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
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
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.

Who does what along stages of increasing illness (PB)
Essence of the mental-health challenge, 2018-2028*.  
1 – Stress increases the rate of people getting mental illness 

For example, a region of 500,000 people ...

The working model plays out the causal mechanisms

Imagine this diagram is on top of a spreadsheet ...

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.
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 overstressed
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

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? ...
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 after the outbreak is over. Assumed recruiting rates for new MHPS are not enough to bring cases back down.

The model plays out the total number of cases, including estimated unknown cases.

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

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 secondary mental-health professionals.

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

GP capacity

Mild cases known

Mild cases known

Primary care helps some moderate cases – others are with secondary mental-health professionals.

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

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.
The mental-illness system overview

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

Most cases would benefit from CBT or other therapies ... but with limited places, new cases join a waiting list

Therapists make up the capacity to offer therapy ... but training time causes a long delay before numbers can be increased

Moderate cases still with GPs also need therapy and join the waiting list. (Those in secondary care are assumed to get therapy from secondary-care teams)

The mental-illness system overview

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

Psychiatric nurses are needed in both primary and secondary care (how are they allocated?)

The number of psychiatric nurses limits capacity for nursing care

Nurse training time causes a long delay before numbers can increase ... but trainee nurses soon add some nursing capacity
The mental-illness system overview

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

Many moderate cases and all severe cases are referred to secondary care, some are referred on to consultants.

Mental-health doctors (and trainees) provide secondary capacity.

Consultant-numbers limit the cases that can get consultant support.

Consultant numbers limit the cases that can get consultant support.

Workloads (cases + capacity) limit patient recovery rates – including nursing capacity.

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

Medical School 4-6 years
Foundation Training 2 years
Core Training 3 years
Higher Training 3 years
Consultant/Senior Post

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

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

6. The total secondary-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

5. Consultant numbers limit the moderate cases they can see

4. A fraction of qualified doctors seek consultant promotion

2. Some do not complete training

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

1. MH-doctor training takes many years

19
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.

New in-patient places may be built to fill any shortage, but with some years’ delay.

Some severe cases need in-patient care.

Shortage of in-patient places leads to some being out-placed with 3rd party providers – at high cost.

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.

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

Any delay to building new places leads to further growth in out-placed numbers that take longer to be reduced.
F. Modelling changes in-patient places for severe cases, any shortage leading to out-placement with 3rd-party providers

1. All patients needing in-patient places are quickly placed, so waiting numbers remain very low
2. New cases are placed with Trust-facilities - if available
3. Patients that cannot be placed in Trust-facilities are out-placed
4. … so more cases due to COVID causes strong growth in out-placed numbers
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

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

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The mental-illness system OVERVIEW …

- stressed people
- normal stresses + COVID
- not-ill
- recovery
- build new places
- in-patient places
- outpatient places
- places shortage
- out-placed in-patients

- Mid cases known
- Moderate cases known
- Severe cases known
- MH-doctors training
- MH-doctors retire or leave
- MH-capacity
- MH-doctor capacity
- with consultants
- referred
- 2ndary-care
- 2ndary-care nursing
- workload on doctors and nurses
- MH-capacity
- MH-doctors
- MH-doctors training
- MH-capacity
- MH-doctors retire or leave

- Voluntary capacity
- GH-capacity
- GH-capacity
- pressure
- not in drugs
- on drugs
- waiting list
- join waiting list
- get therapy
- get therapy
- therapy
- therapists in training
- enrol
- therapists
- enrol
- nurses in training
- enrol
- nurses in place
- retire or leave
- theory
- enrol
- MH-capacity
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.