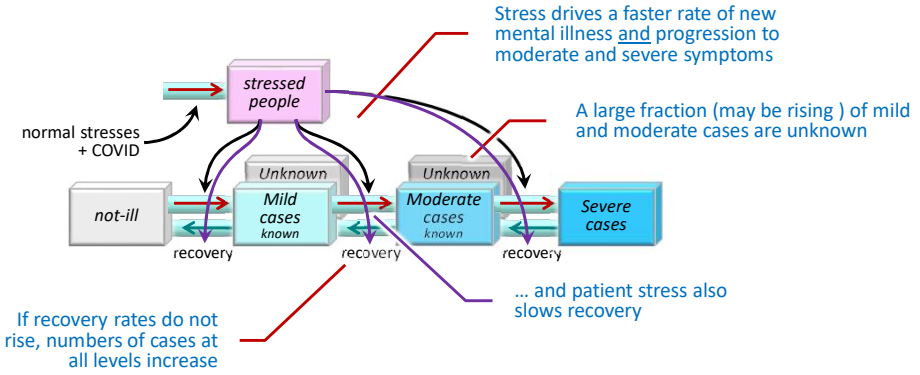
The mental-illness system overview

A. Stress drives new mental illness cases, progression to more severe levels, and slows recovery



How does the model work out how numbers in this part of the system may change over time? …

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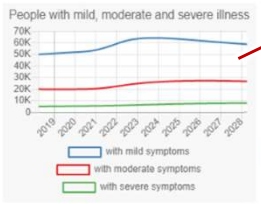
A. Stress drives new mental illness cases, progression to more severe levels, and slows recovery

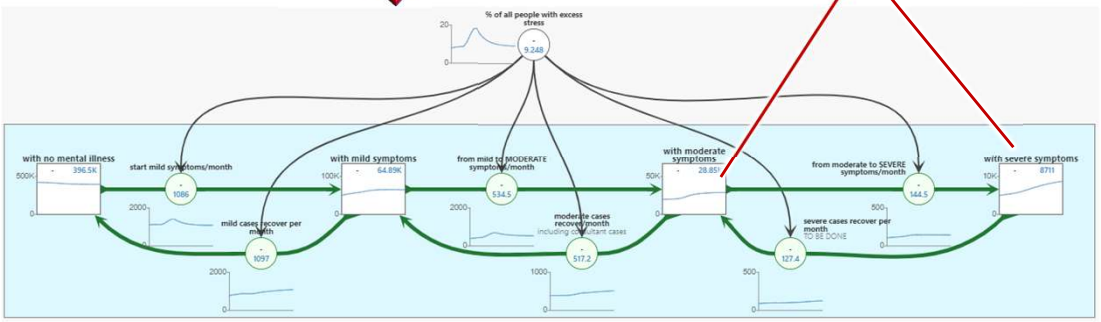


COVID-stress drives persistent rise in all levels of mental illness – continuing <u>after</u> the outbreak is over

Assumed recruiting rates for new MHPS are not enough to bring cases back down

The model plays out the <u>total</u> number of cases, including estimated unknown cases.

Modelling of higher stress rates accelerating progress to moderate and severe levels of mental illness



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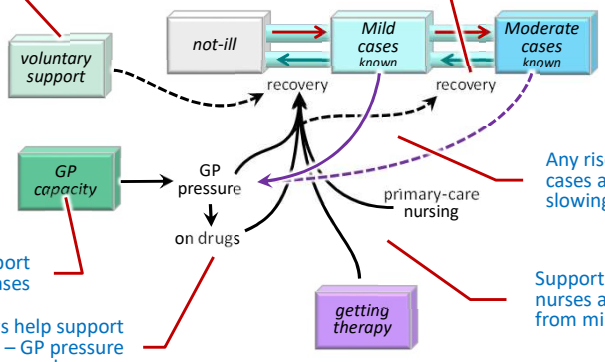
The mental-illness system overview

B. The role of GPs, therapy, drugs and nursing support on recovery for mild and moderate cases

Primary care helps some moderate cases – others are with 2ndary mental-health professionals

Voluntary, non-medical support also helps recovery – art, singing, gardening …



Any rise in mild + moderate cases adds to GP pressure, slowing recovery

GPs provide 1st-line support for mild and moderate cases

Drugs help support patients – GP pressure forces more drug-use

Support from primary-care psychiatric nurses and therapy helps recovery from mild and moderate illness

NOTE: Direct recovery from Moderate illness to not-ill may be possible, but the structure implicitly captures such cases

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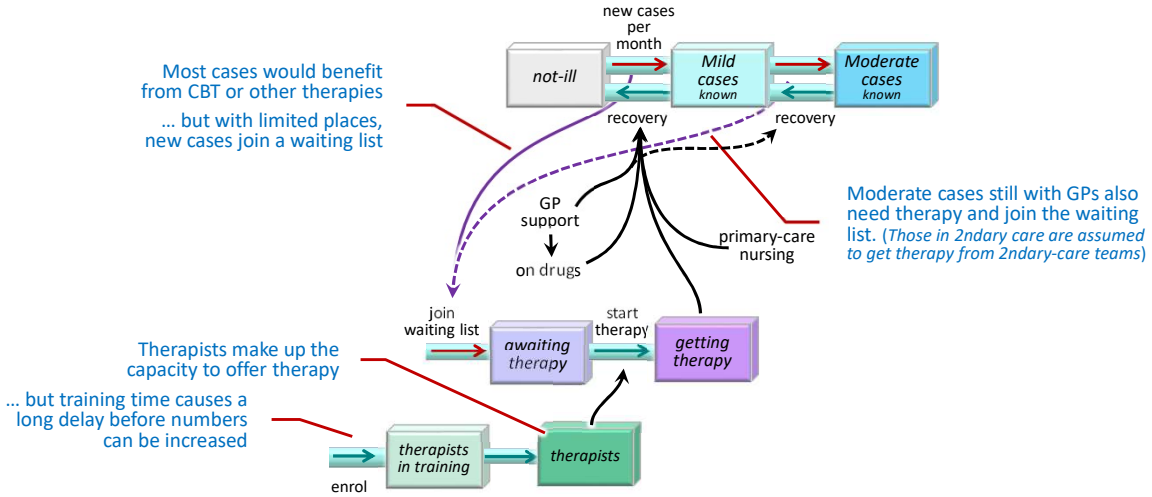
The mental-illness system overview

C. Cases getting ***therapy*** depend on the number of therapists, which takes time to build



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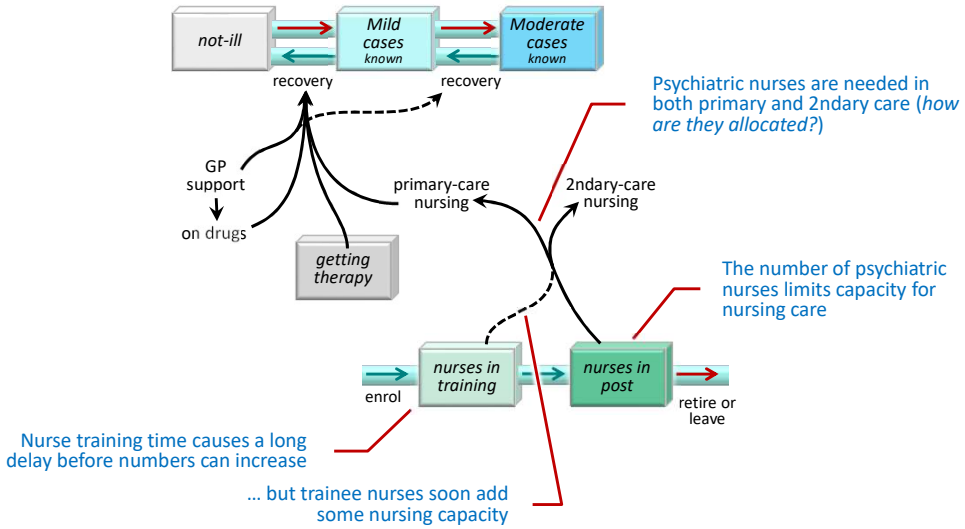
The mental-illness system overview

D. Cases getting ***nursing support*** depend on the number of psychiatric nurses, which takes time to build



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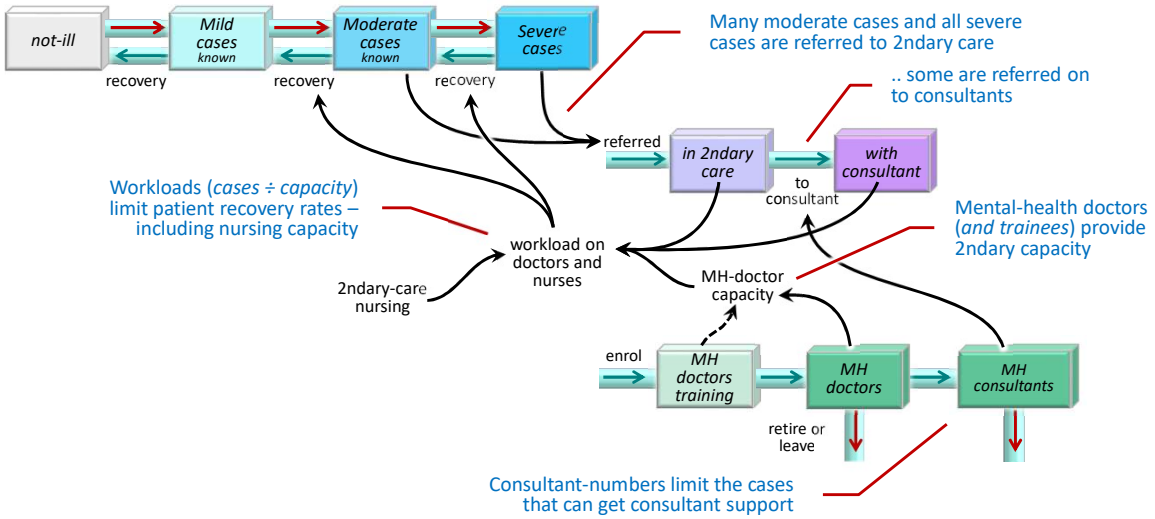
The mental-illness system overview

E. Secondary-level care for some moderate cases and all severe cases, and the doctor capacity to treat them



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The model needs to recognise the time-delays in the development path for psychiatric doctor/consultant

https://www.rcpsych.ac.uk/become-a-psychiatrist/choose-psychiatry/how-to-become-a-psychiatrist

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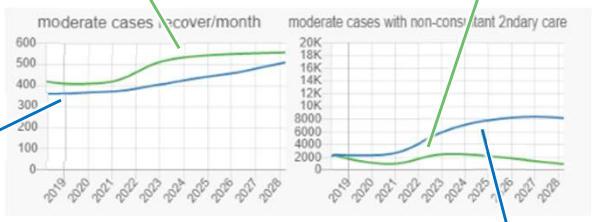
E. Does workload slow the rate that psych. doctors and nurses can help *moderate* cases recover?

If workload ***did not*** cut doctors' and nurses' ability to help patients, more would recover each month

… so there would be ***many*** fewer moderate cases ***and*** COVID's impact on case-numbers would be temporary



The ***base case*** starts with ~10% work overload for psych-nurses and doctors

The stock of moderate cases grows strongly if COVID-driven demand brings new cases faster than doctors and nurses can help people recover

*This result is **highly** dependent on the assumed impact of workload on the ability of doctors and nurses to help patients recover* (10% overload slows recovery by 10%) – *as the **base case** assumes.*

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E. Does workload slow the rate that psych. doctors and nurses can help *severe* cases recover?

If workload ***did not*** cut doctors' and nurses' ability to help patients, more ***severe cases*** also recover each month, cutting demand on consultants

*This result is **highly** dependent on the assumed impact of workload on the ability of doctors and nurses to help patients recover as the **base case** assumes* (10% overload slows recovery by 10%).

With fewer severe cases, consultants can help more ***moderate*** cases, adding to the recovery rate

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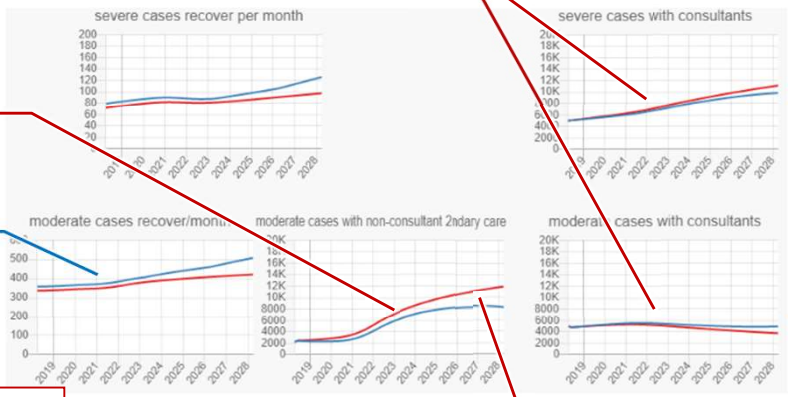
E. Doctor-shortages and failure to recruit doctors faster may cause serious growth in moderate and severe patient numbers

Severe cases also grow faster, cutting consultants' capacity to help moderate cases

With a ***greater doctor-shortage***, recovery is slower still, and case numbers climb faster

The ***base case*** already assumes ~10% shortage of psychiatric doctors ***but also*** increased hiring to address the shortage



This result is dependent on the current shortage of psychiatric doctors and assumptions about training and workload-impact on patient recovery.

Failure to boost doctor training leaves cases growing long after COVID-driven demand ends

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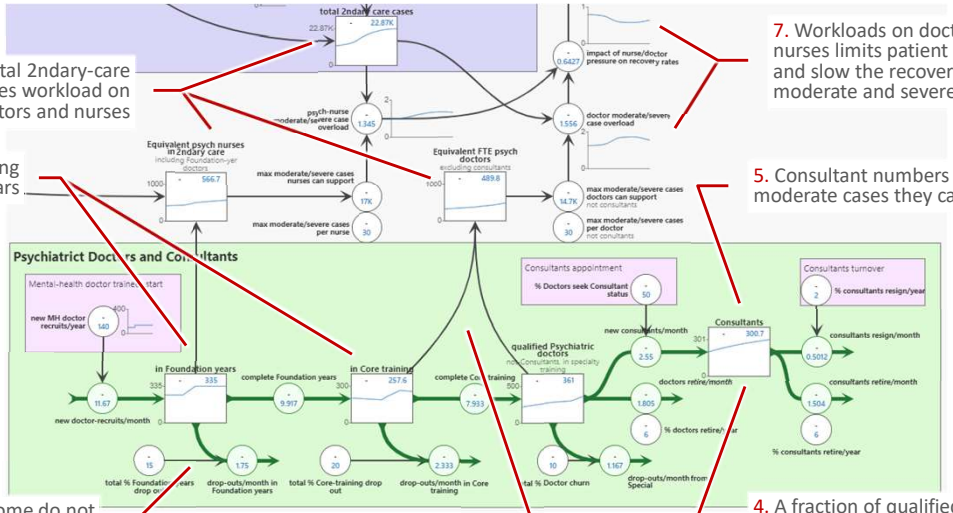
E. Modelling changes to numbers of *mental-health doctors and consultants*, and the overload of secondary-care cases (*including nurses overload*)



6. The total 2ndary-care cases drives workload on both doctors and nurses

7. Workloads on doctors and nurses limits patient support and slow the recovery of moderate and severe cases

1. MH-doctor training takes many years

5. Consultant numbers limit the moderate cases they can see

2. Some do not complete training

3. MH-doctor capacity is from qualified doctors ***and*** trainees

4. A fraction of qualified doctors seek consultant promotion

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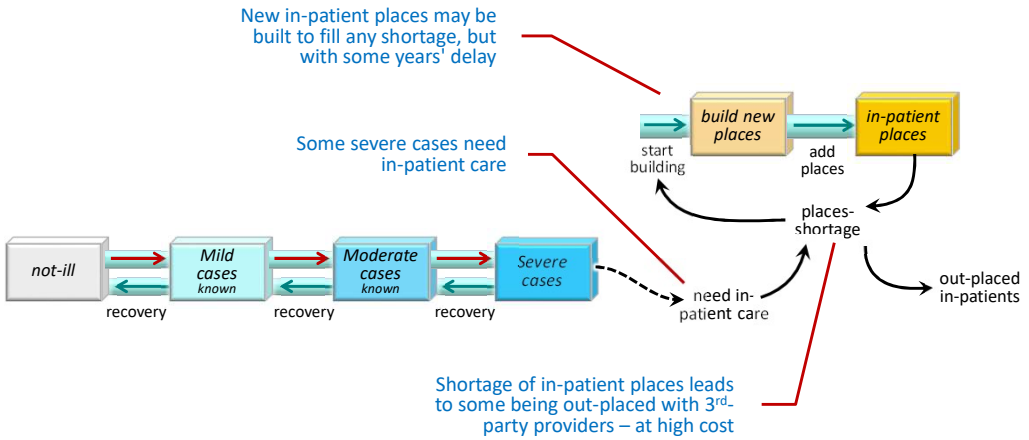
The mental-illness system overview

F. Severe cases drive demand for in-patient places, and any shortage is out-placed to 3rd parties while additional places are built



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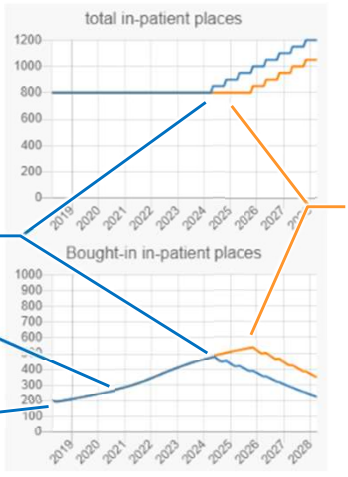
F. How building more in-patient places eventually reduces the need for excess need to be out-placed to 3rd parties



Immediate decisions to build new places eventually absorbs out-placed demand, after a build-delay

With no new places opening, the number ***all*** new severe in-patient cases must be out-placed

Any ***existing*** shortage of in-patient places leaves some severe cases placed with 3rd parties

Any ***delay*** to building new places leads to further growth in out-placed numbers that take longer to be reduced

All severe cases needing in-patient places are assumed to be placed – if necessary in 3rd-party places

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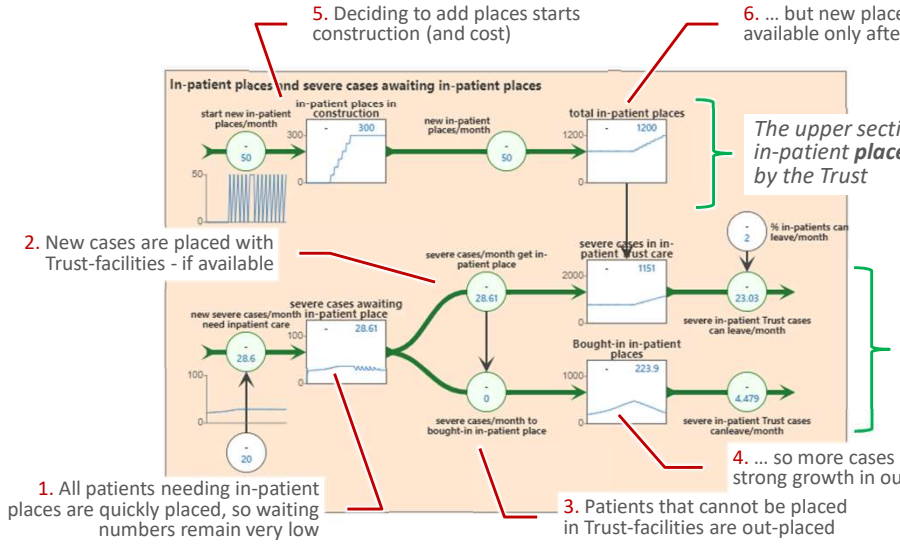
F. Modelling changes in-patient places for severe cases, any shortage leading to out-placement with 3rd-party providers



5. Deciding to add places starts construction (and cost)

6. … but new places become available only after a long delay

*The upper section is about in-patient **places** operated by the Trust*

2. New cases are placed with Trust-facilities - if available

*The lower section is about **patients** awaiting places, placed in Trust-facilities, or out-placed with 3rd parties*

4. … so more cases due to COVID causes strong growth in out-placed numbers

1. All patients needing in-patient places are quickly placed, so waiting numbers remain very low

3. Patients that cannot be placed in Trust-facilities are out-placed

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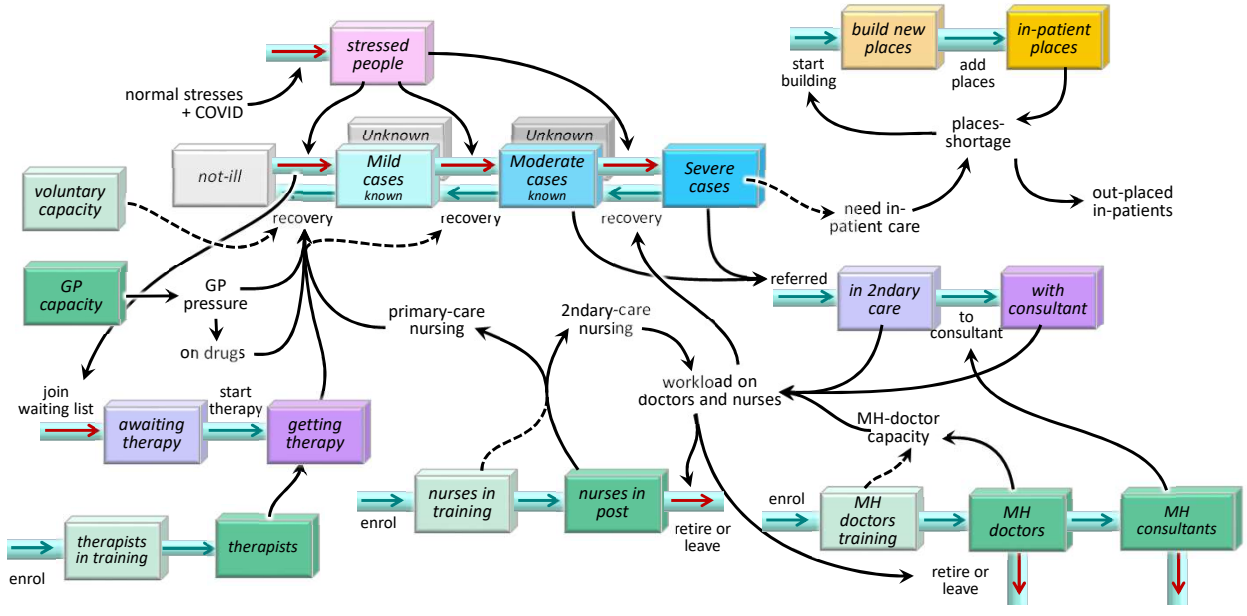
The mental-illness system OVERVIEW …



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Next steps:

The model has been endorsed by MH professionals and senior leaders (*March 2021)*

Next, it will be calibrated with data for several contrasting regions

… which will likely lead to disaggregating some elements, e.g. further sub-division of professional staff groups, breaking out distinct forms of mental illness, developing specific models for children, and so on.

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