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3 **Utilization of Physician Mental Health Services by Mothers with Young Children Before and**
4 **During the COVID-19 Pandemic: A Population-based Study in Ontario, Canada.**
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6 **ABSTRACT (249 words)**
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9 **BACKGROUND:** The COVID-19 pandemic had many unintended consequences such as the
10 disruption of social and material supports, and healthcare services. Of particular interest are
11 mothers with young children who were most vulnerable to these disruptions which could have
12 impacts on mental health. This study compared rates of use for mental health diagnoses during
13 the pandemic to pre-pandemic rates.
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16 **METHODS:** This population-based repeated cross-sectional study used linked health
17 administrative databases in Ontario, Canada to model expected visit rates based on trends prior
18 to the pandemic (March 2016-February 2020) and compared these to observed rates during the
19 pandemic (March 2020 to November 2021). The absolute and relative differences in observed
20 versus expected rates were examined by age of the children (0 – 5, 6-12) diagnosis type, age of
21 the mother, and neighborhood material deprivation.
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24 **RESULTS:** N=1,423,931 mothers of young children were identified during the study period. The
25 analysis showed that during the pandemic the observed visit rates quickly rose to levels higher
26 than expected and persistently stayed higher. Mothers of children 0-5 years of age had the
27 highest relative and absolute rate increase (RR 23.9% (CI: 21.1-26.7), 199/1000 vs. 161/1000) at
28 their peak relative to pre-pandemic trends. Most of the increase was mood and anxiety
29 disorders diagnoses. Rates were highest among the youngest mothers and those living in the
30 most deprived neighborhoods.
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34 **CONCLUSION:** Our study raises concerns about the impacts of NPI during the pandemic on the
35 mental health of mothers of young children and highlights the need to address these concerns.
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INTRODUCTION

Parenting can be joyous and fulfilling but comes with many challenges. Much of the burden of parenting is borne by mothers and mothers experience increased mental health burdens due to a range of biological, social, and economic factors (1, 2). Mothers of young children are at an increased risk for mental health problems such as anxiety and depression. Some estimates indicate that the prevalence of post-partum depression can range between 7.5% to 20% (2-4). When accounting for other mental health conditions and risk-factors this figure is higher. For example, younger mothers were found to have 2 to 4 times elevated risk for experiencing anxiety disorders and other mental health disorders relative to older mothers or peers without children (5). Socioeconomic factors, such as low income, education, job loss, and being a single parent, are associated with anxiety, depression, and negative parenting practices (6-8). During the COVID-19 pandemic, these gender differences in childcare responsibilities, employment, and working arrangements may have magnified pre-existing gender inequities leading to greater psychological distress in mothers with young children. (9, 10)

The COVID-19 pandemic was declared by the World Health Organization on March 11th, 2020. (11). In response, on March 15th 2020, the Office of the Premier declared a provincial state of emergency in Ontario, Canada (12). Efforts to contain the COVID-19 pandemic involved a range of non-pharmaceutical interventions that disrupted many of the basic social and material supports for mothers. These included financial and employment stress, childcare and school closures, added caregiver burden, physical and social distancing from friends, family, and other social networks. It has been argued that these profound changes in supports could lead to despair and stress that could manifest in anxiety and depression and subsequent drug and alcohol abuse, and domestic violence (13, 14). Research showed parents with children living at home reported higher rates of stress, anxiety and depression, as well as increased alcohol consumptions after the pandemic (15). Moreover, pre-existing financial stress made worse by the pandemic resulted in greater mental health challenges for parents and their children, with less parental availability to their children, affirmations of love and affection, and greater domestic conflict (15). In this context of decreased supports, it is important to assess the impact of the disruption of these supports on mental health of mothers. Furthermore, since the mental health of mothers can have a spillover effect on the health and development of children, understanding and addressing the mental health issues of mothers has intergenerational implications.

Many of the studies identified on this topic were based on surveys with small to modest sample sizes, however, population-based quasi-experimental designs were limited (16-18). In this study we aimed to better understand the impacts of the pandemic and related stressors facing mothers of young children at the population level. We hypothesized that pandemic-related disruptions in education, social connection and employment and their subsequent impact on mental health would manifest as healthcare needs that, at least in part, can be measured as a range of interactions with the healthcare system (e.g., outpatient GP and specialist visits) to

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3 meet those needs. Using routinely collected health system data from Ontario, Canada, we
4 examined whether rates of mental health visits between March 2020 to November 2021
5 differed from expected visit rates based on pre-COVID-19 trends in mental health service use by
6 provider type, clinical diagnosis, and variations in outcomes by age of the mother, child, and
7 material deprivation.
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10 **METHODS**

11 Study Design and Data Sources:

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13 We conducted a population-based, repeated cross-sectional study for all mothers with young
14 children (0-12 years of age), living in Ontario, Canada, and eligible for provincial health
15 insurance between March 2016 to November 2021, using linked health administrative
16 databases. The data was obtained through ICES (formerly the Institute for Clinical Evaluative
17 Sciences), an independent research institute with the legal status permitting it to collect and
18 analyze health care and demographic data without individual patient consent for health system
19 evaluation and improvement under the Ontario's health information privacy law.
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24 Databases used in the study included the provincial health insurance database (Ontario Health
25 Insurance Plan - OHIP), which contains billing records for all mental health services provided by
26 family physicians and psychiatrists. The cohorts of mothers with young children were identified
27 using the Mother-Baby Database (MOMBABY), a dataset at ICES which links maternal hospital
28 delivery records with in-hospital births captured in the Discharge Abstract Database (DAD),
29 accounting for over 98% of births in the province (19, 20). Billing and the pairing of mothers
30 with their children are assigned at the individual level. The 2016 Ontario Marginalization Index
31 (ON-MARG) was used to assign material deprivation, which is a composite measure of income,
32 education, single-parent families, and housing quality (21, 22). Statistics Canada's Postal Code
33 Conversion File (PCCF) was used to indicate if a person lives in an urban population center or a
34 rural area (23). Both material deprivation (using ON-MARG) and rurality were assigned at an
35 ecological level (DA – Dissemination Area, a small, relatively stable geographical unit comprised
36 of one of more adjacent dissemination blocks, with a population size between 400-700 persons)
37 (24).
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43 Study Population and Timelines:

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45 The World Health Organization declared a global pandemic on March 11th 2020, followed by a
46 state of emergency in Ontario, Canada on March 17th, 2020 (11, 25). Based on those dates, we
47 obtained data from March 2016 to February 2020 to establish a baseline of pre-pandemic visit
48 rates. Data from the start of March 2020 to the end of November 2021, was used to measure
49 rates of visits during the pandemic. Data was provided to us in quarterly intervals which
50 provided 23 cross-sectional measures over time. Mothers of all ages, who were OHIP insured,
51 and had children between the ages of 0-12, were included in the study. Two cohorts were
52 generated based on the age of the children: 1) mothers with children 0-5 years of age and
53 mothers with children 6-12 years of age. We used open cohorts and assessed at-risk time to
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3 allow for individuals to contribute time at risk for outcomes. Mothers with missing IKN (ICES
4 Key Number - unique encrypted identifier), birth date, sex, OHIP eligibility, non-resident,
5 admitted or discharged from institutional care facilities during the study, or had died prior to
6 index date were excluded. For each mother we collected age at the individual level, material
7 deprivation and rurality at the area level.
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10 Study Outcomes:

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12 The primary outcomes were outpatient visits for mental illness to a primary care provider or to
13 a psychiatrist, derived from physician billing claims. Given the large proportion of virtual visits
14 after the start of the pandemic, we aggregated both in-person and virtual visits. Mental health
15 episodes were derived from physician billing claims using the International Classification of
16 Disease, 8th revision, including: mood and anxiety disorders (OHIP DXCODES 296, 300, 311),
17 alcohol and substance abuse disorders (OHIP DXCODES 303, 304), non-psychotic mental health
18 disorders (OHIP DXCODES 301, 302, 306, 309), and also a total of all mental health related
19 outpatient visits for social problems (OHIP DXCODES: 897, 898, 899, 900, 901, 902, 904, 905,
20 906, 909) (see supplemental Table 1 for details).
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25 Statistical Analysis:

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27 Using negative binomial regression with time and season as predictors, we modeled utilization
28 trends in the pre-pandemic period (March 2016 – February 2020) and visit rates per 1000. The
29 log of the number of mothers in each quarter was used as the offset. Residuals were modeled
30 as an autoregressive AR(1) process to account for serial correlation among observations and to
31 account for seasonality. The fitted model was then used to predict the expected rate of visits
32 for each quarter from March 2020 to the end of November 2021. For the main analysis, we
33 calculated actual observed rates of use during the pandemic compared with expected rates of
34 use based on the model. We calculated the relative difference (95% confidence interval [CI])
35 between the observed and expected rates per 1000 of use for each quarter from March 2020 to
36 the end of November 2021 by subtracting the expected rate from the observed. In the
37 secondary analysis, we stratified results from the primary analysis by individual diagnoses, age
38 of the mother, and material deprivation. Data preparations, analyses, and visualizations were
39 performed using SAS 9.4.
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45 RESULTS

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47 A total of N=1,423,931 million mothers with young children were included in the study with
48 n=986,870 mothers having children 0-5 years of age (cohort 1) and 1,012,997 mothers having
49 children 6-12 years of age (cohort 2). As shown in Table 1, mothers with younger children were
50 younger on average with about 60% between the ages of 27 to 36, followed by 22.4% between
51 37 to 47 years of age. Mothers with children were slightly older, with 53.7% between 37 to 47
52 years of age, followed by 36.3% between 27 to 36 years of age. In both cohorts, a much larger
53 proportion of younger mothers (those bellow 18, and 18 to 26 years of age) were living within
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most deprived neighbourhoods (Q5) relative to older mothers (Supplemental Table 2). Majority of the study population (up to 90%) were living within urban locations in Ontario.

Table 1: Sociodemographic Characteristics of Study Population

Characteristics	Mothers w. Children 0-5 Years of Age (Cohort 1)	Mothers w. Children 6-12 Years of Age (Cohort 2)
Sex		
Female (total)	986,870 (100.0)	1,012,997 (100.0)
Age Band (mothers)		
<18 years	4,906 (0.5)	13 (0.00)
18-26	164,717 (16.7)	36,243 (3.6)
27-36	592,467 (60.0)	368,089 (36.3)
37-47	221,619 (22.5)	544,602 (53.8)
48+	3,161 (0.3)	64,050 (6.3)
Material Deprivation		
1 (least deprived)	231,596 (23.8)	248,140 (24.8)
2	207,234 (21.3)	224,054 (22.4)
3	181,014 (18.6)	186,712 (18.6)
4	170,147 (17.5)	166,238 (16.6)
5 (most deprived)	184,940 (18.9)	176,788 (17.6)
Rural/Urban		
Urban	888,238 (90.3)	908,480 (89.9)
Rural	95,071 (9.7)	102,021 (10.1)

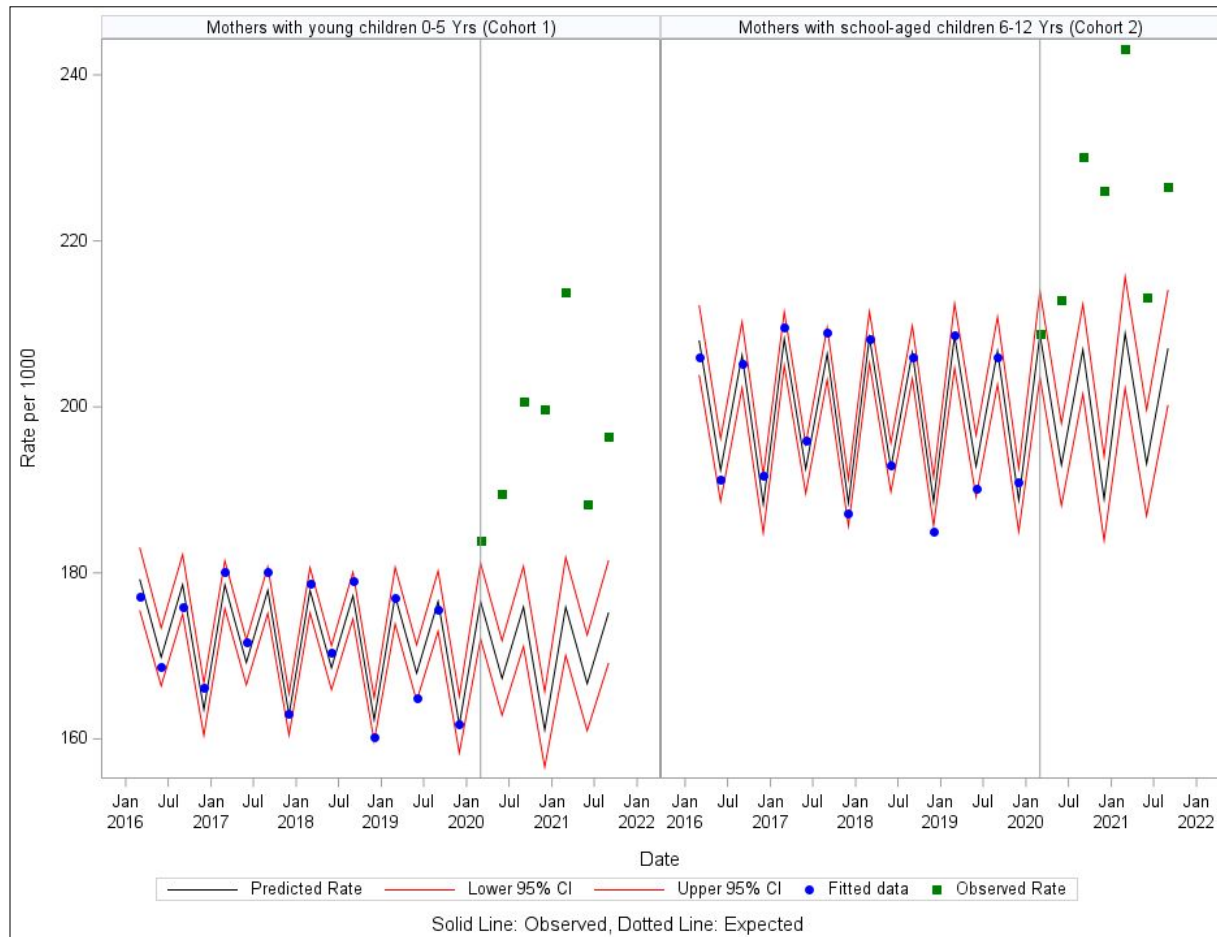
Changes in overall outpatient mental health service utilization (Figure1):

Observed rates for mental health visits began to steadily increase relative to the expected rates for cohort 1 (mothers with young children 0 to 5 years of age), from the onset of the pandemic (March 2020). The first quarter was slightly higher relative to expected rates by 4.5% (CI: 1.5, 6.7; 183 vs. 176/1000). Subsequent quarters were much higher in overall service utilization, which peaked in December-2020/February-2021 by 23.9% (CI: 21.1, 26.7; 199 vs. 161/1000). A year into the pandemic, the observed rates declined slightly but remained high at 21.6% (CI: 18.2, 24.9; 213 vs. 175/1000) above expected. The observed rates were lower in the final quarter of the study (September-November 2021) however, remained above expected rates at 12.1% (CI: 8.5, 16.4; 196 vs. 175/1000).

Cohort 2 (mothers with school-aged children 6-12 years of age) showed no difference in rates of use in the first quarter of the pandemic. However, observed rates for overall mental health service use were higher from the second quarter of the pandemic onwards. The highest difference in service utilization was in the quarter of Dec. 2020/Feb. 2021, which was 19.65% (CI: 16.9, 22.3; 226 vs. 188/1000) higher relative to expected rates. There was a steady decline

thereafter, with rates remaining 9.43% (CI: 6.0, 12.7; 226 vs. 207/1000) higher than expected rates in the last quarter of the study.

Figure 1 – Total Expected and Observed Outpatient Mental Health Visits Over Time



Cohort 1 – Mothers with young children 0 – 5 years of age							
Time (Quarterly)	Mar-May 2020	Jun-Aug 2020	Sep-Nov 2020	Dec-Feb 2020	Mar-May 2021	Jun-Aug 2021	Sep-Nov 2021
Observed Rate/1000	183.88	189.58	200.67	199.64	213.84	188.33	196.39
Expected Rate/1000	176.54	167.29	175.89	161.09	175.87	166.65	175.23
Difference between observed and expected	7	22	25	38	38	22	21
Adjusted *RR (95% CI)	4.5% (1.5-6.7)	13.2% (10.6-15.9)	14.1% (11.3-16.8)	23.9% (21.1-26.7)	21.6% (18.2-24.9)	13.0% (9.5-16.4)	12.1% (8.5-16.4)
Cohort 2 – Mothers with school-aged children 6 – 12 years of age							
Time (Quarterly)	Mar-May 2020	Jun-Aug 2020	Sep-Nov 2020	Dec-Feb 2020	Mar-May 2021	Jun-Aug 2021	Sep-Nov 2021
Observed Rate/1000	208.88	212.84	230.15	226.03	243.13	213.16	226.58
Expected Rate/1000	208.68	192.99	206.88	188.9	208.85	193.15	207.05
Difference between observed and expected	0	20	24	38	35	20	19
Adjusted *RR (95% CI)	0.09% (-2.4-2.5)	10.28% (7.6-12.8)	11.24% (8.6-13.8)	19.65% (16.9-22.3)	16.41% (13.1-19.5)	10.36% (7.0-13.6)	9.43% (6.0-12.7)

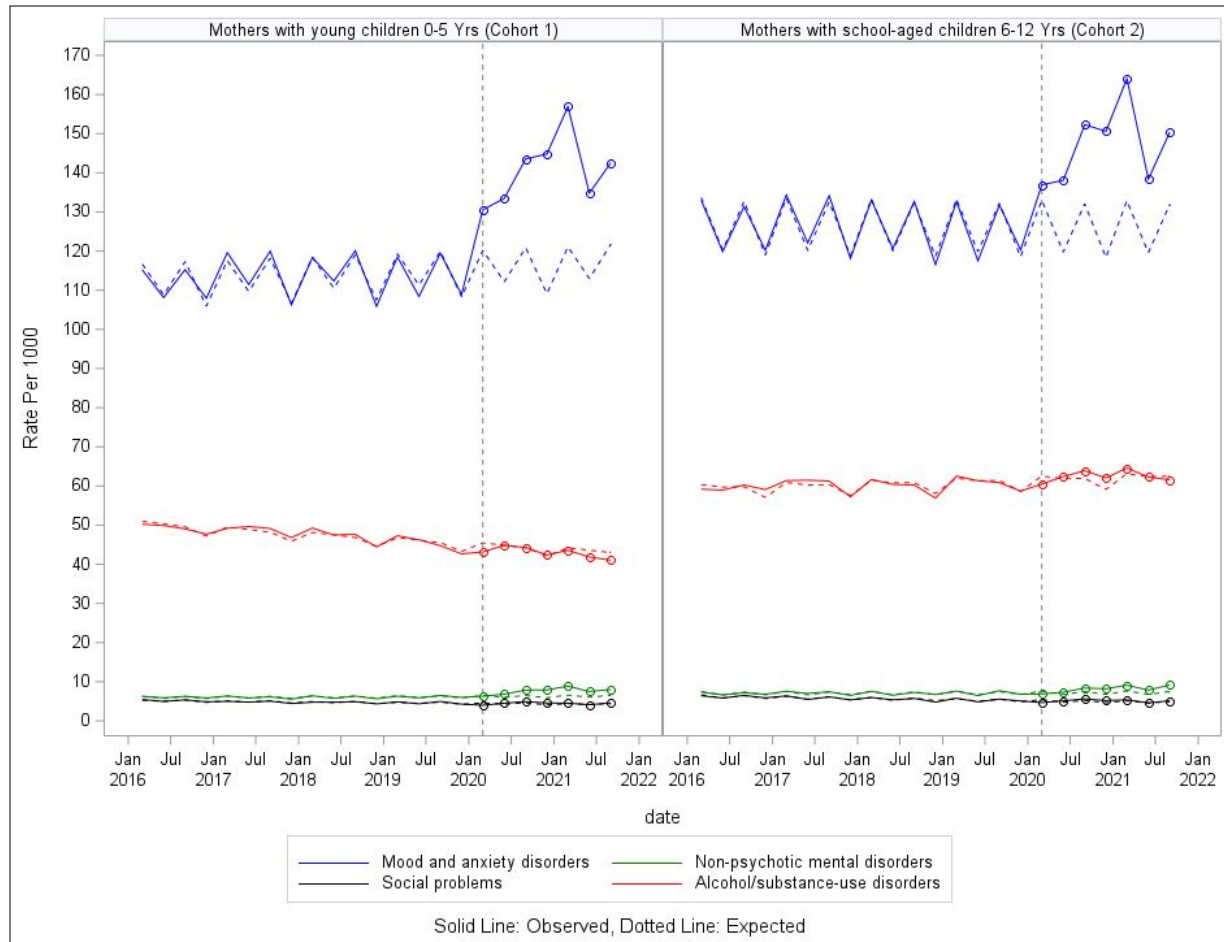
* RR: Relative Rate (i.e., rate ratio)

Changes in mental health service utilization by diagnosis:

Mothers with children 0 to 5 years of age showed substantially higher service use for mood and anxiety disorders, starting from the first quarter of the pandemic 8.6% (CI: 5.1, 11.9; 130 vs. 124/1000) and peaking at 32.7% (CI: 28.4, 36.4; 144 vs. 113/1000) in the Dec-2020/Feb-2021 quarter, relative to expected rates (figure 2). The higher rate in service use for mood and anxiety disorders remained above expected levels in the last quarter of the study at 17% (CI: 12.2, 21.7; 142 vs. 127/1000). Other non-psychotic mental disorder visit rates were lower than expected in the first quarter of the pandemic by 3.5% (CI: -8.8, 1.5; 6.2 vs. 6.8/1000), however, showed higher rates than expected thereafter. The peak visit rate for other non-psychotic mental disorders was in the quarter of Dec-2020/Feb-2021 up 33.5% (CI: 27.3, 39.3; 7 vs. 6/1000) and 34.6% (CI: 27.4, 31.2; 8 vs. 7/1000) in Mar/May-2021. Observed rates remained above expected rates in the last quarter of the study 22.5% (CI: 14.8, 29.6; 8/1000 vs. 7). There was little to no change in expected versus observed rates for social problems, alcohol and substance use disorders.

Changes in service utilization rates for mothers with school-aged children (6-12 years of age), were also higher for mood and anxiety disorders. Service utilization for mood and anxiety was slightly higher from the onset of the pandemic by 2.9% (CI: 0.4, 5.3; 136.9 vs. 136.3/1000) and peaked in the winter quarter of Dec-2020/Feb-2021 by 27.1% (CI: 24.5, 29.7; 150 vs. 121/1000). The relative rates remained above expected levels in the last quarter of the study at 13.9% (CI: 10.6, 17.2; 150 vs. 136/1000). Service use for other non-psychotic mental disorders were lower during the first quarter of the pandemic by 9.4% (CI: -14, -5.1; 6 vs. 7/1000). Difference in rates were highest in Dec-2020/Feb-2021 by 20.9% (CI: 16.3, 25.3; 8 vs. 7/1000) and the last quarter of the study at 22% (CI: 16.4, 27.3; 9 vs. 7/1000). Difference in utilization patterns for social problems were highest in the Dec-2020/Feb-2021 quarter by 11.8% (CI: 6, 17.4; 5 vs. 4/1000). Unlike mothers with young children, there was a difference in service utilization for alcohol and substance use disorders, highest at 4.9% (CI: 0.8, 8.9; 62 vs. 61/1000) in Dec-2020/Feb-2021.

Figure 2 – Expected and Observed Mental Health Visits by Diagnosis Over Time



Changes in mental health service utilization by age and material deprivation of the mother:

Mothers with young children, over the age of 48, had the highest relative increases in visit rates overall, and for all diagnoses except for substance use disorders (Supplemental Figure 2). Younger mothers (<18 and 18-26), while having lower relative and absolute increases in visit rates than other age groups, still had substantially higher baseline rates prior to the pandemic for all types of visits except alcohol and substance use disorders. In contrast, mothers with school-aged children, the largest absolute and relative increases were primarily seen in the 18-26, and the 27–36-year-old age groups (Supplemental Figure 2). This was true overall, for mental disorders, social problems and for substance and alcohol use disorders. For material deprivation, the highest overall visit rates were generally among those living in the most materially deprived neighbourhoods; however, the largest relative increase in service use was primarily observed among those living in the least materially deprived neighbourhoods (Supplemental Figure 3).

DISCUSSION

In this population-based repeated cross-sectional study, from March 2020 to November 2021, we observed a substantial and rapid increase in clinical visits for mental health diagnoses relative to expected patterns of use prior to the pandemic, in mothers of young children, and to a lesser extent mothers of school-aged children. In terms of overall mental health service use, both cohorts showed similar relative and absolute differences, with greater rates of utilization among younger mothers, discussed in detail below. Material deprivation showed a dose-response relationship where living in more deprived neighborhoods was associated with higher mental health utilization overall before and during the pandemic, however, the highest relative increases were observed in less deprived neighborhoods.

Looking at mental health conditions by individual diagnoses shows clearly that the predominant increase in mental health service utilization is attributable to mood and anxiety disorders. This is the trend we expected to see based on our hypothesis that the hardships experienced as a direct or indirect affect of COVID-19 and related social distancing measures would manifest in diseases of despair, largely driven by anxiety and depression. Our findings are consistent with other studies which found similar results for postpartum mothers and those with young children, including elevated stress, anxiety, depression, alcohol, and substance use (6-8, 26). Findings in this study were similar for both cohorts, although increases in alcohol and substance abuse were noticeably higher among mothers with school-aged children (6-12 years of age). We cannot explain the difference in mental health service use between cohorts in this study, however, suspect that the pandemic had equally detrimental effects based on the unique challenges faced by both group of mothers. For example, mothers with children 0-5 years of age have expressed in other studies that their experience with elevated stress and depression is due to concerns with potential for illness from COVID-19, disruption in social support, and disruptions to work and finances (27). While other studies looking at parenting of older children during the pandemic suggest a confluence of economic pressures, increased relational stress, worries about looking after their children, and a constant balancing of competing domestic and work demands, which contributed to worsened mental health, increased alcohol use, and in suicidal thoughts and feelings (8).

For mothers with young children, in absolute terms, younger mothers <18 and 18-26 had the highest rate of utilization. However, in contrast to this, the oldest cohort of mothers 48+ showed the highest relative increase in utilization during the pandemic. This trend in utilization is due to mothers over 48 having the largest increase in mood and anxiety disorders, followed by mothers younger than 18. This trend also held true for non-psychotic mental health disorders. The reasons for these differences are not clear. We can only speculate that perhaps this is due to the relatively smaller sample of mothers over the age of 48 to other age groups, and some unexplained features of mothers in this age group. As for mothers with school-aged children, the youngest cohort 18-26 showed the highest relative and absolute increases in utilization. This was driven by mood and anxiety disorders, alcohol and substance use disorders.

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3 This was consistent with the literature where the burden of children in addition to other factors
4 of life manifested in worse despair outcomes in younger mothers (8).
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6 Lastly, we observed that for both cohorts, less deprived households had lower baseline but
7 higher relative increases in mental health service use compared to most deprived households,
8 who had much higher baseline rates, despite having lower increases after the pandemic. The
9 higher baseline rates in most deprived neighbourhoods were largely due to greater mood and
10 anxiety, and alcohol and substance use disorders. This is consistent with the literature showing
11 increased anxiety, depression, and alcohol abuse associated with lower socioeconomic status
12 and lone-parent families (28-34). However, we are unable to explain the higher difference in
13 mental health service use among least deprived households during the pandemic. The
14 difference may be due to access barriers to care for those with higher material deprivation
15 (e.g., not able to work from home, long wait-times for appointments, high proportion of single-
16 parents with limited social support, limited privacy in apartments and smaller dwellings, greater
17 burden of disease from COVID-19 in terms of cases and deaths, etc.) (35, 36). Moreover, there
18 is a higher proportion of visible minorities living in more deprived neighbourhoods, where
19 stigma around asking for mental health care remains, which may have played a part during
20 lockdowns where much of the care was accessed virtually (35, 37, 38). Another contributing
21 factor may have been the closing of offices or retirement of family doctors in the province
22 during the pandemic which could have further limited access (39). Therefore, it is possible that
23 the need for mental health services brought on by the pandemic was better met in less
24 deprived households accounting for the greater difference, but we cannot be certain. This is a
25 critical question that warrants further investigation.
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33 Limitations

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35 The methodology used for linking the record of the mother and child, correctly or incorrectly
36 assumes that the child is under the mother's care for up to 12 years from birth. This assumption
37 may hold up differently across deprivation quintiles. Studies with outcomes based on
38 healthcare utilization, may underestimate the true prevalence of those health outcomes, due to
39 non-seeking of care, or the seeking of care outside the medical establishment such as private
40 clinics, peers, and support groups. We did not control for history of mental illness or difference
41 in mental health among primipara and multipara mothers, which may have impacted our
42 results to some extent, as we know a history of mental illness is a risk factor for subsequent
43 mental health needs, in addition to the added burden of taking care of multiple children. The
44 study may have been underpowered in examining outcomes for mothers 48+ in cohort 1,
45 relative to the other age groups. There may also be unique features within this small group of
46 mothers relative to other age-groups. While our age and utilization metrics were generated at
47 the individual level, material deprivation was only attributed at the neighbourhood level.
48 Moreover, the ONMARG index needs an update to better reflect changing neighbourhood
49 characteristics since the 2016 version used in this study. Lastly, the results of this study while
50 generalizable to the population of Ontario, Canada, may not be generalizable to other
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3 jurisdictions where COVID-19 cases, containment policies, boundaries and population
4 characteristics are different.
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6 **CONCLUSION**

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8 Over 20-month course of the COVID-19 pandemic, we observed a substantial increase in use of
9 physician services for mental health diagnoses relative to pre-pandemic levels. This increase in
10 utilization was largely driven by services for mood, anxiety, and depressive disorders, and to a
11 lesser extent alcohol and substance use. Although increases in mental health service use were
12 observed across most age groups, when factoring baseline, relative and absolute differences,
13 the largest impact was seen among younger mothers. As for material deprivation, while relative
14 increases were larger in those living in the least deprived neighborhoods, overall rates are
15 much higher in most deprived neighborhoods. Attention should be paid to ensure adequate
16 programs and supports are available addressing both underlying causes of despair, poor mental
17 health, and access to clinical services when they are needed. Our study also raises concerns
18 about growing mental health needs among mothers and the intergenerational impacts on their
19 children.
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REFERENCES

1. Lyons-Ruth K, Wolfe R, Lyubchik A, Steingard R. Depressive Symptoms in Parents of Children Under Age 3: Sociodemographic Predictors, Current Correlates, and Associated Parenting Behaviors. In: McLearn KT, Schuster MA, Halfon N, editors. *Child Rearing in America: Challenges Facing Parents with Young Children*. Cambridge: Cambridge University Press; 2002. p. 217-60.
2. Vigod SN, Stewart DE. Emergent research in the cause of mental illness in women across the lifespan. *Curr Opin Psychiatry*. 2009;22(4):396-400.
3. Lanes A, Kuk JL, Tamim H. Prevalence and characteristics of postpartum depression symptomatology among Canadian women: a cross-sectional study. *BMC Public Health*. 2011;11:302.
4. Canada S. Maternal Mental Health in Canada, 2018/2019 2019 [Available from: <https://www150.statcan.gc.ca/n1/daily-quotidien/190624/dq190624b-eng.pdf>].
5. Van Lieshout RJ, Savoy CD, Boyle MH, Georgiades K, Jack SM, Niccols A, et al. The Mental Health of Young Canadian Mothers. *J Adolesc Health*. 2020;66(4):464-9.
6. Perry NB, Donzella B, Troy MF, Barnes AJ. Mother and child hair cortisol during the COVID-19 pandemic: Associations among physiological stress, pandemic-related behaviors, and child emotional-behavioral health. *Psychoneuroendocrinology*. 2022;137:105656.
7. Radomski A, Cloutier P, Polihronis C, Gardner W, Pajer K, Sheridan N, et al. Parenting during the COVID-19 pandemic: The sociodemographic and mental health factors associated with maternal caregiver strain. *Fam Syst Health*. 2022;40(1):79-86.
8. Thomson KC, Jenkins E, Gill R, Richardson CG, Gagne Petteni M, McAuliffe C, et al. Impacts of the COVID-19 Pandemic on Family Mental Health in Canada: Findings from a Multi-Round Cross-Sectional Study. *Int J Environ Res Public Health*. 2021;18(22).
9. Herten-Crabb A, Wenham C. "I Was Facilitating Everybody Else's Life. And Mine Had Just Ground to a Halt": The COVID-19 Pandemic and its Impact on Women in the United Kingdom. *Social Politics: International Studies in Gender, State & Society*. 2022.
10. Zamarro G, Prados MJ. Gender differences in couples' division of childcare, work and mental health during COVID-19. *Rev Econ Househ*. 2021;19(1):11-40.
11. Cucinotta D, Vanelli M. WHO Declares COVID-19 a Pandemic. *Acta Biomed*. 2020;91(1):157-60.
12. CIHI. COVID-19 Intervention Timeline in Canada Ottawa: The Canadian Institute for Health Information; 2021 [Available from: <https://www.cihi.ca/en/covid-19-intervention-timeline-in-canada>].
13. Shanahan L, Hill SN, Gaydosh LM, Steinhoff A, Costello EJ, Dodge KA, et al. Does Despair Really Kill? A Roadmap for an Evidence-Based Answer. *American Journal of Public Health*. 2019;109(6):854-8.
14. Anderson G, Frank JW, Naylor CD, Wodchis W, Feng P. Using socioeconomic factors to counter health disparities arising from the covid-19 pandemic. *BMJ*. 2020;369:m2149.
15. Westrupp EM, Bennett C, Berkowitz T, Youssef GJ, Toumbourou JW, Tucker R, et al. Child, parent, and family mental health and functioning in Australia during COVID-19: comparison to pre-pandemic data. *European Child & Adolescent Psychiatry*. 2021.
16. Babore A, Trumello C, Lombardi L, Candelori C, Chirumbolo A, Cattelino E, et al. Mothers' and Children's Mental Health During the COVID-19 Pandemic Lockdown: The Mediating Role of Parenting Stress. *Child Psychiatry Hum Dev*. 2021.
17. Mistry R, Stevens GD, Sareen H, De Vogli R, Halfon N. Parenting-related stressors and self-reported mental health of mothers with young children. *Am J Public Health*. 2007;97(7):1261-8.
18. Racine N, Eirich R, Cooke J, Zhu J, Pador P, Dunnewold N, et al. When the Bough Breaks: A systematic review and meta-analysis of mental health symptoms in mothers of young children during the COVID-19 pandemic. *Infant Ment Health J*. 2022;43(1):36-54.
19. ICES. MOMBABY Database 2020 [Available from: <https://datadictionary.ices.on.ca/Applications/DataDictionary/Library.aspx?Library=MOMBABY>].

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2
3 20. Fitzpatrick T, Wilton AS, Guttman A. Development and validation of a simple algorithm to
4 estimate common gestational age categories using standard administrative birth record data in Ontario,
5 Canada. *J Obstet Gynaecol*. 2021;41(2):207-11.
6
7 21. FI M, G M, T vl. 2016 Ontario marginalization index: user guide. 1st revision. Toronto, ON: St.
8 Michael's Hospital (Unity Health Toronto); 2022.
9
10 22. Moin JS, Moineddin R, Upshur REG. Measuring the association between marginalization and
11 multimorbidity in Ontario, Canada: A cross-sectional study. *Journal of Comorbidity*.
12 2018;8(1):2235042X18814939.
13
14 23. CLSA. Data Support Document: Urban / Rural Classification 2018 [
15
16 24. Canada S. Dissemination area: Detailed definition: Statistics Canada 2018 [Available from:
17 <https://www150.statcan.gc.ca/n1/pub/92-195-x/2011001/geo/da-ad/def-eng.htm>.
18
19 25. CIHI. COVID-19 Intervention Timeline in Canada: The Canadian Institute for Health Information;
20 2021 [Available from: <https://www.cihi.ca/en/covid-19-intervention-timeline-in-canada>.
21
22 26. Vigod SN, Brown HK, Huang A, Fung K, Barker LC, Hussain-Shamsy N, et al. Postpartum mental
23 illness during the COVID-19 pandemic: a population-based, repeated cross-sectional study. *CMAJ*.
24 2021;193(23):E835-E43.
25
26 27. van den Heuvel MI, Vacaru SV, Boekhorst MGBM, Cloin M, van Bakel H, Riem MME, et al.
27 Parents of young infants report poor mental health and more insensitive parenting during the first
28 Covid-19 lockdown. *BMC Pregnancy and Childbirth*. 2022;22(1).
29
30 28. Baumann M, Spitz E, Guillemin F, Ravaud J-F, Choquet M, Falissard B, et al. Associations of social
31 and material deprivation with tobacco, alcohol, and psychotropic drug use, and gender: a population-
32 based study. *International Journal of Health Geographics*. 2007;6(1):50.
33
34 29. Calling S, Ohlsson H, Sundquist J, Sundquist K, Kendler KS. Socioeconomic status and alcohol use
35 disorders across the lifespan: A co-relative control study. *PLoS One*. 2019;14(10):e0224127.
36
37 30. Chung RY-N, Marmot M, Mak JK-L, Gordon D, Chan D, Chung GK-K, et al. Deprivation is
38 associated with anxiety and stress. A population-based longitudinal household survey among Chinese
39 adults in Hong Kong. *Journal of Epidemiology and Community Health*. 2021;75(4):335-42.
40
41 31. Durbin A, Moineddin R, Lin E, Steele LS, Glazier RH. Examining the relationship between
42 neighbourhood deprivation and mental health service use of immigrants in Ontario, Canada: a cross-
43 sectional study. *BMJ Open*. 2015;5(3):e006690.
44
45 32. Heflin CM, Iceland J. Poverty, Material Hardship and Depression. *Soc Sci Q*. 2009;90(5):1051-71.
46
47 33. Kashem T, Al Sayah F, Tawiah A, Ohinmaa A, Johnson JA. The relationship between individual-
48 level deprivation and health-related quality of life. *Health Qual Life Outcomes*. 2019;17(1):176.
49
50 34. Agnafors S, Bladh M, Svedin CG, Sydsjo G. Mental health in young mothers, single mothers and
51 their children. *BMC Psychiatry*. 2019;19(1):112.
52
53 35. Moroz N, Moroz I, D'Angelo MS. Mental health services in Canada: Barriers and cost-effective
54 solutions to increase access. *Healthc Manage Forum*. 2020;33(6):282-7.
55
56 36. PHO. COVID-19 in Ontario: A Focus on Neighbourhood Material Deprivation, February 26, 2020
57 to December 13, 2021. Toronto, ON: Public Health Ontario; 2022.
58
59 37. Canada MHC. Shining A Light On Mental Health In Black Communities Ottawa, ON: Mental
60 Health Commission of Canada; 2021 [Available from:
<https://mentalhealthcommission.ca/resource/shining-a-light-on-mental-health-in-black-communities/>.
38. Chiu M, Amartey A, Wang X, Kurdyak P. Ethnic Differences in Mental Health Status and Service
Utilization: A Population-Based Study in Ontario, Canada. *Can J Psychiatry*. 2018;63(7):481-91.
39. Kiran T, Green ME, Wu FC, Kopp A, Latifovic L, Frymire E, et al. Did the COVID-19 pandemic
result in more family physicians stopping practice? Results from Ontario, Canada. *medRxiv*.
2021:2021.09.21.21263891.

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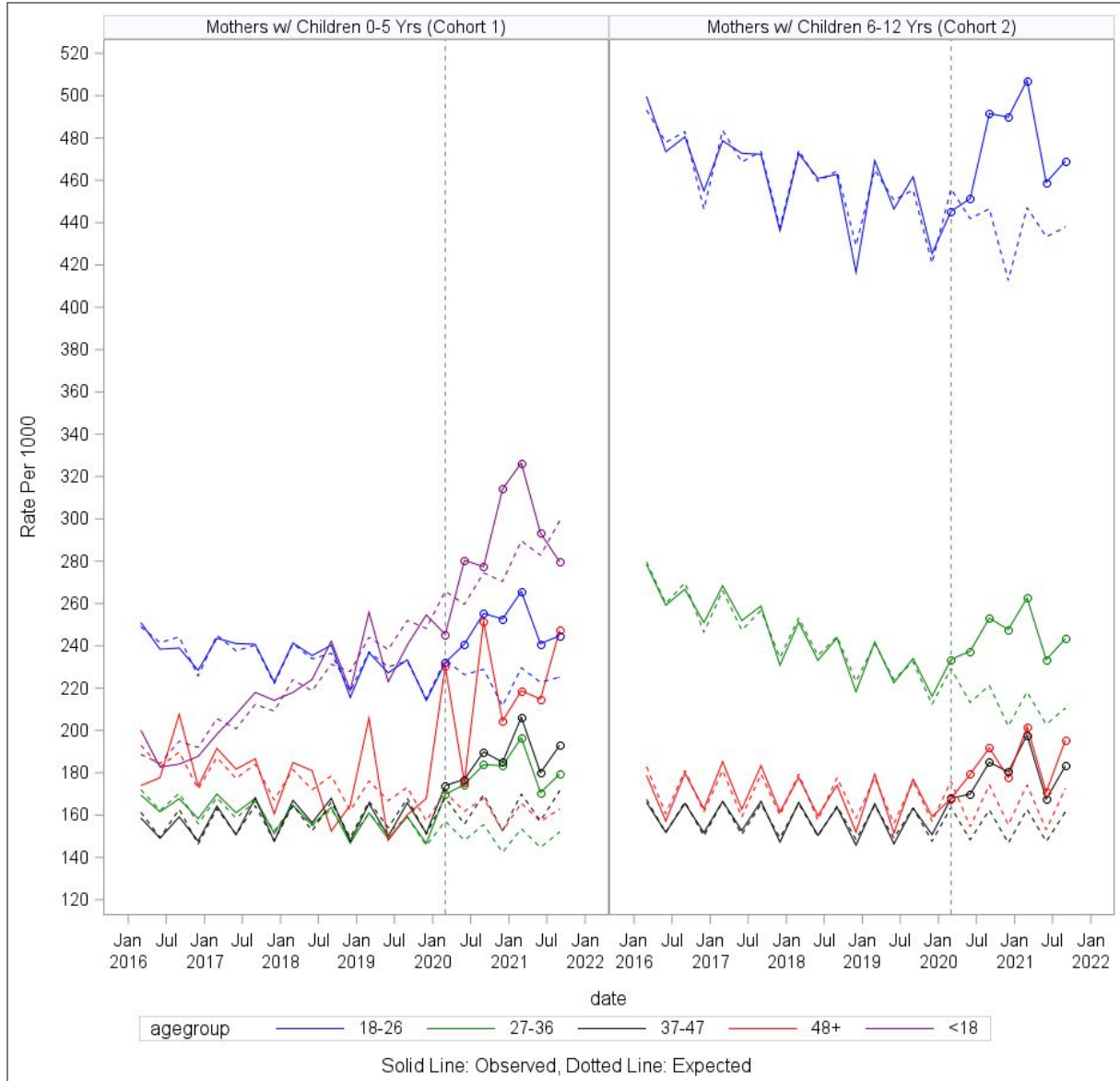
Table 1: OHIP Service and Diagnostic Codes:

Study Outcome Categories	OHIP Diagnostic Codes for Outcomes	Individual Codes and Their Description	
Mood and Anxiety Disorders	OHIP DXCODES: 296, 300, 311	296	Bipolar Disorder
		300	Anxiety and related disorders
		311	Depressive or other non-psychotic disorders
Non-psychotic and other disorders	OHIP DXCODES: 301, 302, 306, 309	301	Personality Disorder
		302	Sexual deviations
		306	Psychosomatic illness
		309	Adjustment reaction
Alcohol/substance abuse disorder	OHIP DXCODES: 303, 304	303	Alcoholism
		304	Drug dependence
Social Problems	OHIP DXCODES: 897, 898, 899, 900, 901, 902, 904, 905, 906, 909	897	Economic problems
		898	Marital difficulties
		899	Parent-child problems
		900	Problems with aged parents or in-laws
		901	Family disruption/divorce
		902	Education problems
		904	Social maladjustment
		905	Occupational problems
		906	Legal problems
909	Other problems of social adjustment		

Table 2: Breakdown of Material Deprivation by Age group

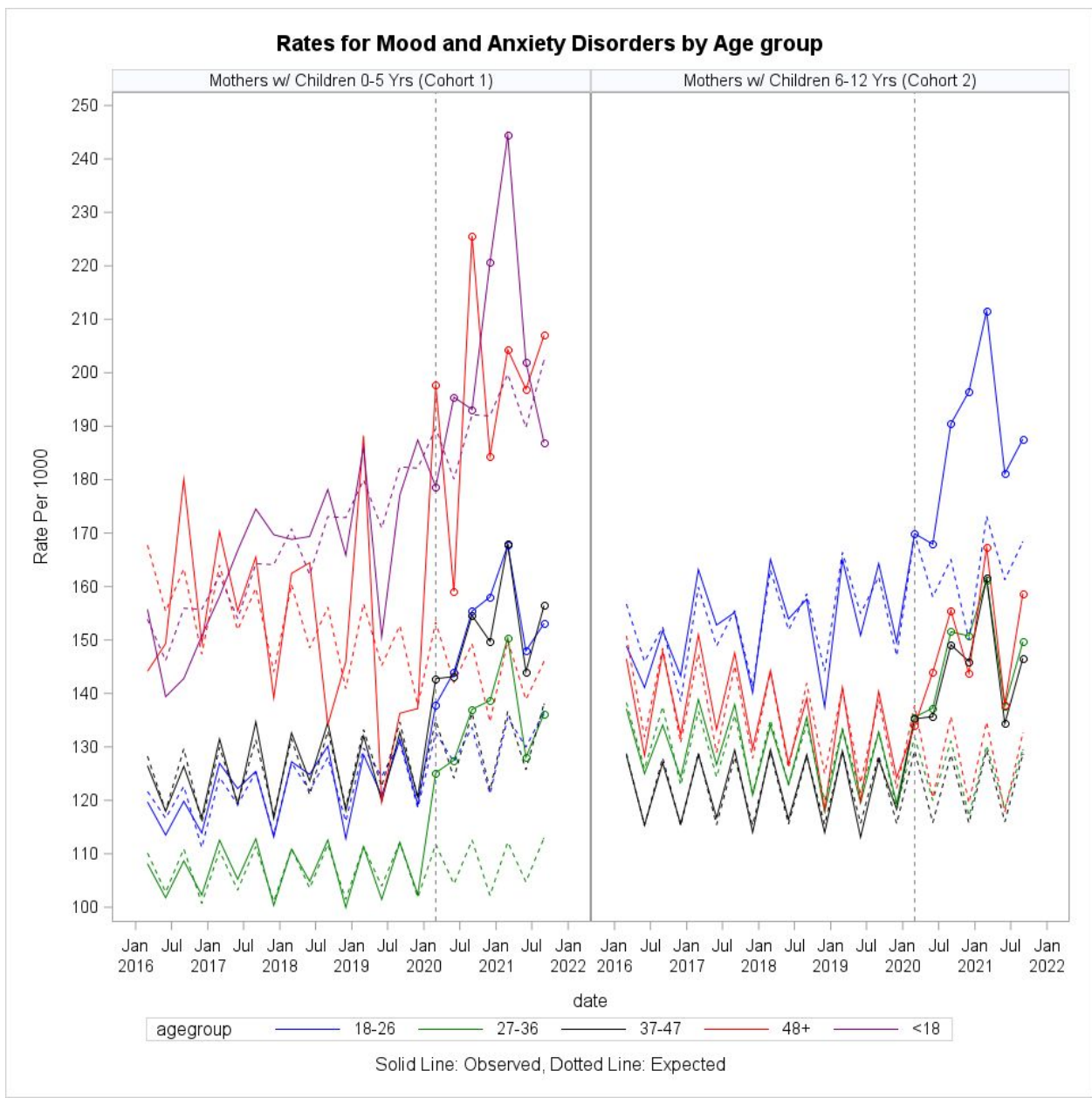
Characteristics	Mothers w. Children 0-5 Years of Age (Cohort 1)	Mothers w. Children 6-12 Years of Age (Cohort 2)
N (%)	986870 (100.0)	1012997 (100.0)
Age Band (mothers)		
<18 years	4906 (0.50)	13(0.00)
18-26	164717(16.69)	36243(3.58)
27-36	592467(60.03)	368089(36.34)
37-47	221619(22.46)	544602(53.76)
48+	3161(0.32)	64050(6.32)
Material Deprivation - Maternal Age <18		
1 (least deprived)	311(6.96)	*1-5 (0.00)
2	481(10.76)	*1-5 (0.00)
3	660(14.76)	*1-5 (0.00)
4	959(21.45)	*1-5 (0.00)
5 (most deprived)	2060(46.07)	*1-5 (0.00)
Material Deprivation - Maternal Age 18 to 26		
1 (least deprived)	20747(12.91)	2928(8.46)
2	25815(16.06)	4187(12.1)
3	29478(18.34)	5409(15.64)
4	34952(21.75)	7590(21.94)
5 (most deprived)	49709(30.93)	14477(41.85)
Material Deprivation - Maternal Age 27 to 36		
1 (least deprived)	145789(24.85)	72535(19.99)
2	128681(21.94)	73317(20.21)
3	111071(18.93)	69617(19.19)
4	100641(17.16)	67802(18.69)
5 (most deprived)	100415(17.12)	79540(21.92)
Material Deprivation - Maternal Age 37 to 47		
1 (least deprived)	63871(29.03)	154728(28.61)
2	51565(23.44)	131542(24.32)
3	39230(17.83)	100027(18.49)
4	33128(15.06)	81208(15.02)
5 (most deprived)	32230(14.65)	73336(13.56)
Material Deprivation - Maternal Age 48+		
1 (least deprived)	878(27.98)	17948(28.19)
2	692(22.05)	15005(23.56)
3	575(18.32)	11657(18.31)
4	467(14.88)	9637(15.13)
5 (most deprived)	526(16.76)	9431(14.81)
* Suppressed due to small cell values		

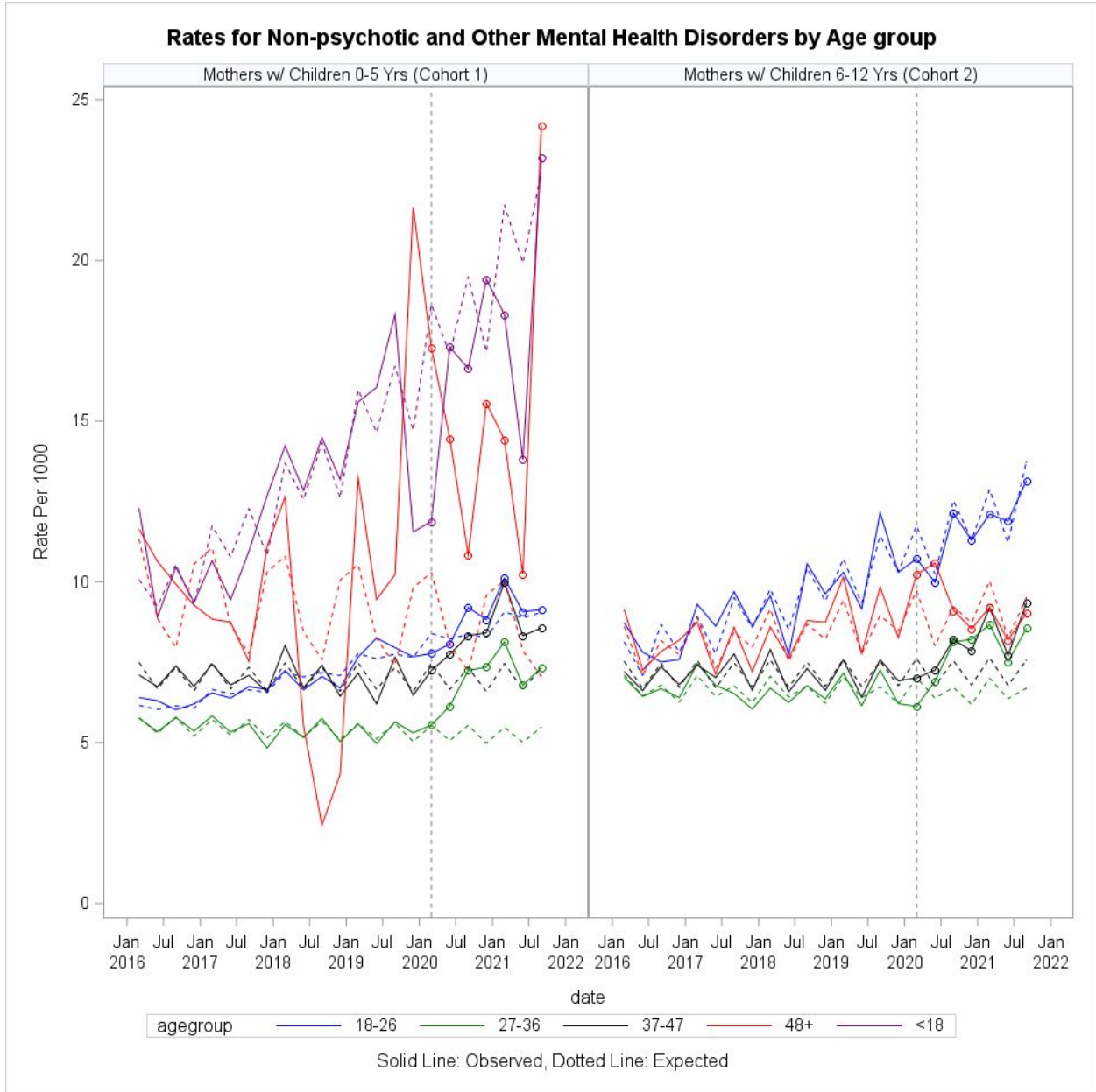
Figure 1: Rates of Total Outpatient Visits by Age Group



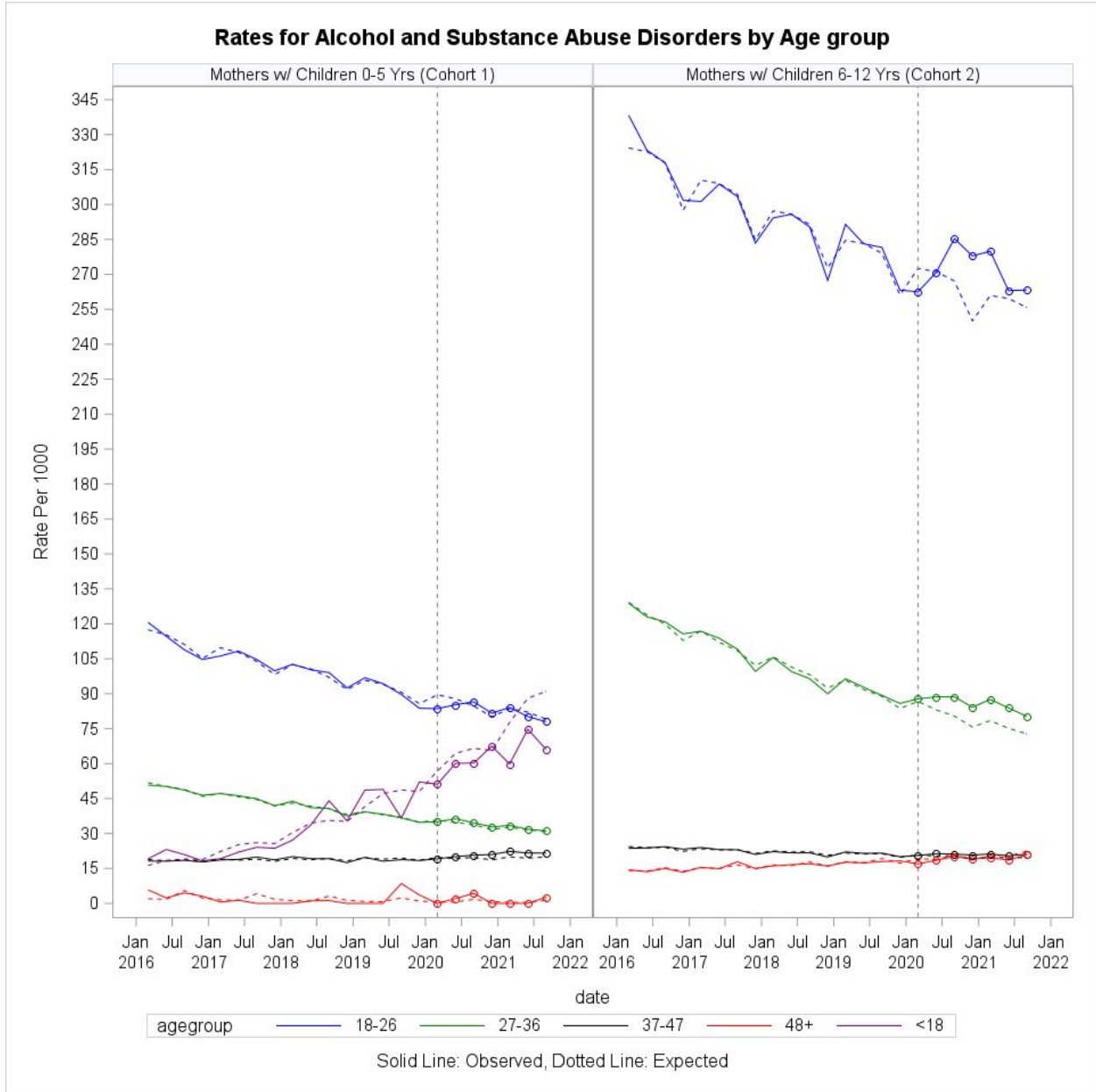
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Figure 2: Rates for Individual Diagnoses (Outpatient Visits) by Age Group





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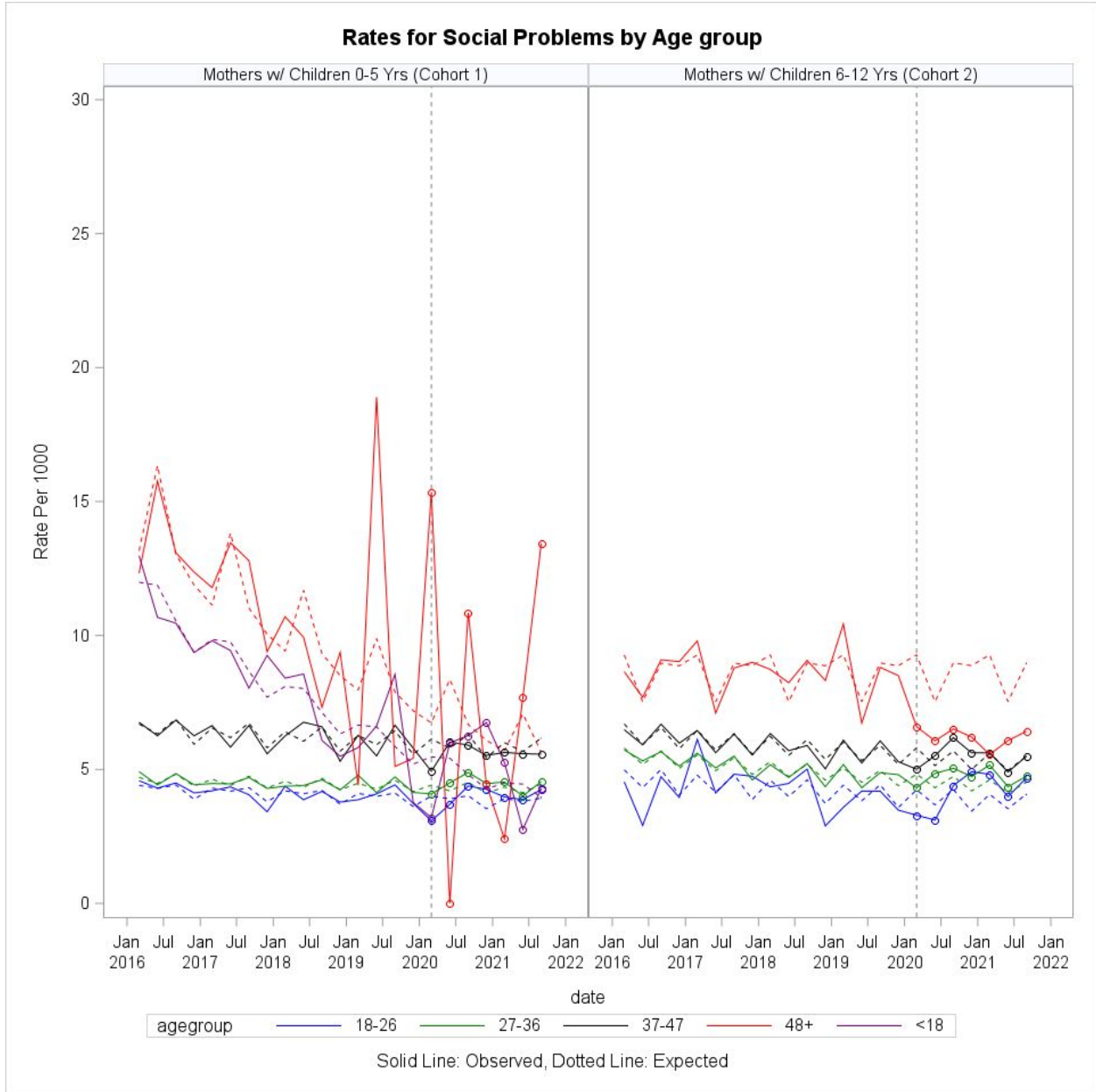
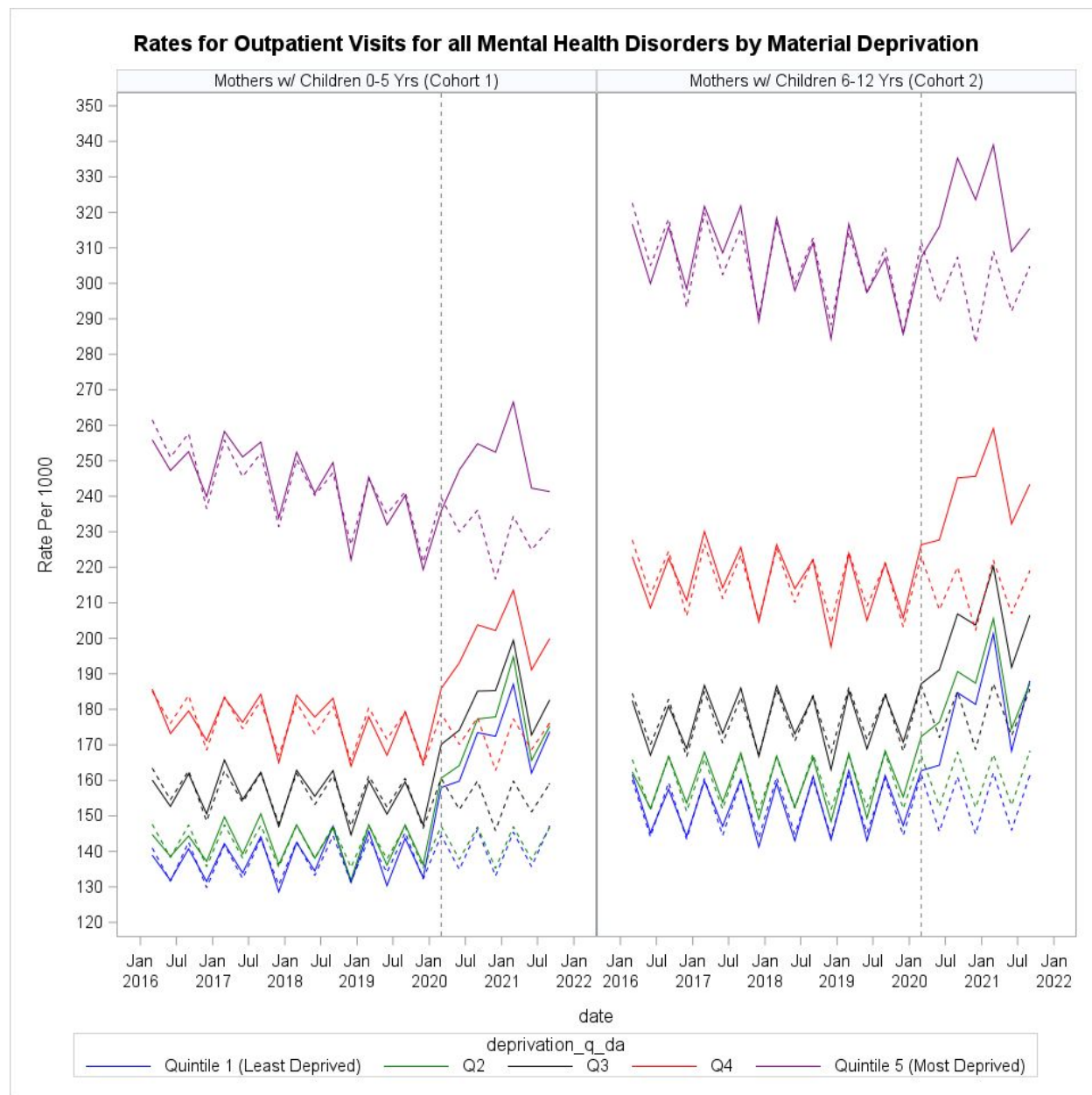
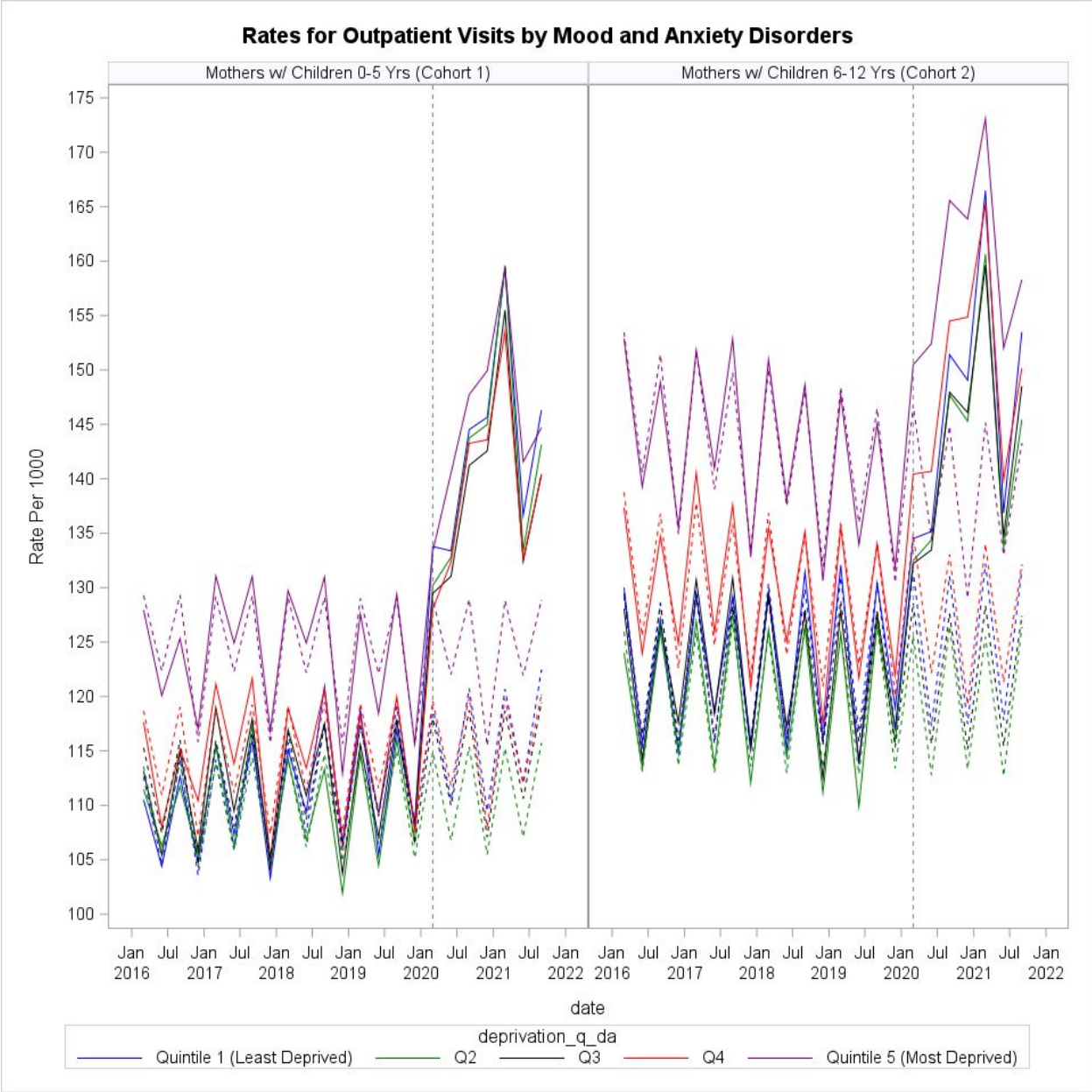


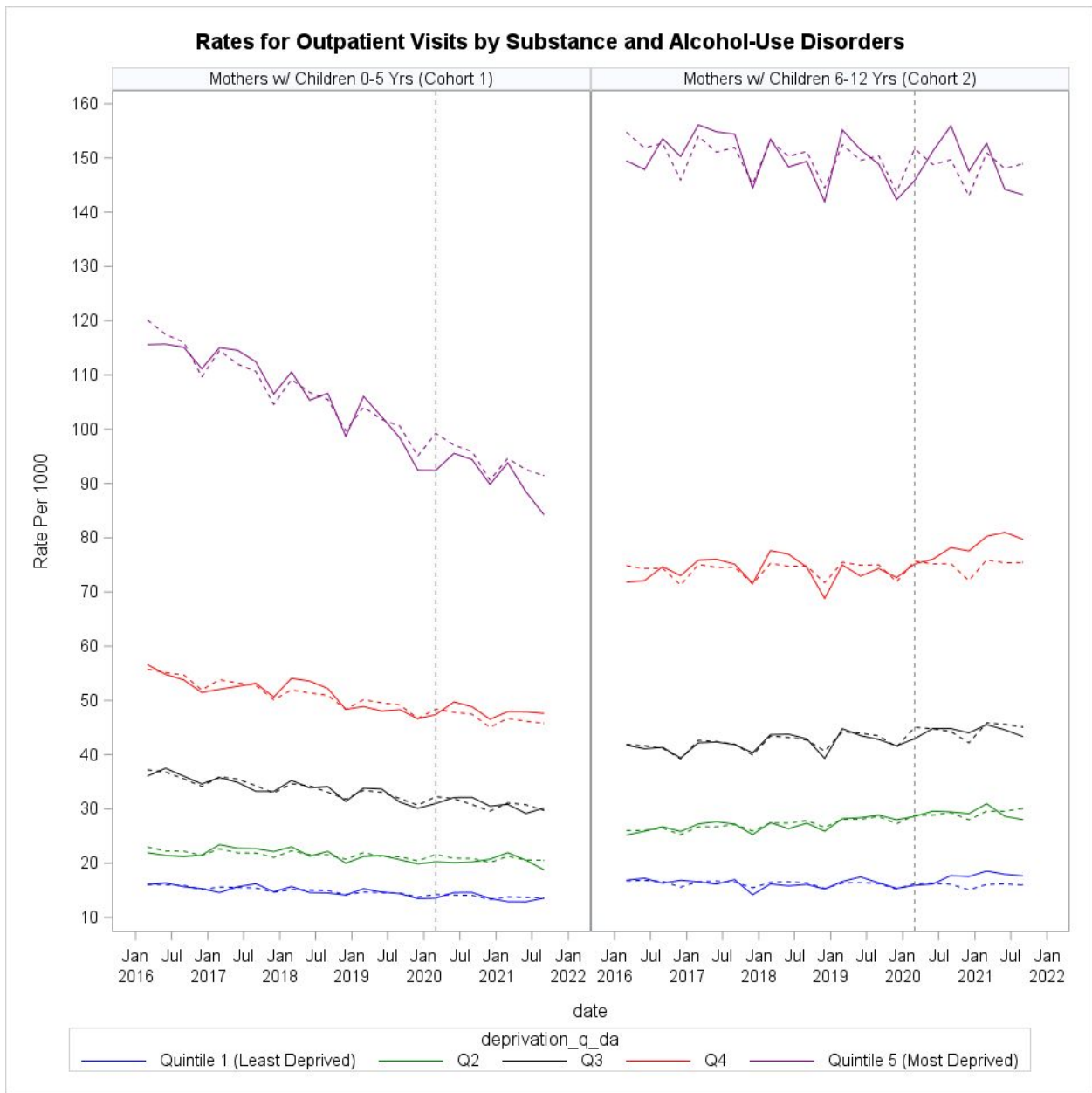
Figure 3: Rates for All Mental Health and Individual Diagnoses (Outpatient Visits) by Material Deprivation

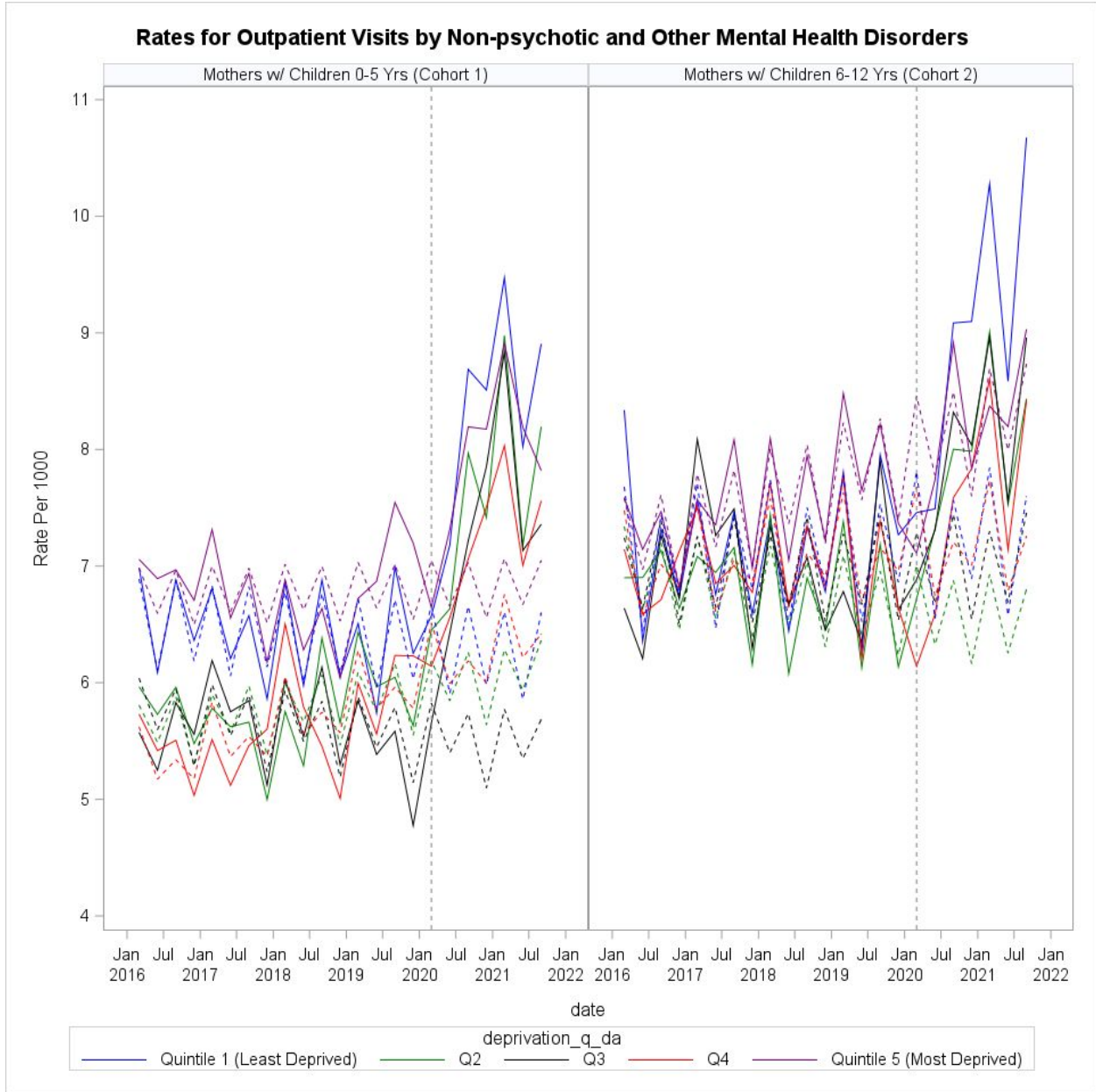


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