SUPPLEMENTARY MATERIAL

The early impact of COVID-19 on mental health and community physical health services and their patients' mortality in Cambridgeshire and Peterborough, UK

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SUPPLEMENTARY METHODS

Geography and population

Cambridgeshire and Peterborough (C&P) is a Combined Authority in the East of England, with a population of ~0.86 million.[1] Encompassing urban and rural areas, it has a total area of ~3,400 km^2 and spans approximately 70×80 km. Its major cities are Cambridge (population ~140,000), Ely (~21,000), and Peterborough (~204,000); the other major conurbation is the town of Huntingdon (~25,000).[2] The population is approximately 50% male and 50% female; 19.9% are aged 0–15, 62% are aged 16–64, and 18.2% are aged 65+.[2] Across C&P, 90.2% are of White ethnicity and 9.8% of minority ethnicity, with greater ethnic diversity in Cambridge and Peterborough than the area as a whole.[3] The area spans a broad range of relative deprivation, with neighbourhoods (Lower Layer Super Output Areas, LSOAs) falling in all deciles of the Index of Multiple Deprivation (IMD) for England, but with a slightly higher proportion being less deprived. (As of 2019: 4.1% of LSOAs fall into the first and most deprived decile by IMD, 8.6% in the second decile, 5.7% the third, 6.4% the fourth, 11.5% the fifth, 11.1% the sixth, 11.3% the seventh, 13.3% the eighth, 14.0% the ninth, and 14.0% the tenth and least deprived decile.[2])

Study approvals

The CPFT Research Database is approved by the Cambridge Central Research Ethics Committee, part of the Research Ethics Service of the UK Health Research Authority (references 12/EE/0407, 17/EE/0442). The present study was initiated via CPFT's pandemic Major Incident Command structure and approved by the CPFT Research Database Oversight Committee on 7 July 2020.

Source clinical records systems and data quality

The four clinical records systems were as follows:

- **RiO.** CPFT's electronic MH records system is RiO from Servelec (rolled out fully by mid-June 2013). Its records are cross-checked against the NHS Spine weekly to update dates of death for patients who have died (and therefore may be out of date with respect to the Spine by up to 7 days). Death notifications to the Spine can also be subject to delay, and this delay, which is unmeasured in our data, may have varied during the pandemic. We estimate this delay when truncating data (see *Methods*).
- **SystmOne.** PH records, and records for MH teams "embedded" in primary care, are in SystmOne, from The Phoenix Partnership (TPP). This has a live connection to the NHS Spine; deaths are registered when an active referral is closed following the death of a patient (so deaths are not registered for patients with no open SystmOne referrals to CPFT at the time of their death).
- **PCMIS.** CPFT's Psychological Wellbeing Service (PWS), the local implementation of the UK's Improving Access to Psychological Therapies (IAPT) programme, uses PCMIS (from the University of York).
- **Epic.** CPFT provides liaison psychiatry (LP) services to general and specialist hospitals in Cambridge (Addenbrooke's Hospital, The Rosie Hospital, Royal Papworth Hospital), Peterborough (Peterborough City Hospital), and Huntingdon (Hinchingbrooke Hospital). Activity is recorded in those Trust's records as well as CPFT's RiO. In Cambridge, the acute hospital is part of Cambridge University Hospitals NHS Foundation Trust (CUH), which uses Epic (from Epic Systems Corporation). This provides additional structured data for a subset of CPFT LP activity.

RiO, SystmOne, and PCMIS are CPFT's three clinical records systems, and between them capture all CPFT activity. They contain complete and non-overlapping data with respect to the outcomes analysed in this study; thus, their data were analysed separately. Epic provides more structured data (e.g. presenting problems) for a subset of liaison psychiatry referrals recorded in RiO.

In terms of data completeness and data quality, all referrals and admissions involve obligatory electronic recording as part of normal clinical workflow, as does detention under the MHA, and we expect 100% completeness (though cannot verify this from the de-identified research data set). As discussed in the main text, records of police detention under s136 MHA may be incomplete. Recording of diagnoses (e.g. those representing severe mental illness, SMI) was by clinicians, and may be incomplete. Liaison Psychiatry presenting problems are not made obligatory by the software but recording them via a structured template is part of the normal clinical workflow of LP teams using Epic. Recording of MH appointments/contacts is strongly encouraged in all secondary care MH teams but but there may be incomplete data (which we cannot measure via the research data set). Information about deaths is discussed above.

Classification of secondary care CPFT MH teams

We classified such teams as (a) child and adolescent mental health (CAMH) teams; (b) community MH teams (CMHTs) for adults of all ages, including perinatal MH teams, the personality disorder community service, some non-extant teams (assertive outreach teams), and older people's primary care mental health services; (c) crisis resolution/home treatment teams (CRHTs); (d) adult liaison psychiatry (LP) teams; (e) early intervention in psychosis (EIP) teams; (f) eating disorder teams; (g) other specialist services (autistic spectrum disorder service, community forensic service, learning disability, prison in-reach and criminal justice liaison, community substance misuse [no longer provided by the NHS], memory/young-onset dementia services, brain injury services, art therapy, specialist psychotherapy, social care teams, approved mental health practitioner services, electroconvulsive therapy). We excluded wards (see *Admissions*) and some other services (e.g. day care, placement/support services, on-call teams, pharmacy).

Community services and Minor Injury Unit provision

Here we describe services whose data are captured within CPFT's SystmOne electronic records system.

CPFT's Children and Young People's Directorate provides integrated children's health services. This includes health visiting, community nursing, school nursing, speech and language therapy, paediatric psychology, occupational therapy, physiotherapy, community paediatrics, and child development. (This directorate also provides secondary care MH services for children and adolescents, captured within the RiO electronic system.)

CPFT's Older People's and Adult Community (OPAC) Directorate provides integrated Neighbourhood Teams for over-65s and for over-18s requiring community services. Their staff include support workers, district nurses, mental health nurses, occupational therapists, and physiotherapists. They provide case management integrating physical and mental health, a Hospital at Home service (encompassing community rehabilitation and palliative care), support for people to access personal care budgets, intermediate care (avoiding hospital admission or supporting those recently discharged), and crisis intervention. Other services include district nursing, podiatry, dietetics, memory services, speech and language therapy. There are four inpatient wards within this service for rehabilitation and end-of-life care (in Cambridge, Ely, Wisbech, and Peterborough). Joint Emergency Teams provide a two- or four-hour response for those aged 65+ or with long-term conditions who require urgent medical care but do not require hospital admission. (This directorate also provides secondary care mental health services for those aged 65+, captured within RiO.)

CPFT's OPAC Directorate also provides Minor Injury Units (MIUs) for patients of all ages, staffed by specialist nurse practitioners. These are walk-in services. The MIUs treat wounds, bites, minor burns/scalds, fractures, muscle and joint injuries (including sports injuries), eye problems (e.g. foreign bodies, conjunctivitis), earache, cystitis (excluding children and male patients), and minor head injuries without loss of consciousness. The three MIUs (at Doddington, Ely, and Wisbech) lie within a circle of diameter ~33 km.

Service reorganization

A number of services reorganized during this period, influencing activity from the "supply" side. These included:

- CAMH closed to non-urgent referrals, and ordinarily receives many referrals from schools, which shut on 2020-03-19 (week 12). Staff were moved into CPFT's First Response Service (FRS), the service providing the NHS 111 MH crisis telephone line, to provide a 24/7 crisis assessment service for children/adolescents.
- The Adult & Specialist MH directorate deferred appointments for many non-urgent referrals and offered interim telephone support, or closed to non-urgent referrals. Services in these categories included the primary care mental health service, locality teams, perinatal service, and neurodevelopmental assessment service. Others continued as normal, though with a shift towards remote work (e.g. eating disorder services, CRHT, first-episode psychosis services).

- The older people's MH directorate shut routine memory/stepped care services, and advised professionals that referrals would be triaged to focus on people requiring intervention to prevent deterioration that might lead to hospital admission or threat to life.
- Non-urgent referrals were suspended for PH services including community rehabilitation, neurorehabilitation, diabetes, dietetics, continence, and speech/language therapy.
- The Doddington and Wisbech MIUs were closed on 2020-04-06 (week 15). The Ely MIU remained open and its hours were extended.
- Acute hospitals cancelled routine activity and discharged patients in preparation for COVID-19. For example, CUH is a 1,268-bed hospital[4] and had 413 empty beds by 2020-04-23 (week 17), influencing inpatient (ward) referrals to LP. Additionally, the CUH ED was reconfigured on 2020-03-20 (week 12) to redeploy its CDU, a ward normally used for patients awaiting test results or having observation/therapy following overdose. Such patients were instead transferred directly to medical wards, which may in turn have shifted a proportion of LP referrals from the ED to wards.
- MH hospitals similarly made all efforts to discharge patients where safe, including to create isolation areas in some wards (with a reduction in total available bed numbers); at times there were ward closures in response to outbreaks. CAMH closed one of its three wards temporarily (closed 2020-03-17, reopened 2020-06-01).
- Inter-ward transfers within CPFT were curtailed. Such transfers normally occur for several reasons, including repatriation between CPFT's hospitals to be closer to home, transfer to/from specialist wards such as as the psychiatric intensive care unit, and policy-based transfer. For working-age adults, CPFT ordinarily operates a "3-3-3" ward system,[5] in which most voluntary patients are admitted to an "assessment" (3-day) ward, then transferred if necessary to a "treatment" (3-week) ward (to which detained patients are admitted initially), and then to a "rehabilitation" (3-month) ward. This system was changed (formally on 2020-04-20, week 17) to reduce inter-ward transfer. Older people's MH services restricted inter-ward transfers for infection control on 2020-03-23 (week 13).
- There was a deliberate shift towards remote consultation across the NHS.[6]
- Alternative locations were sometimes used for urgent psychiatric assessments that might normally have taken place in EDs, to minimize ED footfall. However, these were recorded by and against the teams that would normally have performed those assessments.
- CPFT collaborated with a local mental health charity (Cambridgeshire, Peterborough and South Lincolnshire Mind) to provide non-urgent psychological support via telephone as an alternative to 111 and IAPT.[7] Calls to this service were not captured in the present data.
- Other parts of the health service such as primary care changed procedures and priorities, which may have affected referrals "inwards" to CPFT.

Changes to national data reporting

Data from the UK central COVID-19 reporting for Cambridgeshire and Peterborough changed retrospectively,[8] with more cases being reported as the result of adding "pillar 2" testing (antigen tests by commercial partners for the wider population) to "pillar 1" testing (antigen tests by Public Health England laboratories and NHS hospitals for those with a direct clinical need and health/care workers), plus de-duplication.[8] Nationally, this was associated with a shift in the apparent peak of COVID-19 cases from weeks 14–15 to weeks 15–18.[9] This change also accounts for some differences in these data (**Figure 5C**) from the preprint of the present study (at https://dx.doi.org/10.2139/ssrn.3648247).

SUPPLEMENTARY RESULTS

Referrals to secondary care MH teams, by SMI

Referrals to secondary care MH teams, shown aggregated across all patients in **Figure 1E,** are shown split by patients who did or did not have a lifetime recorded diagnosis of a severe mental illness (SMI, classified as per the Methods), in **Supplementary Figure 1**.

Admission, Mental Health Act, documentation, and contact data, by SMI

Whereas **Figure 3** shows data for all patients, **Supplementary Figure 2** shows these measures but only for patients with a lifetime recorded diagnosis of an SMI, and **Supplementary Figure 3** for patients without such a recorded diagnosis.

SUPPLEMENTARY REFERENCES

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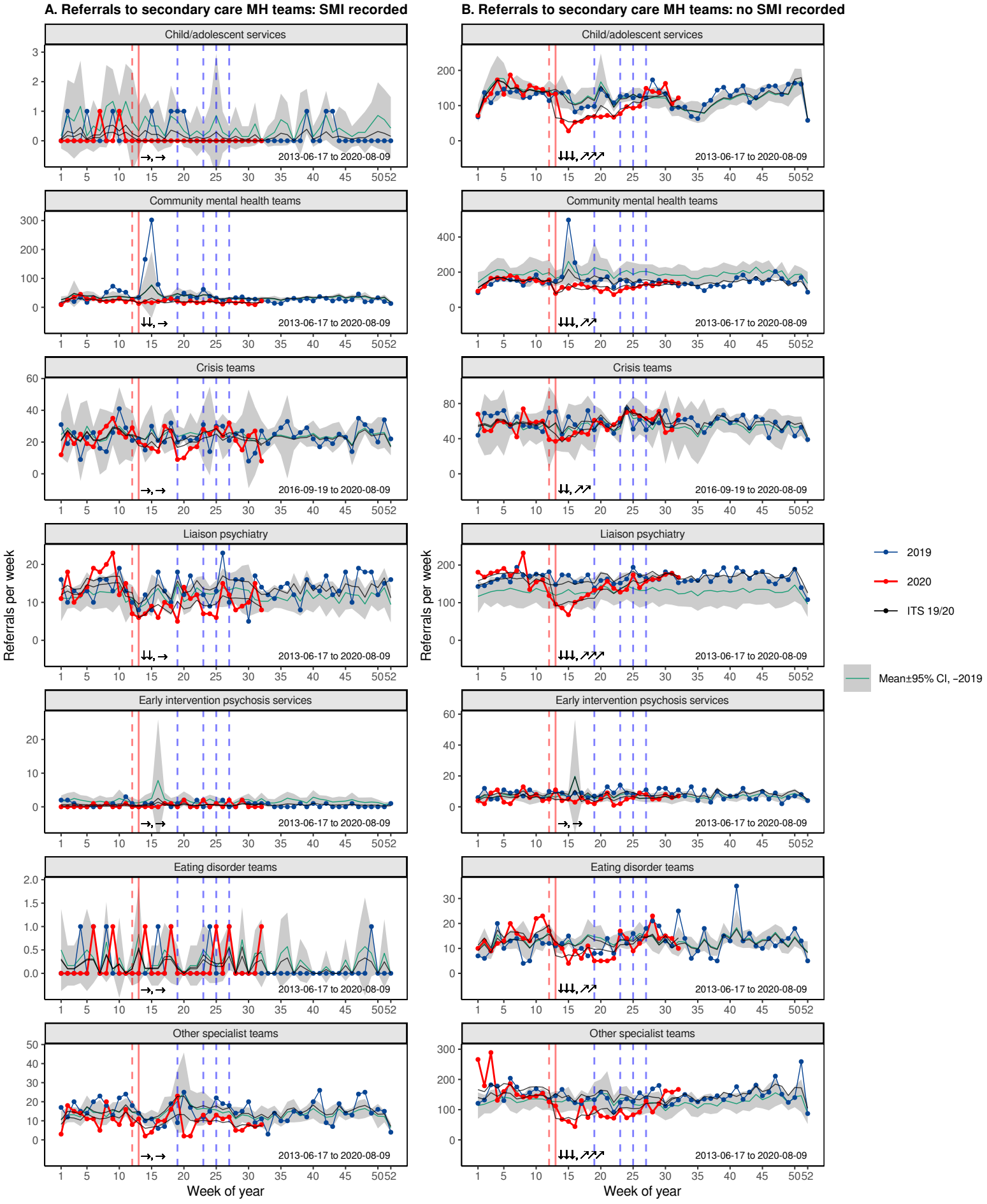
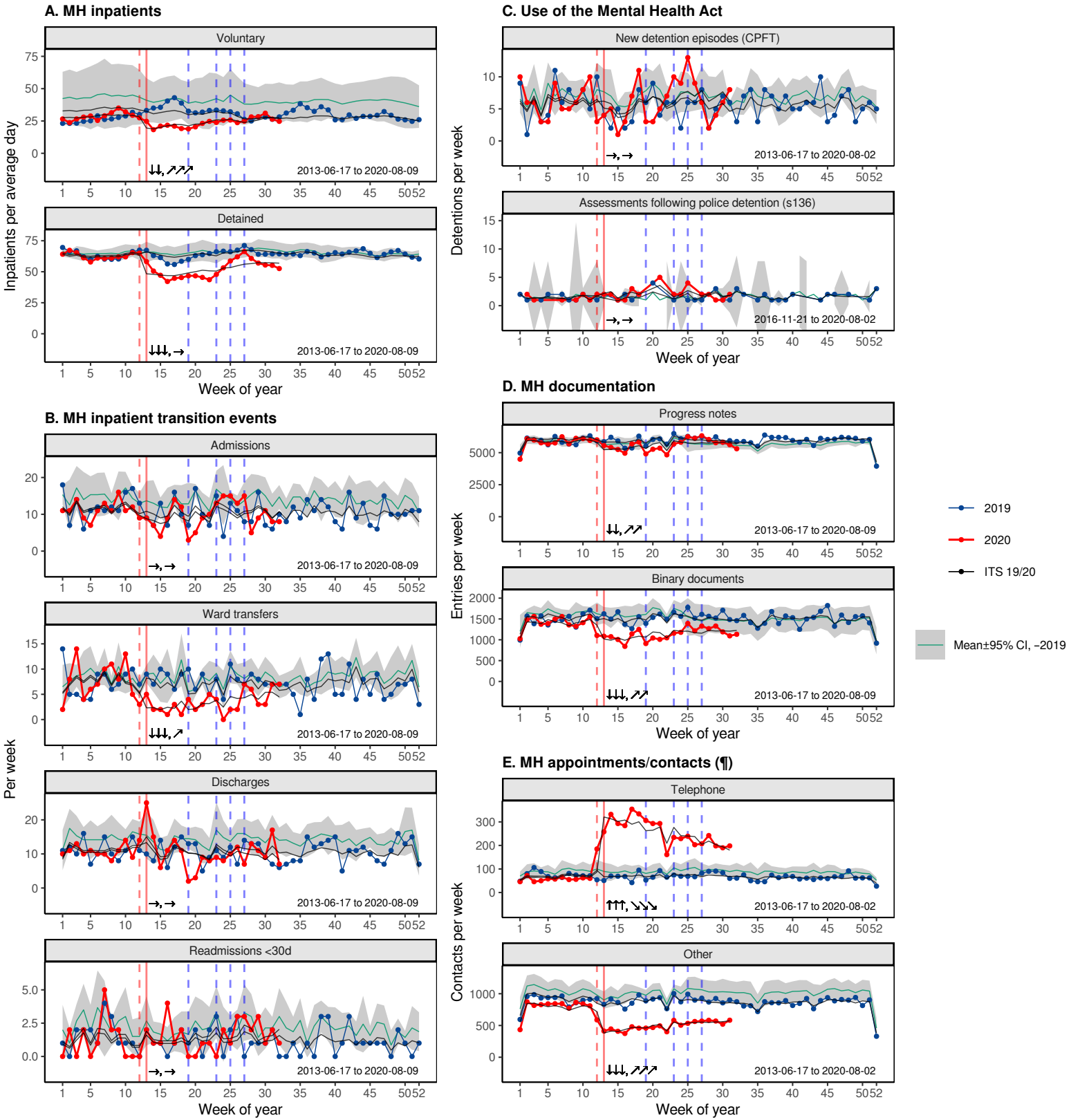
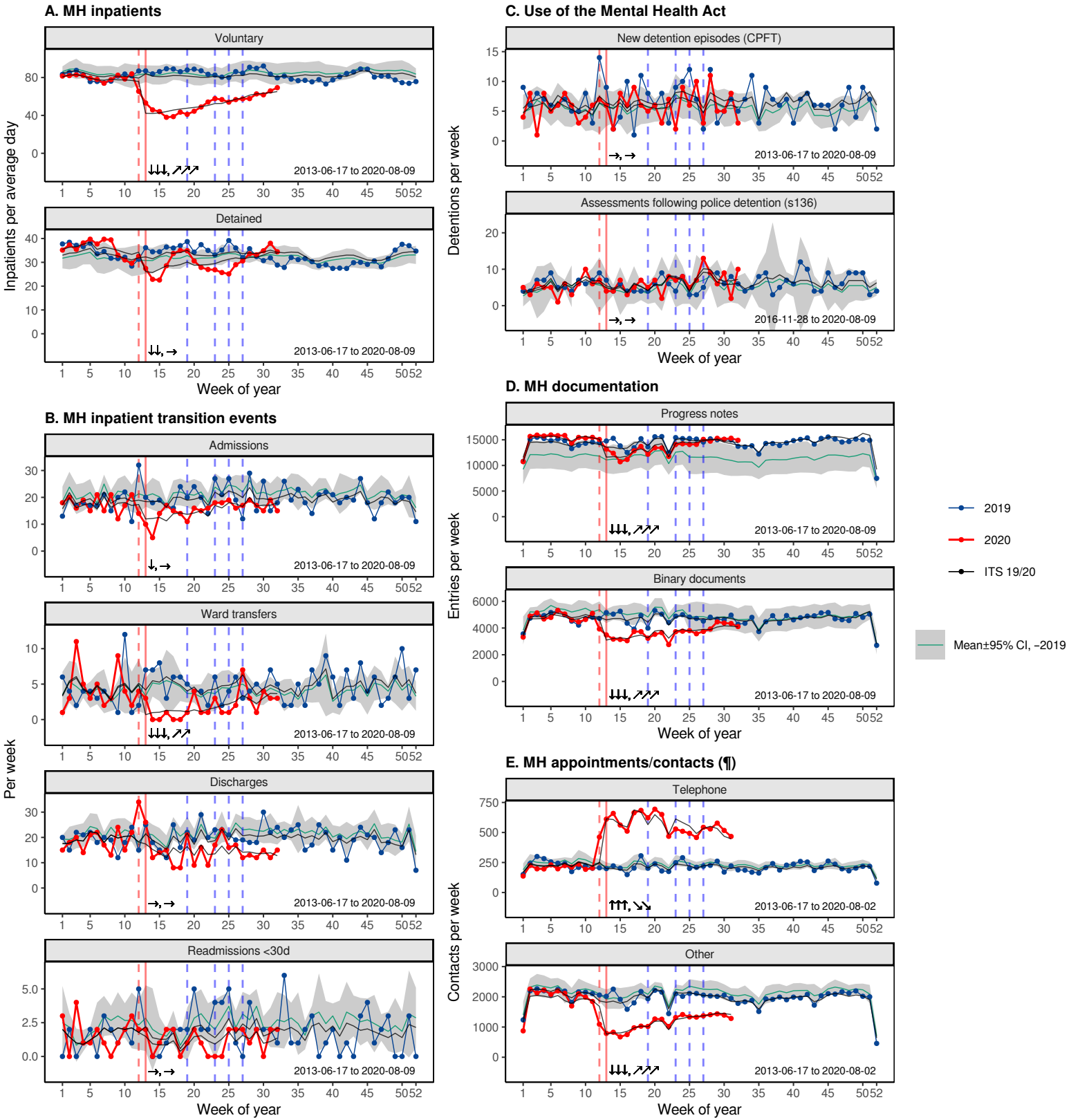


Supplementary Figure 1. Referrals to secondary care MH teams, split by SMI. **(A)** Referrals for patients with a lifetime recorded diagnosis of an SMI. **(B)** Referrals for patients without a recorded SMI. Graphical conventions as for **Figure 1.**



Supplementary Figure 2. Measures as for **Figure 3**, but restricted to patients *with* a lifetime recorded diagnosis of an SMI. Graphical conventions as for **Figure 1.**



Supplementary Figure 3. Measures as for **Figure 3**, but restricted to patients *without* a lifetime recorded diagnosis of an SMI. Graphical conventions as for **Figure 1.**