

# Treatment and postpartum health care utilization among pregnant women with opioid use disorder in Maine, 2010-2017

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KATHERINE AHRENS, PHD ([KATHERINE.AHRENS@MAINE.EDU](mailto:KATHERINE.AHRENS@MAINE.EDU))

UNIVERSITY OF SOUTHERN MAINE

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# Co-authors

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Carole McBride, PhD (carole.mcbride@med.uvm.edu)

Marjorie C. Meyer, MD (Marjorie.Meyer@uvmhealth.org)

Department of Obstetrics and Gynecology

Larner College of Medicine, University of Vermont

Burlington, VT

# Objective

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- The objective of our analysis was to estimate the prevalence, treatment, and postpartum health care utilization of pregnant women with opioid use disorder (OUD) in Maine and Vermont.
- Today, I'm presenting **preliminary** methods and results for Maine

# Analytic overview: prenatal OUD and OUD treatment

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- Women who delivered a baby in Maine during 2010-2017
- Delivery was covered, in part, by Medicaid
- Enrolled in Medicaid for 5 months leading up to delivery month
- See if any diagnosis during pregnancy for OUD
- Estimate percentage of women with OUD that were in medication assisted treatment

# Medication assisted treatment

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- Look at 5 months leading up to month of delivery
- Hierarchy:
  - 1) At least one buprenorphine prescribed/administered for each of 5 months
  - 2) At least one methadone prescribed/administered for each of 5 months
  - 3) Inconsistent treatment (didn't meet #1 or #2)
  - 4) No evidence of treatment during these 5 months

# Postpartum healthcare utilization

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- Subset of OUD women who were enrolled in Medicaid through 12 months' postpartum
- Looked at two outcomes by treatment group:
  - 1) Emergency department visits (any visit and rate per 100 member months)
  - 2) Inpatient hospitalizations (any hospitalization and rate per 100 member months)

# Methods

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- Data use request approved by MHDO
- Requested substance use disorder codes in the aggregate
- Submitted SQL code for pulling data
- Submitted SAS code for aggregating data
- I did final analysis using SAS on aggregated data
- Vermont doing corresponding analysis on their data; no data mixed
  
- Feel free to comment on either approach! Planning to submit a new data request for a sensitivity analysis (different methods, different code lists, see what changes)

# SQL Step 1: Getting unique delivery events 2010-2017

--get unique ID, submitter, claim number, and from date for any procedure related to live birth or stillbirth delivery in 2010-2017

```
select distinct MC911_MHDO_MEMBERID, MC001_SUBMITTER, MC907_MHDO_CLAIM, MC059_FDATE,
MC055_CPT, MC901_AGE, MC016_PATZIP, MC076_BILLPRVIDN, MC077_NPI, MC078_PRVLNAME
into #temp1
from [APCD].[dbo].[MedicalClaim]

where MC059_FDATE >= '01-JAN-2010'
and MC059_FDATE < '01-JAN-2018'
and (MC055_CPT in ('59610', '59612', '59614', '59618', '59620', '59622')
or (MC055_CPT between '59510' and '59515')
or (MC055_CPT between '59400' and '59410'))
and MC012_GENDER='F'
and MC901_AGE >12
and MC901_AGE <50
```

## SQL Step 2: Getting eligibility month info on these women

```
--merge with medical eligibility files to get all data on eligibility month
information on these women, by payer
select distinct ME910_MHDO_MEMBERID, ME001_SUBMITTER, ME005_MONTH, ME004_YEAR
into #temp2
from [APCD].[dbo].[MedicalElig] as a
inner join
(select distinct MC911_MHDO_MEMBERID
from #temp1
) as b on b.MC911_MHDO_MEMBERID = a.ME910_MHDO_MEMBERID
group by ME910_MHDO_MEMBERID, ME001_SUBMITTER, ME004_YEAR, ME005_MONTH
order by ME910_MHDO_MEMBERID, ME001_SUBMITTER, ME004_YEAR, ME005_MONTH
```

Did same thing to get pharmacy eligibility info on these women

# SQL Step 3: Getting all ICD-9/10 diagnoses for women who delivered during 2010-2017

```
select distinct b.MC911_MHDO_MEMBERID, b.MC001_SUBMITTER, b.MC907_MHDO_CLAIM,  
b.MC059_FDATE,  
MC039_ADMDX,  
MC041_DX1, MC042_DX2, MC043_DX3, MC044_DX4, MC045_DX5, MC046_DX6, MC047_DX7, MC048_DX8,  
MC049_DX9..... .MC298_OTHDX23, MC300_OTHDX24  
  
into #temp4  
from  
(select distinct MC911_MHDO_MEMBERID  
from #temp1 ) as a  
left outer join [APCD].[dbo].[MedicalClaim] as b on a.MC911_MHDO_MEMBERID =  
b.MC911_MHDO_MEMBERID  
where  
(  
MC039_ADMDX in ('30550', '30551', .....  
OR  
MC200_PRINDGNS in ('F1110','F1111','F11120','F11121','F11122',.....
```

SQL Step 4: Getting all unique member ID months where there was at least one prescriptions for buprenorphine, methadone, antidepressants (confounder), benzodiazepine (confounder)

```
--grab buprenorphine prescriptions, this includes buprenorphine + naltrexone drugs
--the list of NDC codes is from Brogly et al 2016 paper, AJE, supplement
select distinct
PC910_MHDO_MEMBERID, PC917_INCURRED_MON, PC916_INCURRED_YR
into #temp5
from [APCD].[dbo].[PharmacyClaim] as a
where
(PC027_DRUGNM LIKE ('BUPRENORPHINE%') or PC027_DRUGNM LIKE ('%BUPRENORPHINE') or
PC026_NDC in (
'00054017613',.....)
```

Did similar thing for CPT codes for buprenorphine and methadone (bc methadone mostly captured using CPT code 'H0020'), got unique member ID months

# SQL Step 5: Getting all unique member hospital admission dates and principal and admitting diagnosis codes

```
---get all unique admission hospital inpatient f dates for women with deliveries 2010-2017
select distinct a.MC911_MHDO_MEMBERID, MC036_BILLTYPE, MC059_FDATE,
MC041_DX1,MC200_PRINDGNS, MC202_ADMDGNS, MC254_OTHDX1
into #temp11
from (
select distinct MC911_MHDO_MEMBERID
from #temp1
) as a
left outer join [APCD].[dbo].[MedicalClaim] as b on
a.MC911_MHDO_MEMBERID=b.MC911_MHDO_MEMBERID
where MC036_BILLTYPE in (11, 12, 17, 18)
```

# SQL Step 6: Getting all unique ED service dates and revenue codes

```
---get all unique fdates for emergency department visits for women with deliveries 2010-2017
--https://www.resdac.org/articles/how-identify-hospital-claims-emergency-room-visits-medicare-claims-data
select distinct a.MC911_MHDO_MEMBERID, MC036_BILLTYPE, MC059_FDATE, MC054_REV
into #temp12
from (
select distinct MC911_MHDO_MEMBERID
from #temp1
) as a
left outer join [APCD].[dbo].[MedicalClaim] as b on
a.MC911_MHDO_MEMBERID=b.MC911_MHDO_MEMBERID
where MC054_REV in ('0450', '0451', '0452', '0453', '0454', '0455', '0456', '0457', '0458',
'0459', '0981')
```

## SAS Step 1: Organizing everything by month in relation to delivery month (-12 through +12)

- Pulls in tables from SQL
- Figure out delivery month-year for each delivery event, time zero
- Joins up static factors as of the time of delivery: age, zip code level rurality (RUCA code), delivery hospital type, etc.
- Organize all other time-varying factors in relation to time zero, going back 12 months and forward 12 months
- Joins time-varying factors by member ID and month-year

# SAS Step 1: Organizing everything by month in relation to delivery month (-12 through +12)

- Each time-varying factor categorized as “any evidence” vs. “none”
- Factors:
  - Medicaid eligibility (y/n)
  - Other insurance eligibility (y/n)
  - Pharmacy eligibility (y/n)
  - Other insurance enrollment (y/n)
  - OUD diagnosis (y/n)
  - Buprenorphine rx and/or CPT code (y/n)
  - Methadone rx and/or CPT code (y/n)
  - Antidepressant rx (y/n)
  - Benzo rx (y/n)

# SAS Step 3: Number of hospitalizations per month

```
*inpatient hospitalizations among women with in delivery file;  
data ip;  
set apcdwork.kate_ip;  
month =month(MC059_FDATE);  
year   =year(MC059_FDATE);  
hosp_month=mdy(month,15, year);  
format hosp_month  yymon.;  
run;  
proc sort data = ip; by MC911_MHDO_MEMBERID MC059_FDATE ;  
run;  
data ip2;  
set ip;  
  by MC911_MHDO_MEMBERID MC059_FDATE;  
if last.MC059_FDATE;  
run;  
*just keep unique fdates per ID;  
proc sort data = ip2; by MC911_MHDO_MEMBERID hosp_month ;  
run;
```

## SAS Step 3: Number of hospitalizations per month

```
*count number of unique hospitalizations dates for each ID by month;  
data ip3;  
set ip2;  
  by MC911_MHDO_MEMBERID hosp_month;  
retain hosp_per_month;  
if first.hosp_month then do;  
hosp_per_month=0;  
end;  
hosp_per_month= hosp_per_month+1;  
if last.hosp_month;  
run;
```

Did similar calculation for ED visits per month per person

# AGGREGATE FILE THAT I USED FOR ANALYSIS

- Line-listed by unique delivery events (but women could have multiple rows and delivery events too close together)
- Wide (not long)
- 259 columns
- 105,024 rows

Data Set Name	WORK.ALL	Observations	105024
Member Type	DATA	Variables	259

# AGGREGATE FILE THAT I USED FOR ANALYSIS

No dates

Just months before and after delivery month

Obs	MC911_MHDO_MEMBERID	MC055_CPT	month_diff	elig_mon_12	elig_mon_11	elig_mon_10	elig_mon_9	elig_mon_8	elig_mon_7	elig_mon_6	elig_mon_5	elig_mon_4
1	42	59400	.	0	0	0	0	0	0	0	0	0
2	250	59400	.	0	0	0	0	0	0	0	0	0
3	527	59622	0	0	0	0	0	0	0	0	0	0
4	677	59400	28	0	0	0	0	0	0	0	0	0

# Example of how SAS code worked

```
*making eligibility categories;  
if  
elig_mon_5 =1 and  
elig_mon_4 =1 and  
elig_mon_3 =1 and  
elig_mon_2 =1 and  
elig_mon_1 =1  
then presixmos=1; else presixmos=0;
```

```
/*any diagnosis of OUD -6 months pregnancy  
through delivery?*/  
if  
oud_mon_5 =1 or  
oud_mon_4 =1 or  
oud_mon_3 =1 or  
oud_mon_2 =1 or  
oud_mon_1 =1 or  
oud_mon0 =1 then oud_pregdeliv=1;else  
oud_pregdeliv=0;
```

# RESULTS

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Table 1. Total number of deliveries each calendar year, by state, and paid for in part by Medicaid funds: Vermont and Maine All-Payer Claims Database vs. other reports, 2010-2017

Calendar year	Vermont			Maine		
	APCD <sup>1</sup>	Medicaid reports <sup>2</sup>	US Natality data, for Vermont, expected payer <sup>3</sup>	APCD <sup>1</sup>	Medicaid reports <sup>2</sup>	US Natality data, for Maine, expected payer <sup>3</sup>
2010			2,897	5,050	Not reported	Not reported
2011			2,783	5,979	Not reported	Not reported
2012			2,768	5,912	Not reported	Not reported
2013			2,722	5,646	5,764	Not reported
2014		2462	2,770	5,356	5,427	5,570
2015		2313	2,593	5,177	5,327	5,245
2016		2192	2,483	4,996	5,073	5,018
2017		2147	2,421	4,856	4,959	4,804
Total	22,947			42,972		

APCD= All-Payer Claims Data

# Maine

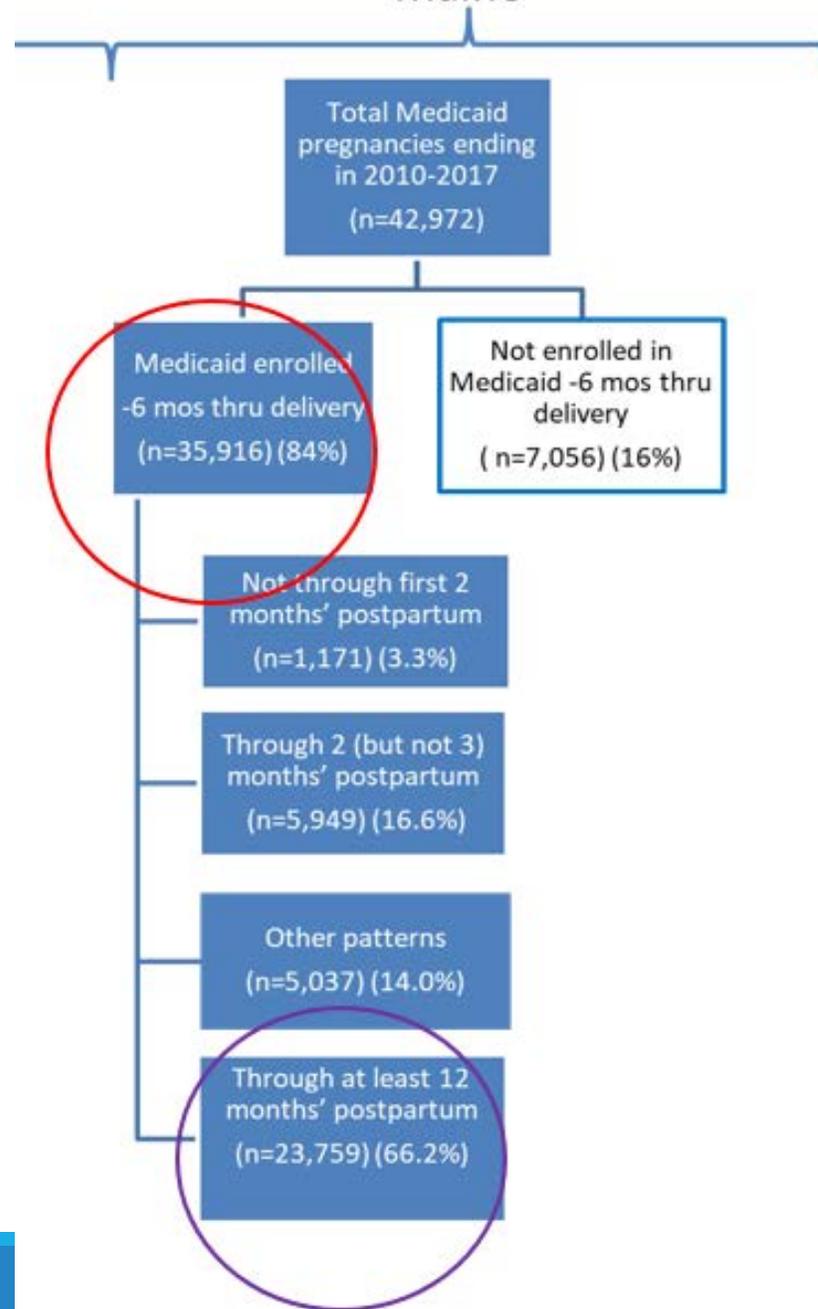


Figure 2. Among Medicaid pregnancies ending in 2010-2017 among women enrolled at -6 months through delivery, the percentage with any evidence of opioid use disorder in pregnancy (Maine, n=35,916)

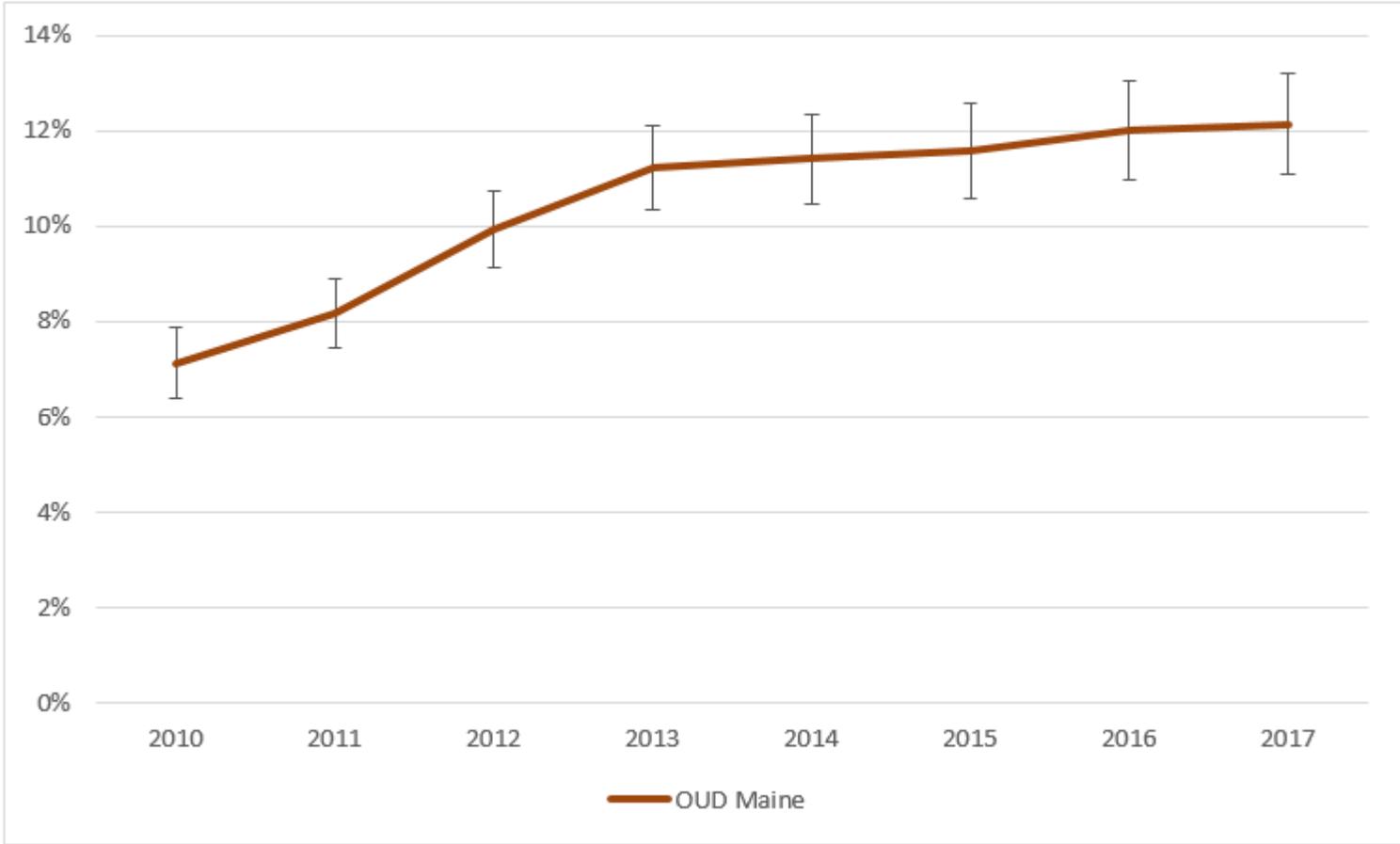


Figure 3. Among pregnancies with evidence of opioid use disorder enrolled -6 months through delivery, the percentages with no medication-assisted treatment, consistent buprenorphine, consistent methadone, or inconsistent medication-assisted treatment, for Vermont and Maine (Maine, n=3,694)

Maine

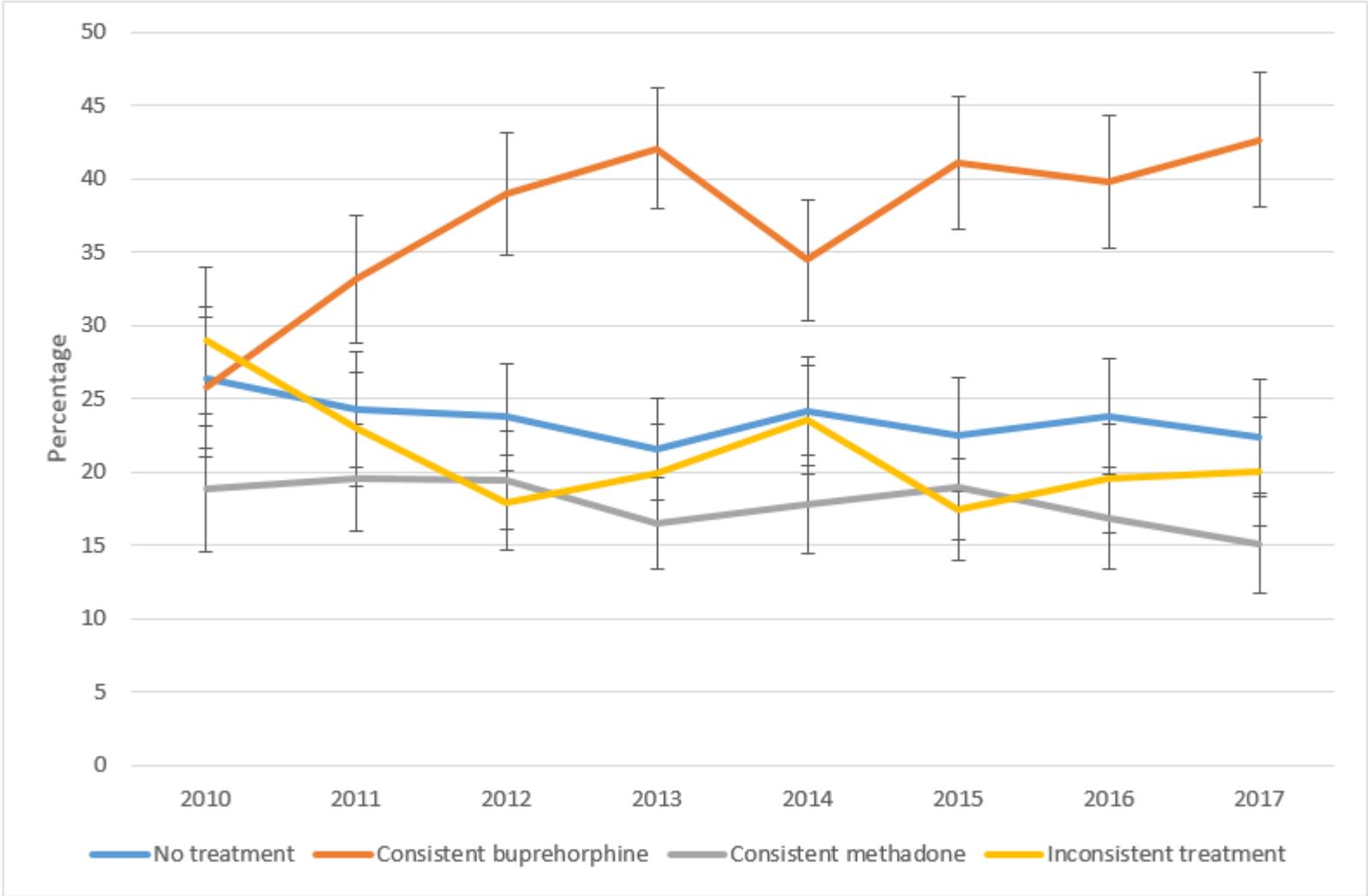
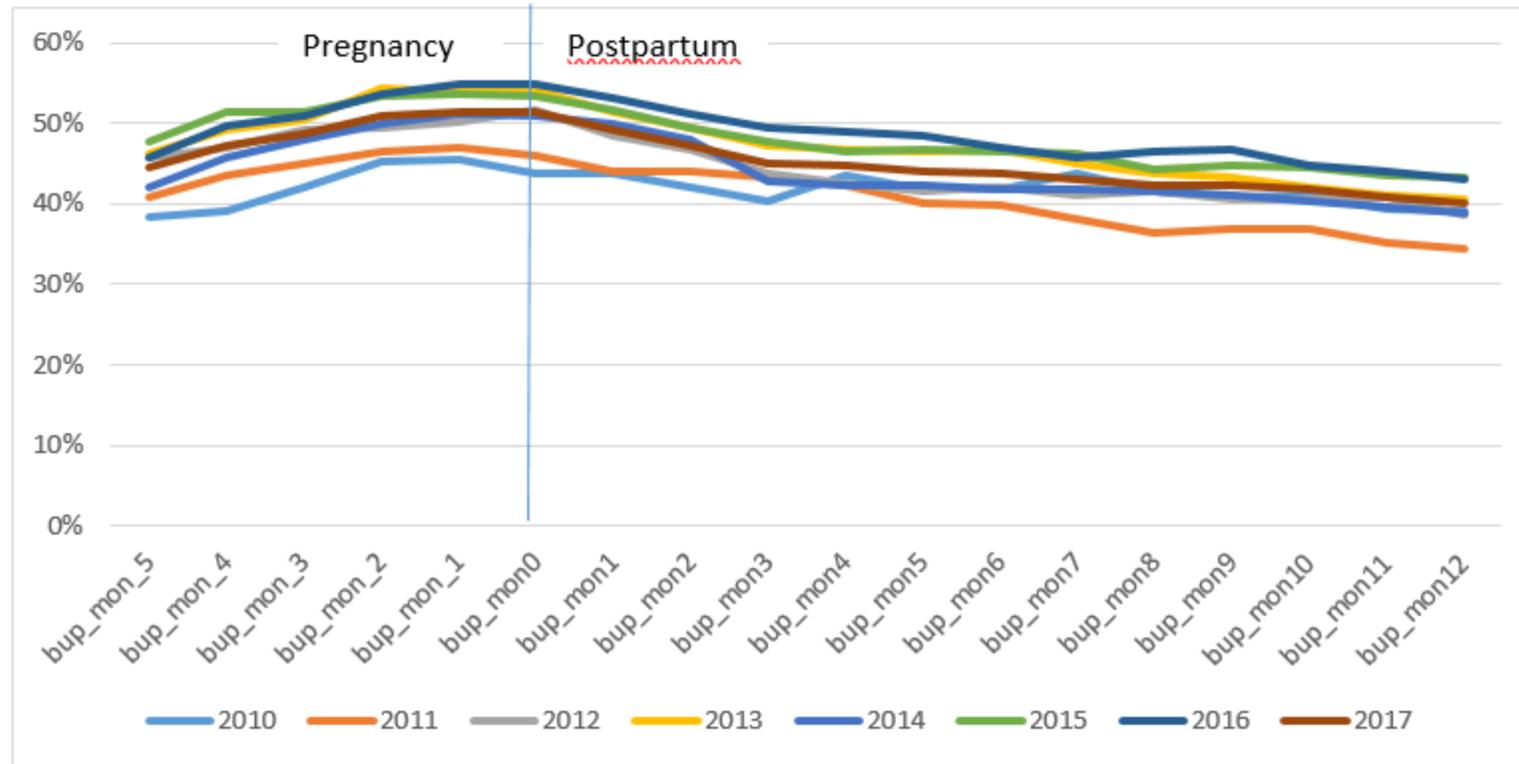
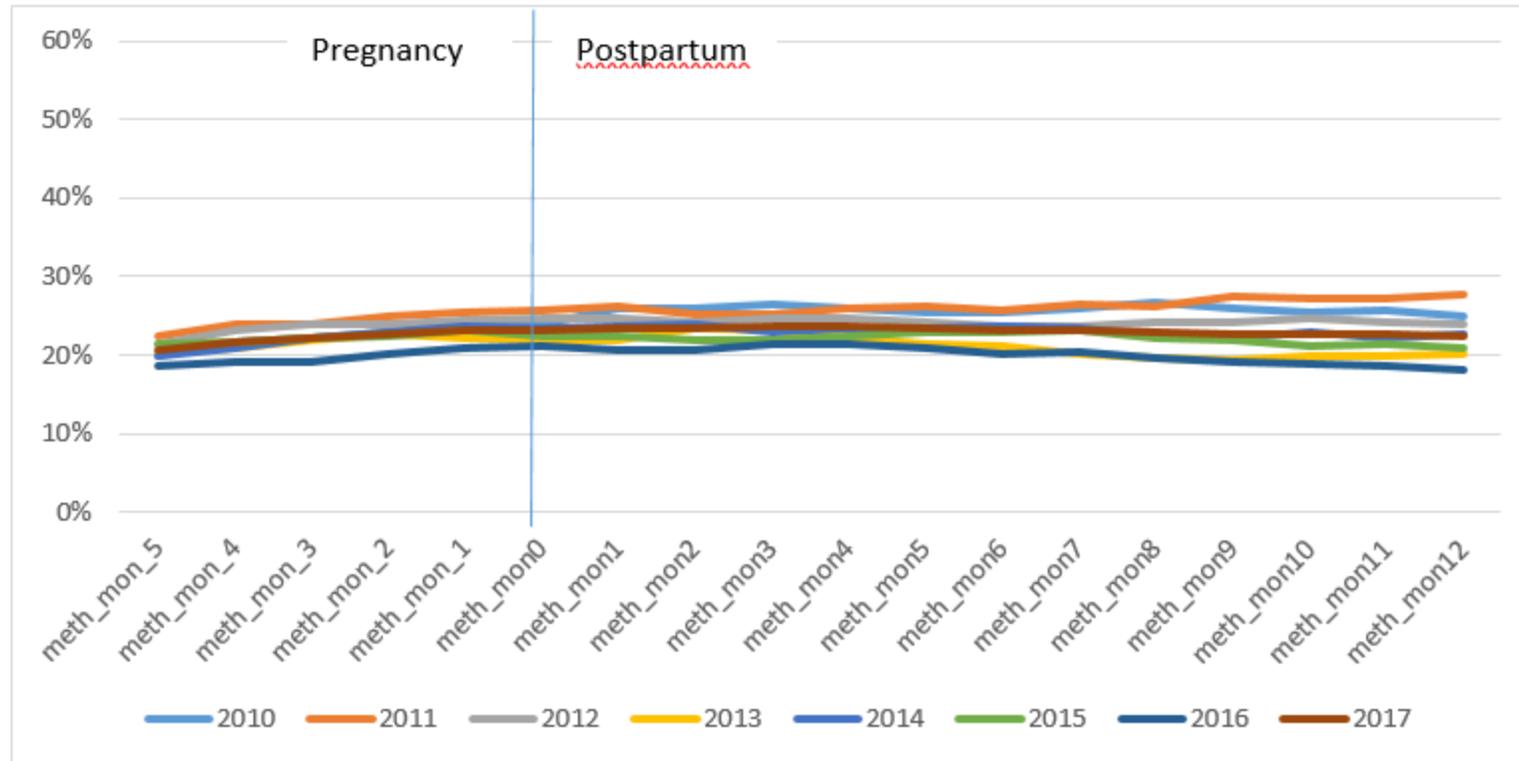


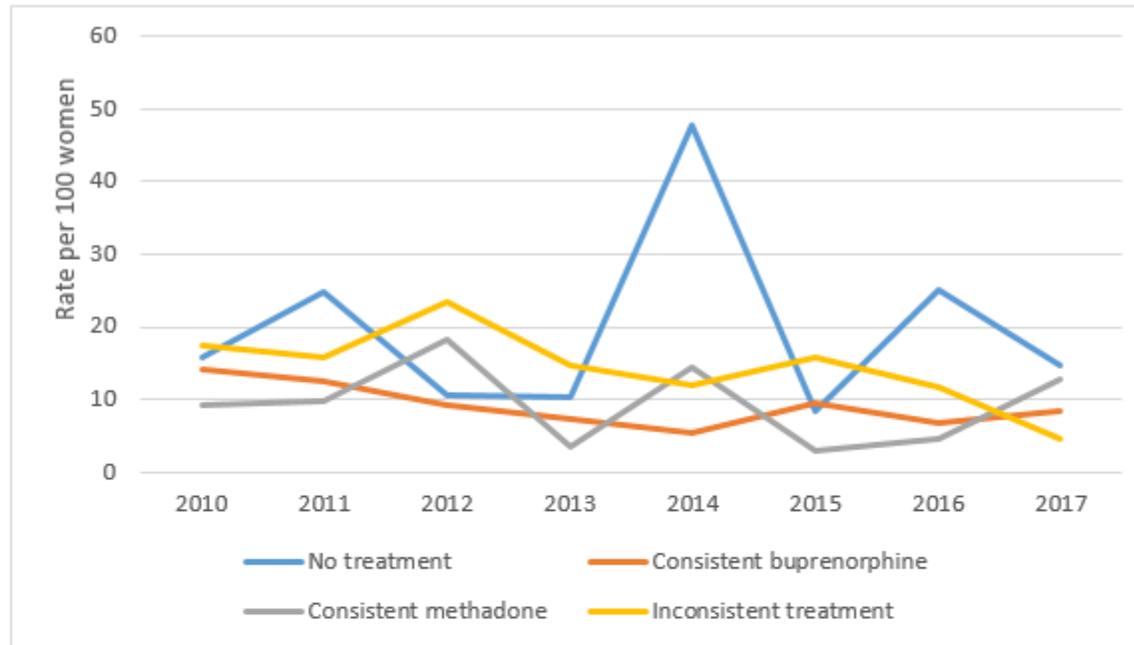
Figure 4. Among pregnancies with evidence of opioid use disorder enrolled -6 months through 12 months' postpartum, the percentages of women with at least one prescription per month methadone and buprenorphine, separately, by delivery year (Maine, n=3058)

Maine, buprenorphine:



Maine, methadone:



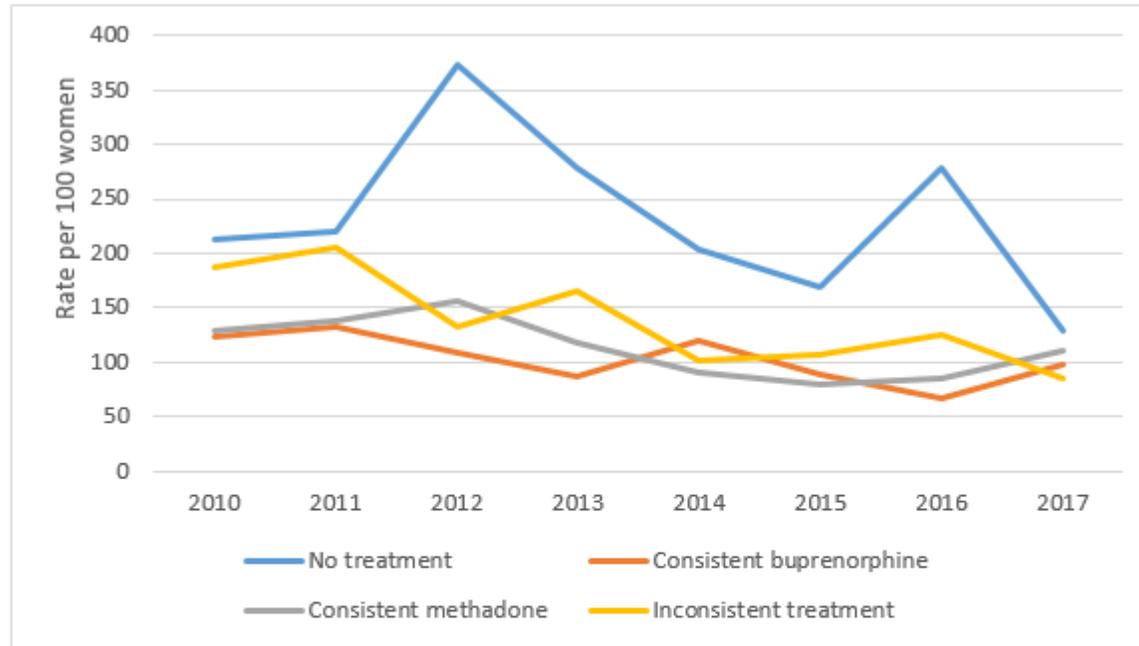


383 hospitalizations among 3058 women in first 12 months postpartum; 4 women with 5 or more hospitalizations

Adjusted for age, rurality, delivery type, hospital type, benzo use, antidepressant use (pooled 2010-2017)

Treatment	Comparison group	P-value	Rate ratio	95% CI
b.Consistent buprenorphine	c.Consistent methadone	0.8881	0.98	0.7, 1.36
b.Consistent buprenorphine	d.Other patterns	0.0071	0.68	0.51, 0.9
b.Consistent buprenorphine	a.Nothing -6 to deliv	<.0001	0.49	0.37, 0.64
c.Consistent methadone	d.Other patterns	0.0323	0.69	0.49, 0.97
c.Consistent methadone	a.Nothing -6 to deliv	<.0001	0.50	0.36, 0.69
d.Other patterns	a.Nothing -6 to deliv	0.0175	0.72	0.55, 0.94

All these results show no difference in hospitalizations rates between consistent buprenorphine users and methadone users, but lower rates for each of these types of users compared with no use or inconsistent use.



4329 ER visits among 3058 women in first 12 months postpartum; 76 women with 10 or more ER visits

**Adjusted for age, rurality, delivery type, hospital type, benzo use, antidepressant use (pooled 2010-2017)**

Treatment	Comparison group	P-value	Rate ratio	95% CI
b.Consistent buprenorphine	c.Consistent methadone	0.1611	0.93	0.85, 1.03
b.Consistent buprenorphine	d.Other patterns	<.0001	0.77	0.7, 0.84
b.Consistent buprenorphine	a.Nothing -6 to deliv	<.0001	0.46	0.42, 0.5
c.Consistent methadone	d.Other patterns	0.0001	0.82	0.74, 0.91
c.Consistent methadone	a.Nothing -6 to deliv	<.0001	0.49	0.45, 0.54
d.Other patterns	a.Nothing -6 to deliv	<.0001	0.60	0.55, 0.65

Adjusted models: All these results show no difference in ER rates between consistent buprenorphine users and methadone users, but lower rates for each of these types of users compared with no use or inconsistent use. The unadjusted model shows buprenorphine users have lower rates of ER visits than the methadone users.

# CONCLUSION

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# Conclusion

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## -Preliminary results

-Increases in OUD prevalence among pregnant women enrolled in Medicaid in Maine 2010-2017

-Buprenorphine treatment increasing compared with methadone

-Being in continuous treatment during pregnancy associated with lower rates of ER visits and hospitalizations in the first year after delivery

```

*emergency department visits among women with deliveries, by unique fdate and
revenue code, and billtype;
*used revenue codes 0450-0459, 0981, got list from ResDac, but still need to figure
out how to include inpatient stays were emergency room charge are >$0;
*have to de-duplicate by fdate, can have multiple ER revenue codes per single fdate;
data er;
set apcdwork.kate_er;
month =month(MC059_FDATE);
year   =year(MC059_FDATE);
er_month=mdy(month,15, year);
format er_month  yymon.;
run;
proc sort data = er; by MC911_MHDO_MEMBERID MC059_FDATE ;
run;
data er2;
set er;
  by MC911_MHDO_MEMBERID MC059_FDATE;
if last.MC059_FDATE;
run;*just keep unique fdates per ID;
proc sort data = er2; by MC911_MHDO_MEMBERID er_month;
run;

```

```
*count number of unique ED dates for each ID by month;  
data er3;  
set er2;  
  by MC911_MHDO_MEMBERID er_month;  
retain er_per_month;  
if first.er_month then do;  
er_per_month=0;  
end;  
er_per_month= er_per_month+1;  
if last.er_month;  
run;
```

```
/*note:
"59400"="Routine obstetric care including antepartum care, vaginal delivery (with or without
episiotomy, and/or forceps) and postpartum care"
"59409"="Vaginal delivery only (with or without episiotomy and/or forceps)"
"59410"="Vaginal delivery only (with or without episiotomy and/or forceps); including postpartum care"
"59510"="Routine obstetric care including antepartum care, cesarean delivery, and postpartum care"
"59514"="Cesarean delivery only"
"59515"="Cesarean delivery only; including postpartum care"
"59610"="Routine obstetric care including antepartum care, vaginal delivery (with or without
episiotomy, and/or forceps) and postpartum care, after previous cesarean delivery"
"59612"="Vaginal delivery only, after previous cesarean delivery (with or without episiotomy and/or
forceps)"
"59614"="Vaginal delivery only, after previous cesarean delivery (with or without episiotomy and/or
forceps); including postpartum care"
"59618"="Routine obstetric care including antepartum care, cesarean delivery, and postpartum care,
following attempted vaginal delivery after previous cesarean delivery"
"59620"="      "Cesarean delivery only, following attempted vaginal delivery after previous cesarean
delivery"
"59622"="Cesarean delivery only, following attempted vaginal delivery after previous cesarean delivery;
including postpartum care";
*/
```