Supplementary Online Content

Pilarinos A, Bromberg DJ, Karamouzian M. Access to medications for opioid use disorder and associated factors among adolescents and young adults: a systematic review. *JAMA Pediatr*. Published online December 6, 2021. doi:10.1001/jamapediatrics.2021.4606

This supplementary material has been provided by the authors to give readers additional information about their work.

eMethods. Summary of Gray Literature Search, Screening and Inclusion Criteria, and Risk of Bias Assessment

Grey literature search

A grey literature search was also conducted to identify any research that any research on MOUD access among AYA. This was done by combining a series of keywords including "adolescent", "young adult", "opioid agonist treatment" and "medication assisted treatment" and applying them to a number of grey literature sources and websites. These included Google Scholar, Google, the Sickkids Hospital Foundation (Canada), the Centre for Health Services and Policy Research (Canada), the National Institutes for Health and Care Excellence (United Kingdom), opengrey.eu, the World Health Organization, the United Nations Office on Drugs and Crime, the United States Centre for Disease Control, the Centre for Addiction and Mental Health (Canada), the Substance Abuse and Mental Health Services Administration (USA), Harm Reduction International, the International Society of Addiction Medicine, the Canadian Public Health Association, and the American Public Health Association.

Screening inclusion and exclusion criteria

Peer-reviewed studies that evaluated the availability, prescription receipt, and/or initiation of MOUD and were published in either English, French, Russian, or Spanish languages were eligible for inclusion, based on the co-authors' language capacity. Similarly, studies were included if they involved participants who were diagnosed with OUD using a validated scale (e.g. DSM-V), if participants self-reported seeking OUD treatment, or if more than 50% of the sample reported used opioids to a degree that was defined as problematic. Studies were excluded if non-AYA populations or the general public were the population of interest, if AYA were not reported separately from non-AYA populations, or if the objective did not include examining MOUD access.

Race- and ethnicity-based data collection

There is growing recognition of the importance of collecting race- or ethnicity-based data in health research and the role this plays in identifying solutions to inequities in health care.[1] For this reason, we collected race- and ethnicity-based data in order to identify differences in MOUD access based on AYAs race or ethnicity. Among the included studies, participants' race and ethnicity were deduced using public and private databases (i.e., Medicaid, private insurers, government agencies), electronic health records, and self-reporting.

Risk of bias

Using the modified Newcastle-Ottawa Scale for cross-sectional and cohort studies[2] and the GRADE-CERQual tool for qualitative studies,[3] a majority of studies were of moderate to high quality. More specifically, there was strong evidence of an association between MOUD access and age, geography, criminal justice, race, and sociodemographic factors. However, evidence on the association between personal motivation and health system-related factors and MOUD access were of moderate quality. While one study examining motivators for MOUD access among pregnant women was of low quality, this is not expected to impact study conclusions given higher quality studies examining MOUD access motivation were also included. Individual risk of bias scores are available in eTables 3, 4, and 5, while summary scores are provided in eTables 6 and 7.

eReferences (eMethods)

1. Flanagin A, Frey T, Christiansen SL, Bauchner H. The reporting of race and ethnicity in medical and science journals: comments invited. *JAMA.* 2021;325(11):1049-1052.
2. Wells G, Shea B, O'connell D, et al. The Newcastle-Ottawa Scale (NOS) for assessing the quality of nonrandomised studies in meta-analyses. *Ottawa Hospital Research Institute.* 2016.
3. Lewin S, Glenton C, Munthe-Kaas H, et al. Using qualitative evidence in decision making for health and social interventions: an approach to assess confidence in findings from qualitative evidence syntheses (GRADE-CERQual). *PLoS Medicine.* 2015;12(10):e1001895.

eTable 1. Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) Checklist for a Systematic Review on MOUD Access and Associated Factors Among Adolescents and Young Adults Who Use Opioids

Section/topic	#	Checklist item	Reported on page #
TITLE			
Title	1	Identify the report as a systematic review, meta-analysis, or both.	E1
ABSTRACT			
Structured summary	2	Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number.	E1
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known.	E2
Objectives	4	Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	E2
METHODS			
Protocol and registration	5	Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number.	E2
Eligibility criteria	6	Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale.	E2, Online Supplement (p. 2-3)
Information sources	7	Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched.	E2
Search	8	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	Online Supplement (p. 7-8)
Study selection	9	State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis).	E2, Online Supplement (p. 2-3)
Data collection process	10	Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate)	E2, Online Supplement (p. 2-3)

		and any processes for obtaining and confirming data from investigators.	
Data items	**11**	**List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made.**	**E2, Online Supplement (p. 2-3)**
Risk of bias in individual studies	**12**	**Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis.**	**E2, Online Supplement (p. 9-11)**
Summary measures	**13**	**State the principal summary measures (e.g., risk ratio, difference in means).**	**E2**
Synthesis of results	**14**	**Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., I^2) for each meta-analysis.**	**E2, Online Supplement (p. 2-3)**
Risk of bias across studies	**15**	**Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies).**	**NR**
Additional analyses	**16**	**Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified.**	**NR**
RESULTS			
Study selection	**17**	**Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.**	**E3**
Study characteristics	**18**	**For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations.**	**E2, Online Supplement (p. 15-32)**
Risk of bias within studies	**19**	**Present data on risk of bias of each study and, if available, any outcome level assessment (see item 12).**	**Online Supplement (p. 9-11)**
Results of individual studies	**20**	**For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group (b) effect estimates and confidence intervals, ideally with a forest plot.**	**E2-E5**
Synthesis of results	**21**	**Present results of each meta-analysis done, including confidence intervals and measures of consistency.**	**NR**
Risk of bias across studies	**22**	**Present results of any assessment of risk of bias across studies (see Item 15).**	**NR**

Additional analysis	**23**	**Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]).**	**NR**
DISCUSSION			
Summary of evidence	**24**	**Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., healthcare providers, users, and policy makers).**	**E5-E6**
Limitations	**25**	**Discuss limitations at study and outcome level (e.g., risk of bias), and at review-level (e.g., incomplete retrieval of identified research, reporting bias).**	**E6**
Conclusions	**26**	**Provide a general interpretation of the results in the context of other evidence, and implications for future research.**	**E6**
FUNDING			
Funding	**27**	**Describe sources of funding for the systematic review and other support (e.g., supply of data); role of funders for the systematic review.**	**E6**

eTable 2. Medline Search Strategy for a Systematic Review on MOUD Access and Associated Factors Among Adolescents and Young Adults Who Use Opioids

Ovid MEDLINE(R) ALL <Database inception to May 3, 2021>	
1	**[AYA MAT access search in Ovid MEDLINE]**
2	**[Opioid use disorder concept]**
3	exp opioid-related disorders/ or exp substance abuse, intravenous/ or exp substance abuse/
4	((Non-medical prescription$ or opi* prescription$ or prescription$ opi* or prescription$ drug$ or off-label) adj2 (abuse* or misuse* or disorder* or use* or addict* or depend*)).mp.
5	((injection drug$ or intravenous drug$ or IV drug$ or injection opi* or intravenous opi*) adj2 (abuse* or misuse* or disorder* or use* or addict* or depend*)).mp.
6	((opioid* or opiate* or drug$ or substance$ or heroin) adj2 (abuse* or misuse* or disorder* or use* or addict* or depend*)).mp.
7	((poly-substance$ or poly-drug$) adj3 (abuse* or misuse* or disorder* or use* or addict* or depend*)).mp.
8	(PWID or PWUD or IDU or OUD or SUD or NMPOU).mp.
9	exp narcotics/ or exp Opiate Alkaloids/ or exp Fentanyl/
10	exp controlled substances/ or exp prescription drugs/ or exp street drugs/ or exp Designer Drugs/
11	((illicit or street or recreational or illegal or regulated or hard or custom or designer or problem) adj2 (drug$ or substances$)).mp.
12	3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11
13	**[MAT concept]**
14	exp Opiate Substitution Treatment/
15	((medically-assisted or opi* agonist or opi* antagonist or opiate$ or opioid$ or methado* or injectable opi*) adj2 (therap* or treatment* or pharmacotherap* or drug$ or substitution or replacement or maintenance)).mp.
16	(pharmacotherapy or OST or OAT or MAT or MMT or LAAM or iOAT or DAM or SROM).mp.
17	exp buprenorphine, naloxone drug combination/ or exp naltrexone/ or exp Buprenorphine/ or exp Methadone/
18	(methado* or dolophine or buprenorphine or buprenorphine-naloxone or Suboxone or subutex or hydromorph* or diacetylmorph* or dilaudid or slow-release oral morphine or Kadian or levomethadyl acetate or clonidine or alpha-2-adrenergic agonists or naltrexone or vivitrol or revia).mp.
19	14 or 15 or 16 or 17 or 18
20	**[MAT access concept]**
21	exp Health Services Accessibility/
22	(uptake or access* or availab* or attempt* or engag* or enrol* or register* or continu* or prevalen*).mp.
23	21 or 22
24	**[Adolescent and young adult concept]**
25	exp Adolescent/ or exp Young Adult/

26	(teen* or youth* or adolesc* or juvenile$ or child* or boy$ or girl$ or young adult* or emerg* adult* or young people* or young person* or young m*n or young wom*n or student$).mp.
27	25 or 26
28	**[Summation & filters]**
29	12 and 19 and 23 and 27
30	remove duplicates from 29
31	30 and animals
32	31 and humans
33	32 or (30 not 31)

eTable 3. Risk of Bias Assessment for Cohort Studies Using the Modified Newcastle-Ottawa Scale

Authors (Year)	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Total
Alinsky (2020b)[1]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	L
Bagley (2020)[2]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	L
Bell (1992)[3]	-	Yes	-	Yes	-	-	Yes	Yes	Yes	M
Bell (2021)[4]	Yes	Yes	Yes	Yes	-	Yes	Yes	Yes	Yes	L
Chavez (2020)[5]	Yes	Yes	Yes	Yes	Yes	-	-	Yes	Yes	L
Hadland (2017)[6]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	L
Hadland (2018a)[7]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	L
Hadland (2018b)[8]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	L
Knittel (2020)[9]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	L
Krans (2016)[10]	Yes	Yes	Yes	-	-	-	Yes	Yes	Yes	M
Krans (2019)[11]	Yes	Yes	Yes	-	Yes	Yes	Yes	Yes	Yes	L
Krebs (2021)[12]	Yes	Yes	Yes	Yes	-	-	Yes	Yes	Yes	L
Mills (2004)[13]	Yes	Yes	Yes	Yes	-	-	-	Yes	Yes	M
Schiff (2020)[14]	Yes	Yes	Yes	Yes	-	Yes	Yes	Yes	Yes	L
Smyth (2012)[15]	Yes	Yes	Yes	Yes	-	-	Yes	Yes	Yes	L
Stancliff (2012)[16]	Yes	Yes	Yes	Yes	-	-	Yes	Yes	Yes	L
Yang (2011)[17]	Yes	Yes	Yes	-	Yes	Yes	-	Yes	Yes	L

Q1 = Representativeness of the exposed cohort, Q2 = Selection of the non-exposed cohort, Q3 = Ascertainment of exposure, Q4 = Demonstrated that outcome of interest not present at start of study, Q5 = Comparability of cohorts on the bases of the design or analysis controlled for age, gender, ethnicity, Q6 = Comparability of cohorts on the bases of the design or analysis controlled for other important factors, Q7 = Assessment of outcome, Q8 = Was follow-up long enough for outcomes to occur, Q9 = Adequacy of follow-up of cohorts;
Abbreviations: L, low risk of bias; M, moderate risk of bias; H, high risk of bias.

eTable 4. Risk of Bias Assessment for Cross-sectional Studies Using the Modified Newcastle-Ottawa Scale

Authors (Year)	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Total
Alinsky (2020a)[18]	Yes	Yes	Yes	Yes	-	Yes	Yes	Yes	Yes	Yes	L
Angelotta (2016)[19]	Yes	Yes	Yes	Yes	-	-	-	Yes	Yes	Yes	M
Bachhuber (2017)[20]	Yes	Yes	Yes	Yes	-	-	-	-	Yes	Yes	M
Bateman (2014)[21]	Yes	Yes	Yes	Yes	-	-	-	-	Yes	Yes	M
Fagan (2008)[22]	Yes	Yes	-	Yes	-	-	-	Yes	Yes	Yes	M
Feder (2017)[23]	Yes	Yes	-	Yes	-	Yes	Yes	Yes	Yes	Yes	L
Hadland (2020)[24]	Yes	Yes	Yes	-	Yes	Yes	Yes	Yes	Yes	Yes	L
Hand (2017)[25]	Yes	Yes	Yes	-	Yes	-	Yes	Yes	Yes	Yes	L
Liebling (2016)[26]	Yes	Yes	-	-	Yes	-	Yes	-	Yes	Yes	M
Maremmani (2015)[27]	Yes	Yes	-	-	Yes	Yes	Yes	-	Yes	Yes	M
Paino (2015)[28]	Yes	Yes	Yes	-	Yes	-	Yes	-	Yes	Yes	M
Patrick (2020)[29]	Yes	Yes	Yes	-	Yes	-	Yes	-	Yes	Yes	M
Quigley (2012)[30]	-	Yes	Yes	-	-	-	-	-	Yes	Yes	H
Stine (2009)[31]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	L
Winkelman (2020)[32]	Yes	Yes	Yes	Yes	Yes	-	Yes	Yes	Yes	Yes	L

Q1 = Representativeness of the exposed cohort, Q2 = Justified and satisfactory sample size, Q3 = Comparability between respondents and non-respondents, Q4 = Use of validated measurement tool, Q5 = Use of non-validated measurement tool that is defined, Q6 = Study controls for an important potentially confounding variable, Q7 = Study controls for other variables, Q8 = Used independent blind assessment or record linkage, Q9 = Used self-reported data, Q10 = Appropriate measurement of the association is presented and described;
Abbreviations: L, low risk of bias; M, moderate risk of bias; H, high risk of bias.

eTable 5. Risk of Bias Assessment for Qualitative Studies Using the GRADE-CERQual Scale

Authors	Year	GRADE-CERQual results	Final
Ayres[33]	2014	**Methodological**: Low **Relevance**: Low **Coherence**: Moderate **Data adequacy**: Low	Low
Boyd[34]	2017	**Methodological**: Low **Relevance**: Low **Coherence**: Moderate **Data adequacy**: High	Moderate
Brands[35]	2005	**Methodological**: Moderate **Relevance**: Low **Coherence**: Low **Data adequacy**: Low	Low
Guarino[36]	2009	**Methodological**: Low **Relevance**: Low **Coherence**: Moderate **Data adequacy**: Moderate	Moderate
Larney[37]	2017	**Methodological**: Low **Relevance**: Moderate **Coherence**: Low **Data adequacy**: High	Low

Abbreviations: GRADE-CERQual, Grading of Recommendations, Assessment, Development and Evaluations-Confidence in the Evidence from Reviews of Qualitative Research.

eReferences (eTables 3-5)

1. Alinsky RH, Zima BT, Rodean J, et al. Receipt of Addiction Treatment After Opioid Overdose Among Medicaid-Enrolled Adolescents and Young Adults. *JAMA Pediatrics.* 2020:e195183.
2. Bagley SM, Larochelle MR, Xuan Z, et al. Characteristics and Receipt of Medication Treatment Among Young Adults Who Experience a Nonfatal Opioid-Related Overdose. *Annals of Emergency Medicine.* 2020;75(1):29-38.
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eTable 6. Summary of Included Studies Examining MOUD Access and Associated Factors Among Adolescents and Young Adults Who Use Opioids

First author (Year)	Study design	Location	Participants	Sociodemographic	Substance use characteristics	MOUD type	Inclusion/exclusion criteria	Risk of Bias
Alinksy (2020a)[1]	Cross-sectional	USA	N=13,537 treatment facilities	Adolescents (age NR)	All adolescent-specific SUD treatment facilities over the study period	Buprenorphine, methadone, naltrexone	**Inclusion criteria:** All SUD treatment facilities that participated in the 2017 National Survey of Substance Abuse Treatment Services; **Exclusion criteria:** NR;	Low
Alinksy (2020b)[2]	Retrospective cohort	USA	N=3,791	Med (IQR): 18 (16 – 20) 58.9% Female; 65.7% white;	Opioid use disorder in 3 months before and 1 month after overdose	Buprenorphine, methadone, naltrexone	**Inclusion criteria:** 13-22 years; ≥6 months continuous enrolment in the Truven-IBM Watson Health MarketScan Medicaid Database between 2009 and 2015; received primary or secondary diagnosis of opioid poisoning on emergency department or inpatient claims; **Exclusion criteria:** Disenrolled from insurance coverage;	Low
Angelotta (2016)[3]	Cross-sectional	USA	N=8,292	N=5,997 (73.3%) 18-29 years 100% Women; 85% white;	Any primary opioid use at treatment admission	Buprenorphine, methadone	**Inclusion criteria:** ≥12 years; pregnant women with an opioid use disorder admitted for treatment; primary substance use includes opioids; derived from the 2012 TEDS; **Exclusion criteria:** secondary or tertiary substance use includes opioids; missing data on MOUD; treatment occurred in Puerto Rico and Washington, DC;	Moderate
Ayres (2014)[4]	Qualitative	UK	N=30	N=5 young adults (Ages: 22, 27, 28, 29, 30) 2 Female; 3 Male;	Any injection heroin use over the study period	Methadone	**Inclusion criteria:** Participated in 'prescription in a day' RCT through the Bristol Drug Project; retained in study for at least 3-months between October 2011 and September 2012; **Exclusion criteria:** NR	Low
Bachhuber (2017)[5]	Cross-sectional	USA	N=3,354	N=2,388 (71.2%) 18-29 years 100% Women; 84.9% white;	Heroin or opioid analgesics at treatment admission	Buprenorphine or methadone	**Inclusion criteria:** 18-44 years; pregnant women; admitted to residential or outpatient treatment; had Medicaid insurance; data available in the 2013 and 2014 TEDS; **Exclusion criteria:** accessed detoxification services;	Moderate
Bagley (2020)[6]	Retrospective cohort	USA	N=15,281	N=4,268 (27.9%) 18-25 years N=1,209 (7.9%) 18-21 years N=3,059 (20.0%) 22-25 43.8% Women (18-21 years) 38% Women (22-25 years)	Opioid use in the past year	Buprenorphine, methadone, naltrexone	**Inclusion criteria:** Experienced an opioid-related overdose between January 1, 2012 and December 31, 2014; had an ambulance encounter or through the emergency department, observation, or through a hospital encounter where an overdose was diagnosed; data derived from a Massachusetts Department of Health linked dataset; **Exclusion criteria:** Visits to Veterans Administration Hospitals; death within 30 days of overdose;	Low

First author (Year)	Study design	Location	Participants	Sociodemographic	Substance use characteristics	MOUD type	Inclusion/exclusion criteria	Risk of Bias
Bateman (2014)[7]	Cross-sectional	UK	N=404 adolescents	N=90 <16 years N=314 from 16-18 years	Any opioid use over the study period	Buprenorphine, lofexidine, methadone	**Inclusion criteria:** Any prescribers attached to specialist SUD services in England between April 2006 and March 2007; **Exclusion criteria:** Prescribers not attached to specialist SUD services; prescribers only in the criminal justice system; prescriptions written outside of study period; young people >18 years;	Moderate
Bell (1992)[8]	Prospective cohort	Australia	N=291	N=243 were <31 years 27.8% Female	Any opioid use in the past 3 days or past 8 or more years	Methadone	**Inclusion criteria:** Assessed between March 1986 and June 1987; attended the first of two study interviews at a hospital-based methadone unit; **Exclusion criteria:** NR	Moderate
Bell (2021)[9]	Retrospective cohort	USA	N=318	Age NR; 60% Female; 84% white, 94% non-Hispanic	OUD-related diagnostic Medicaid code over the study period	Buprenorphine, buprenorphine-naloxone, naloxone, naltrexone	**Inclusion criteria:** 10-19 years; OUD-related diagnostic code between July 2007 and January 2017; **Exclusion criteria:** NR;	Low
Boyd (2017)[10]	Qualitative	Canada	N=22	M (Range): 26 (20-31) 8 Women, 14 Men; 19 white; 3 Indigenous	Any injection drug use over the study period	Methadone	**Inclusion criteria:** Enrolled in the At-Risk Youth Study between May 2013 and September 2015; History of injection drug use; reported cessation of injection drug use for at least one 6-month period; could be actively injecting drugs; **Exclusion criteria:** NR	Moderate
Brands (2005)[11]	Qualitative	Canada	N=49	Female: M (SD): 18 (1) Male: M (SD): 17 (1) 24 Female; 25 Male; 58% white Males; 71% white Females	Heroin use in the past year	Methadone	**Inclusion criteria:** 12-19 years; recruited from drop-in agencies between October 2000 and April 2002; past 12-month heroin use by any route; self-described involvement in "street-life"; **Exclusion criteria:** NR	Low
Chavez (2020)[12]	Retrospective cohort	USA	N=2,097	Age NR; 45.2% Female; 76.9% white	Opioid use disorder diagnosis over the study period	Buprenorphine, naltrexone	**Inclusion criteria:** OUD diagnosis between August 1, 2012 and May 31, 2016 based on Ohio Medicaid records; 12-18 years at time of diagnosis and did not turn 19 within 3-months of diagnosis; no pharmacy claim or procedure code for MOUD in year before OUD diagnosis; enrolled in Medicaid 9-12 months before OUD diagnosis; enrolled in Medicaid continuously for 3 months after OUD diagnosis; **Exclusion criteria:** NR	Low
Fagan (2008)[13]	Cross-sectional	Ireland	N=86	M (IQR): 16.8 (16-17) 54% Female	Any opioid use at treatment admission	Methadone	**Inclusion criteria:** <19 years; enrolled in the YPP between January 2001 and October 2006; **Exclusion criteria:** NR	Moderate

First author (Year)	Study design	Location	Participants	Sociodemographic	Substance use characteristics	MOUD type	Inclusion/exclusion criteria	Risk of Bias
Feder (2017)[14]	Cross-sectional	USA	N=139,092	N=3,086 (2.2%) from 15-17 years Heroin use (N=761); 49.3% Female; 73.3% white; Other opioid use: (N=2,325); 31.7% Female; 70% white	Any heroin or other opioid use at treatment admission	Buprenorphine, methadone	**Inclusion criteria:** Derived from the 2013 TEDS; treated for heroin, non-prescription use of methadone, or other opiate or synthetics; first treatment episode only; **Exclusion criteria:** Missing information on covariates; Data from Pennsylvania, Georgia, West Virginia, Wisconsin, Wyoming;	Low
Guarino (2009)[15]	Qualitative	USA	N=22	N=7 (31.8%) AYA M (SD): 24.29 (2.87) 86% Female; 100% white	Any opioid use over the study period	Methadone	**Inclusion criteria:** 18-23 years; dependent on opioids; recruited through young adult methadone program in 2006; **Exclusion criteria:** NR	Moderate
Hadland (2017)[16]	Prospective cohort	USA	N=20,822	M (SD): 21 (2.5) 34.2% Female; 82.2% white	OUD diagnosis over the study period	Buprenorphine, naltrexone	**Inclusion criteria:** 13-25 years; OUD diagnosis between January 1, 2001 and June 30, 2014; 6 months or more of continuous enrollment in insurance after OUD diagnosis; data derived from a large private USA health insurer that provided prescription drug coverage to all enrollees; **Exclusion criteria:** NR	Low
Hadland (2018a)[17]	Retrospective cohort	USA	N=4,837	Med (IQR): 20 (19-21) 56.9% Female; 76.0% white	OUD diagnosis over the study period	Methadone, buprenorphine, naltrexone	**Inclusion criteria:** 13-22 years; enrolled in the Truven-IBM Watson Health MarketScan Medicaid database between 2014 and 2015; primary or secondary OUD diagnosis in inpatient, emergency department, or outpatient claims; no prior OUD diagnosis or MOUD access in 60-days prior to OUD diagnosis; at least 3-months continuous enrolment in insurance after OUD diagnosis; **Exclusion criteria:** NR	Low
Hadland (2018b)[18]	Retrospective cohort	USA	N=6,864	Med (IQR): 20 (19-22) 59.4% Female; 78.4% non-Hispanic white	OUD diagnosis over the study period	Buprenorphine, methadone, naltrexone	**Inclusion criteria:** 13-22 years; enrolled in the Truven-IBM Watson Health MarketScan Medicaid database between 2014 and 2015; >11 months continuous enrolment in insurance; diagnosis of OUD; no MOUD receipt in month preceding OUD diagnosis; **Exclusion criteria:** NR	Low
Hadland (2020)[19]	Cross-sectional	USA	N=9,920 treatment facilities	N=2,285 (23%) adolescent-tailored OUD treatment facilities	OUD treatment facilities	Buprenorphine, methadone, naltrexone	**Inclusion criteria:** Treatment facilities that treat OUD and provide MOUD; from U.S. counties and county equivalents identified through the SAMHSA Behavioral Treatment Service Locator and the CDC as of October 2018;	Low

First author (Year)	Study design	Location	Participants	Sociodemographic	Substance use characteristics	MOUD type	Inclusion/exclusion criteria	Risk of Bias
							Exclusion criteria: Provided buprenorphine or methadone detoxification;	
Hand (2017)[20]	Cross-sectional	USA	N=8,656	N=6,111 (70.6%) <31 years 100% Women	Primary opioid use at treatment admission	Buprenorphine, methadone	**Inclusion criteria:** Pregnant seeking admission to private or public OUD treatment; primary opioid use; derived from the 2013 TEDS; **Exclusion criteria:** NR	Low
Knittel (2020)[21]	Retrospective cohort	USA	N=179	M (SD): 28.9 (4.5) 100% Women 91.6% white	OUD diagnosis over the study period	Buprenorphine, methadone, oxycodone taper or brief maintenance	**Inclusion criteria:** Incarcerated at North Carolina Correctional Institute for Women between 2016 and 2018; Pregnant and identified as having OUD through prison prenatal clinic roster problem lists; **Exclusion criteria:** Incorrectly identified as being pregnant; First trimester pregnancy lost after arrival in prison; No medical records beyond pregnancy test;	Low
Krans (2016)[22]	Retrospective cohort	USA	N=791	M (SD): 27.3 (4.7) 100 % Women; 96.9% white	OUD diagnosis over the study period	Buprenorphine, methadone	**Inclusion criteria:** Pregnant women with OUD; delivered an infant at University-affiliated hospital between 2009-2012; received MOUD; **Exclusion criteria:** NR	Moderate
Krans (2019)[23]	Prospective cohort	USA	N=12,587	M (SD): 27.7 (4.7) 100% Women; 87.8% white	OUD diagnosis over the study period	Buprenorphine, methadone	**Inclusion criteria:** 15-44 years; enrolled in Medicaid; have a life birth between January 1, 2009 and September 30, 2015; OUD diagnosis during pregnancy; data derived from the Pennsylvania Department of Health and Human Services Medicaid Program; **Exclusion criteria:** Later pregnancy excluded if interpregnancy interval less than 24 weeks;	Low
Krebs (2021)[24]	Retrospective cohort	Canada	N=4,048	N=446 (11%) 12-18 years 64.4% Female; N=3,602 (89%) 19-24 years 44.9% Female	Ever accessed health services for OUD	Buprenorphine-naloxone, injectable OAT, methadone, slow-release oral morphine	**Inclusion criteria:** All individuals diagnosed with OUD between January 1, 1996 and September 30, 2018; no record of death and not lost to follow-up over the study period; **Exclusion criteria:** NR;	Low
Larney (2017)[25]	Qualitative	Australia	N=46	N=6 young adults (ages: 25, 26, 28, 28, 28, 28) 4 Women, 2 Men	Opioid dependence documented upon imprisonment	Buprenorphine, methadone	**Inclusion criteria:** Imprisoned between September 2012 and October 2013; continued MOUD from community, commenced MOUD in custody, or recently initiated MOUD (<28 days); voluntarily ceased MOUD in custody or reported opioid dependence but have not sought MOUD in custody; **Exclusion criteria:** NR	Moderate
Liebling (2016)[26]	Cross-sectional	USA	N=200	M (SD): 24.5 (3.24) 34.5% Female;	Non-medical prescription	MAT (not specified)	**Inclusion criteria:** 18-29 years; residing in Rhode Island; enrolled in the Rhode Island Young Adult Prescription and	Moderate

First author (Year)	Study design	Location	Participants	Sociodemographic	Substance use characteristics	MOUD type	Inclusion/exclusion criteria	Risk of Bias
				61.5% white	opioid use in the past 30 days		Illicit Drug Study between January 2015 and February 2016; no current involvement in formal alcohol or substance treatment; able to complete interview in English; provide informed consent; must confirm non-medical use of prescription opioids in the past 30 days; **Exclusion criteria:** NR	
Maremmani (2015)[27]	Cross-sectional	Italy	N=317	M (SD): 27.95 (7.7) 32.8% Female	Heroin or prescription opioid use in the past 30 days	OAT (not specified)	**Inclusion criteria:** Participants accessing a SUD treatment units in Cossato and Bari over an 18-month period (study recruitment dates NR); **Exclusion criteria:** NR	Moderate
Mills (2004)[28]	Prospective cohort	Australia	N=210	M (SD): 21.5 (1.9) 40% Female	Heroin use in the past 30 days		**Inclusion criteria:** ≥18 years; no treatment for heroin use or imprisonment in preceding month; provided contact details for follow-up; not previously enrolled in the Australian Treatment Outcome Study between February 2001 and August 2002; **Exclusion criteria:** NR	Moderate
Paino (2015)[29]	Cross-sectional	USA	N=307 adolescent treatment facilities	Adolescents (age NR)	All adolescent-specific SUD treatment facilities over the study period	Acamprosate, buprenorphine, disulfiram, naltrexone	**Inclusion criteria:** SUD treatment facilities participating in the National Treatment Centre Study between June 2009 and January 2012; provide minimum level of care at least equivalent to structured outpatient services defined by the American Society of Addiction Medicine; **Exclusion criteria:** Counsellors in private practice; transitional living facilities; court-ordered driver education classes; detoxification services; programs located in Veterans Health Administration facilities; prisons; methadone-only programs;	Moderate
Patrick (2020)[30]	Cross-sectional	USA	N=10,871	N=10,117 (93.1%) buprenorphine prescribers 55.4% white N=754 (6.9%) opioid treatment programs 55.4% white 100% Women	Simulated pregnant and nonpregnant women with OUD	Buprenorphine, methadone	**Inclusion criteria:** Prescribers in Florida, Kentucky, Massachusetts, Michigan, Missouri, North Carolina, Tennessee, Virginia, Washington, and West Virginia; contacted between March 7 to September 5, 2019; **Exclusion criteria:** NR;	Moderate
Quigley (2012)[31]	Cross-section study	USA	N=77	M (SD): 25 (4.3) 100% Women	OUD diagnosis over the study period	Methadone	**Inclusion criteria:** Pregnant women seeking methadone treatment in an inpatient psychiatry unit between June 2010 and April 2011; **Exclusion criteria:** NR	High
Schiff (2020)[32]	Retrospective cohort	USA	N=5,247	M (SD): 28.7 (5) 100% Women	Clinical indication of OUD or MOUD	Buprenorphine, methadone	**Inclusion criteria:** Pregnant women who had a delivery between October 1, 2011 and December 31, 2015; diagnosis	Low

First author (Year)	Study design	Location	Participants	Sociodemographic	Substance use characteristics	MOUD type	Inclusion/exclusion criteria	Risk of Bias
				86.7% white	use over the study period		of OUD from hospital discharge, an opioid overdose event, enrollment in a state-funded treatment program for OUD, receipt of buprenorphine or methadone treatment, or an insurance claim for neonatal abstinence syndrome; **Exclusion criteria:** Women with neonatal abstinence syndrome who received opioid prescription in 3 months before delivery or before 34 gestational weeks; OUD from diagnosis claim alone;	
Smyth (2012)[33]	Retrospective cohort study	Ireland	N=100	M (SD): 16.6 (0.9) 54% Female	Any heroin or opioid use at treatment admission	Buprenorphine, methadone	**Inclusion criteria:** ≤18 years; heroin or opioid use; treated with MOUD; initiated treatment through the Young Persons Program between May 2000 and July 2008; **Exclusion criteria:** NR	Low
Stancliff (2012)[34]	Prospective cohort study	USA	N=153	N=16 M (SD): 23.4 (5.8) 31.3% Female	Heroin use at treatment admission	Buprenorphine detoxification	**Inclusion criteria:** Referred through syringe exchange programs between November 21, 2005 and July 28, 2008; **Exclusion criteria:** NR	Low
Stine (2009)[35]	Cross-sectional study	Austria, Canada, and USA	N=427	M (SD): 27.6 (5.9) 100% Women; 78.5% white	Previous OUD diagnosis or OUD diagnosis at treatment admission	Buprenorphine, methadone	**Inclusion criteria:** 18-41 years; enrolled in the Maternal Opioid Treatment: Human Experimental RCT which completed enrolment on October 31, 2008; current or historical OUD diagnosis and risk of relapse; provide opioid-positive urine sample; estimated gestational age limit of 13 weeks or 6 weeks if normal fetal heartbeat confirmed by sonogram; no vaginal bleeding in week prior to or at enrolment; **Exclusion criteria:** Medical condition that makes participation hazardous; acute severe psychiatric condition requiring treatment; imminent risk to self or others; pending legal action that could lead to withdrawal from study; evidence of regular benzodiazepine or alcohol use; multiple-fetus pregnancy; did not intend on delivering at local hospital;	Low
Winkelman (2020)[36]	Cross-sectional	USA	N=131,838	N=82,992 (63.0%) 12-29 years 100% Women	Admitted to treatment for OUD	Buprenorphine, methadone	**Inclusion criteria:** Pregnant women admitted to treatment for OUD and identified through the TEDS between 1992 and 2017; **Exclusion criteria:** State of Florida due to incompatible reporting; admissions that are missing a referral source; treatment admission records that were missing data on study covariates;	Low
Yang (2011)[37]	Prospective cohort study	Canada	N=397	Med (IQR): 24.5 (21.4-27.4) 53.4% Female;	Daily injection or non-injection	Methadone	**Inclusion criteria:** 14-30 years; enrolled in the Cedar Project between October 2003 and July 2007; lifetime or previous six-	Low

First author (Year)	Study design	Location	Participants	Sociodemographic	Substance use characteristics	MOUD type	Inclusion/exclusion criteria	Risk of Bias
				100% Indigenous	opioid use in the past 6 months		month self-reported injection or non-injection opioid use; provide written informed consent; **Exclusion criteria:** NR	

Note: Risk of bias or quality assessment was conducted using the modified Newcastle-Ottawa Scale for cohort and cross-sectional studies and the GRADE-CERQual tool for qualitative studies.
Abbreviations: M, mean; Med, median; MOUD, medications for opioid use disorder; NR, none reported; OUD, opioid use disorder; SAMSHA, Substance Abuse and Mental Health Services; RCT, randomized controlled trial; SUD, substance use disorder; TEDS, Treatment Episode Dataset; USA, United States of America.

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eTable 7. Summary of Findings From Included Studies Examining MOUD Access and Associated Factors Among Adolescents and Young Adults Who Use Opioids

First author (Year)	Objective(s)	Covariate(s)/Predictor(s)	Outcome indicator(s)	Proportion of AYA that accessed MOUD	Factors associated with MOUD access
Alinksy (2020a)[1]	Examine associations between adolescent-serving SUD treatment facility characteristics and the provision of MOUD	Facility characteristics: non-profit status, acceptance of health insurance, cash-only treatment, outpatient treatment, residential treatment, inpatient treatment, license by national authority	The provision of buprenorphine, methadone, or extended-release naltrexone	N = 816 (23.1%) of SUD treatment facilities with adolescent programs provide buprenorphine, methadone, or extended-release naltrexone; 13.2% of cash-only facilities with adolescent-focused programs provide MOUD vs. 41.5% of cash-only facilities with adult-focused programs	**Positive associations:** Non-profit vs. for-profit (OR: 1.38, 95% CI: 1.08 – 1.75), Insured vs. free/subsidized treatment (OR: NR), Offer inpatient services/licensed by national authority vs. not (OR: NR); **Negative associations:** South vs. Northeast (OR: 0.24, 95% CI: 0.19-0.30)**,** West vs. Northeast (OR: 0.15, 95%: 0.12-0.19)**,** Midwest vs. Northeast (OR: NR);
Alinksy (2020b)[2]	The percentage and characteristics of AYA who receive MOUD within 30 days of an opioid-related overdose	Age, Gender, Race, Pregnancy status, Pain condition, Depression, Self-harm/suicidal ideation, Anxiety disorder, Attention-deficit/hyperactivity disorder, Type of SUD, Prior MOUD, Prior behavioral health service, Prior opioid prescription, Year of overdose	Receipt of timely addiction treatment (including buprenorphine, methadone or naltrexone) within 30 days of opioid-related overdose	N = 67 (1.9%) between 13-22 years received buprenorphine, methadone, or naltrexone within 30 days of opioid-related overdose	**Positive associations:** OUD vs. no OUD diagnosis (AOR: 9.03, 95% CI: 3.95 – 20.7), Prior MOUD vs. none (AOR: 14.2, 95% CI: 7.29 – 27.8); **Negative associations:** NR;
Angelotta (2016)[3]	Explore the relationship between use of MAT for pregnant women with OUD and other potential factors that affect MOUD access	State prenatal child abuse laws, Principal source of referral to treatment, Geographical region of USA, Medicaid coverage of MOUD	Absence of methadone or buprenorphine in treatment plan of pregnant women with primary OUD	N=2,641 (44.0%) between ages 12-29 received methadone or buprenorphine N = 7 (21.88%) 12-17 years N = 1,224 (42.15%) 18-24 years N = 1,410 (46.06%) 25-29 years	**Positive associations:** NR **Negative associations:** SUD care provider referral vs. self-referral (OR: 2.21, 95% CI: 1.91-2.56), Other healthcare provider referral vs. self-referral (OR: 1.51, 95% CI: 1.31-1.74), Criminal justice referral vs. self-referral (OR:7.17, 95% CI: 6.08-8.43), Other community referral vs. self-referral (OR: 3.78, 95% CI: 3.22-4.44), Unknown referral source vs. self-referral (OR: 2.07, 95% CI: 1.45-2.95), South vs. Northeast (OR: 2.41, 95% CI: 2.10-2.76), West vs. Northeast (OR: 1.37, 95% CI: 1.19-1.58), MOUD Medicaid coverage vs. none (OR: 2.28, 95% CI: 1.97-2.64), State permits child abuse charges for SUD vs. not (OR: 1.43, 95% CI: 1.26-1.62);
Ayres (2014)[4]	Understand the effectives of an acceptability of a same-day methadone prescription intervention	NR	Positive outcomes and motivation for using methadone	NR	**Positive associations:** Feeling like they are in a bad place and are looking for stabilization; **Negative associations:** Long wait times or physicians take too long to prescribe methadone, Gatekeeper barriers and having to go from one doctor to the next in search of prescription;

First author (Year)	Objective(s)	Covariate(s)/Predictor(s)	Outcome indicator(s)	Proportion of AYA that accessed MOUD	Factors associated with MOUD access
Bachhuber (2017)[5]	Estimate the association between state Medicaid coverage of methadone and use of OAT among pregnant women admitted for specialty OUD treatment	State Medicaid coverage of methadone or buprenorphine, Age, Race/ethnicity, Education, Heroin use, Treatment referral source, Residential, Intensive outpatient, Non-intensive outpatient treatment	Planned use of methadone or buprenorphine	52.9% (51.2-54.6) in all treatment settings 30.7% (27.2-34.3) in residential treatment 36.3% (32.0-40.6) in intensive outpatient 63.5% (61.4-65.5) in non-intensive outpatient	**Positive associations:** All settings: Medicaid vs. private/non-Medicaid/no insurance (AD: 21.2, 95% CI: 4.6-37.9), Residential: Medicaid vs. private/non-Medicaid/no insurance (AD: 16.1, 95% CI: 0.8-31.4), Intensive outpatient: Medicaid vs. private/non-Medicaid/no insurance (AD: 37.0, 95% CI: 8.1-66.0) **Negative associations:** NR;
Bagley (2020)[6]	Estimate the time to MOUD treatment and rates of MOUD access in the 12 months after a non-fatal overdose	Age, Gender, Homelessness, Involuntary treatment, Past-year: anxiety, depression, prescription benzodiazepine use, MOUD, detoxification, residential treatment	Treatment with methadone, buprenorphine, or naltrexone following non-fatal overdose	N=1209 (28%) 18-21 years N=193 (16%) received buprenorphine N=121 (10%) received naltrexone N=85 (7%) received methadone N=3,059 (36%) 22-25 years accessed MOUD: N=612 (20%) received buprenorphine N=367 (12%) received methadone N=306 (10%) received naltrexone	**Positive associations:** 18-21 vs. 26-45 and naltrexone (AHR: 1.65, 95% CI: 1.36-2.00), 22-25 vs. 26-45 and naltrexone (AHR: 1.41, 95% CI: 1.23-1.61); **Negative associations:** 18-21 vs. 26-45 and methadone (AHR: 0.60, 95% CI: 0.45-0.70);
Bateman (2014)[7]	Describe the nature of prescribing pharmacological treatment to AYA and identify differences in prescribing between younger and older adolescents	Age, Prescriber who wrote the prescription	Prescribed methadone, buprenorphine, or lofexidine	N=33 (36.7%) <16 years N=172 (54.7%) 16-18 years	**Positive associations:** 16-18 vs. <16 years (OR: 2.08, 95% CI: 1.03-4.16) at the bivariate level, not statistically significant after adjusting for the prescriber; **Negative associations:** NR;
Bell (1992)[8]	Understanding factors associated with being rejected from MMT	Drug use, Health and social functioning, Treatment for SUD, Illegal activities	Being rejected from a methadone program	N=196 (80.7%) ≤30 years N=15 (62.5%) ≤20 years N=81 (79%) 21-25 years N=100 (86%) 26-30 years	**Positive associations:** Daily vs. <daily opioid use (AOR: 10, 95% CI: 4.5-20), Positive vs. negative urine opioid screen (AOR: 5, 95% CI: 1.8-14), ≥10 criminal convictions vs. <10 (AOR: 17, 95% CI: 3.5-100); **Negative associations:** NR;
Bell (2021)[9]	Examining demographic factors associated with the receipt of buprenorphine	Age, Race, Ethnicity, Sex	Buprenorphine receipt	N=177 (55.7%) received any MOUD N=79 (44%) received buprenorphine-naloxone N= 66 (37%) received naltrexone N= 26 (15%) received naloxone N=6 (3%) received buprenorphine	**Positive associations:** Older vs. younger age (per year older) (AOR: 3.29, 95% CI: 2.00-5.40); **Negative associations:** NR;
Boyd (2017)[10]					
	Explore how street-youth characterize their transitions into period of injection cessation as well as perceived barriers to injection cessation, including experiences with MMT programs	NR	NR	Majority accessed MMT (proportion NR)	**Positive associations:** Wanting to cease injection drug use; **Negative associations:** Treatment costs;

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Brands (2005)[11]					
	Assess motivation street-involved youth's motivation with respect to treatment	Sociodemographic information, Specific drug use patterns, Characteristics of heroin use including symptoms of opioid dependence, Tolerance and withdrawal, Risk factors for Infections associated with heroin use, Efforts to quit or cut down	Gender differences in reasons for seeking help and barriers to methadone	N=18 (16%) accessed methadone	**Positive associations:** Women more likely to access methadone in comparison to Men (29% vs. 4%, p<0.05); **Negative associations:** Women more like to experience program restrictions (38% vs. 0%, p<0.005) and stigma or fear (25% vs. 4%, p<0.05) as barriers to treatment in comparison to Men, Men more likely to report friends' influence (32% vs. 4%, p<0.05) as a barrier to treatment;
Chavez (2020)[12]	Examine the receipt of medications and health care within 3 months of an OUD diagnosis	Age, Gender, Ethnicity, County of residence, Clinical characteristics, Mental health conditions, Other SUD, Opioid overdose, Pain-related diagnoses, Pharmacy claims data, Health care utilization	Receipt of buprenorphine or naltrexone within 3 months of OUD diagnosis	4.6% (2.8 – 5.6) accessed any MOUD: 3.9% (3.1 – 4 .8) accessed buprenorphine 0.8% (0.5 – 1.2) accessed any oral or injectable naltrexone	**Positive associations:** Any MOUD: 12-15 vs. 16-18 years: 1.2% vs. 5.9% (p<0.01), Any buprenorphine: 12-15 vs. 16-18 years: 0.7% vs. 5.1% (p<0.01); **Negative associations: NR**
Fagan (2008)[13]	Describe the patterns of substance use and psychosocial problems of under-19 year old opiate-dependent teenagers presenting to a specialist adolescent opiate treatment service	Age, Gender, Education, Residence, Family history of SUD, Relationship status, Main opiate used, Secondary substance use, Route of heroin use, Criminal behavior, Psychiatric history, Hepatitis-C status	Gender differences in methadone prescription	N=86 (100%) accessed methadone	**Positive associations:** Women vs. Men: Currently in a relationship (76% vs. 25%, p<0.001), History of deliberate overdose (32% vs. 8%, 0=0.007); Men vs. Women: Sibling alcohol use (29% vs. 5%, p=0.007), Past criminal convictions (63% vs. 35%, p=0.02), Younger age of school leaving (13.9 years vs. 14.9 years, p=0.01); **Negative associations:** NR;
Feder (2017)[14]	Provide information on the extent of MOUD use among adolescents treated for OUD	Age, Gender, Race or ethnicity, Referral source, Homelessness, Number of substances reported at admission	Receipt of methadone or buprenorphine	N=18 (2.4%) of adolescents who reported heroin use N=9 (0.4%) of adolescents who reported other opioid use	**Positive associations:** NR; **Negative associations:** Adolescents vs. adults who use heroin (AOR: 0.09, 95% CI: 0.05-0.14), Adolescents vs. adults who use other opioids (AOR: 0.05, 95% CI: 0.03-0.10);
Guarino (2009)[15]	Gather qualitative data on AYAs' perceptions of the components of effective treatment	NR	NR	N=7 (100%) accessed methadone	**Positive associations:** Feeling as though their life is "really bad" and they want treatment, Making information about treatment available to youth, Having failed at inpatient detoxification and residential treatment; **Negative associations:** Feeling forced or experiencing external pressure;
Hadland (2017)[16]	Identify trends in and disparities in pharmacotherapy for youth	Age, Gender, Race/Ethnicity, Neighborhood education and poverty levels, Geographic	Receiving buprenorphine or naltrexone within 6	N=5,580 (26.8%) accessed buprenorphine or naltrexone N=4,976 (23.9%) accessed buprenorphine N=604 (2.9%) accessed naltrexone	**Any MOUD:** **Positive associations:** NR; **Negative associations:** 13-15 vs. 21-25 years (AOR: 0.03, 95% CI: 0.02-0.06), 16-17 vs. 21-25 years (AOR: 0.25, 95%

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		region, Census region, Year of diagnosis	months of OUD diagnosis		CI: 0.21-0.29), 18-20 vs. 21-25 years (AOR: 0.64, 95% CI: 0.60-0.69), Being a woman (AOR: 0.79, 95% CI: 0.73-0.84), Non-Hispanic Black race (AOR: 0.58, 95% CI: 0.33-0.99), Hispanic vs. non-Hispanic ethnicity (AOR: 0.83, 95% CI: 0.71-0.97), Low-middle vs. low-income poverty level (AOR: 0.90, 95% CI: 0.83-0.98); **Buprenorphine vs. Naltrexone** **Positive associations:** Non-metropolitan vs. metropolitan area (OR: 1.44, 95% CI: 1.19-1.75), Low/Low-middle vs. high educational level neighborhood (OR: 1.77, 95% CI: 1.29-2.43), High vs. low poverty level (OR: 1.82, 95% CI: 1.16-2.84), High-middle vs. low-income poverty level (OR: 1.67, 95% CI: 1.27-2.20), Low-middle vs. low-income poverty level (OR: 1.25, 95% CI: 1.01-1.53), Midwest vs. South (OR: 1.30, 95% CI: 1.04-1.62); **Negative associations:** Younger age [16-17 vs. 21-25 years (OR: 0.47, 95% CI: 0.32-0.68), 18-20 vs. 21-25 years (OR: 0.78, 95% CI: 0.65-0.94)], Being a woman (OR: 0.82; 95% CI: 0.69-0.99);
Hadland (2018a)[17]	Identify the frequency with which youths who presented for care for OUD received timely addiction treatment	Age, Gender, Race/Ethnicity, Medicaid status, Pregnancy status, Depression, Anxiety disorder, Attention-deficit/hyperactivity disorder, Alcohol use disorder, Other SUD, Acute pain condition, Chronic pain condition	Receipt of methadone, buprenorphine, or naltrexone within 3 months of an OUD diagnosis	N=1,139 (23.5%) accessed any MOUD N=936 (19.4%) accessed buprenorphine N=135 (2.8%) accessed naltrexone N=68 (1.4%) accessed MMT	**Positive associations:** Adolescents vs. young adults and naltrexone (35.3% vs. 11.1%, p<0.001) **Negative associations:** NR;
Hadland (2018b)[18]	Determine the percentage of Medicaid-enrolled youth with OUD who receive recommended MOUD and identify disparities in access	Age, Gender, Race/Ethnicity, Psychiatric comorbidity	Receipt of buprenorphine, methadone, or naltrexone	N=1,483 (21.6%) accessed any MOUD N=1,245 (18.1%) accessed buprenorphine N=157 (2.3%) accessed naltrexone N=81 (1.2%) accessed methadone	**Positive associations:** Adolescents vs. young adults (p<0.001) and naltrexone, Young adults vs. adolescents and methadone (p<0.001) **Negative associations:** Age 13-15 vs. ≥21 (AOR: 0.09, 95% CI: 0.04-0.21), Age 16-17 vs. ≥21 (AOR: 0.17, 95% CI: 0.12-0.24), Age 18-20 vs. ≥21 (AOR: 0.76, 95% CI: 0.67-0.87), Men vs. Women (AOR: 0.75, 95% CI: 0.67-0.86), Black vs. Non-Hispanic white (AOR: 0.39, 95% CI: 0.28-0.55), Depression (AOR: 0.79, 95% CI: 0.66-0.96), Comorbid alcohol use disorder (AOR: 0.70, 95% CI: 0.51-0.97), Comorbid substance use disorder (AOR: 0.83, 95% CI: 0.70-0.98)

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Hadland (2020)[19]	Determine the availability of OUD treatment facilities that provide medications for adolescents	Age, Gender, Race/Ethnicity, Employment, Poverty status, Insurance, US Census Bureau division, Rural/Urban, Medically underserved area, Opioid overdose rate per 100,000	Treatment facilities that provide MOUD and accept adolescents	N=1,889 (60.1%) of US Counties had treatment facilities that provided MOUD N=1,062 (33.8%) of US Counties had adolescent-tailored programs N=371 (11.8%) of US Counties had adolescent programs that provided buprenorphine N=40 (1.3%) of US Counties had adolescent programs that provided methadone N=512 (16.3%) of US Counties had adolescent programs that provided naltrexone N=742 (23.6%) of US Counties had adolescent programs that permitted MOUD for outside prescribers/facilities	**Positive associations:** Greater county-level population of 45-64 vs. 11-17 years (ARR: 1.04, 95% CI: 1.00-1.07); Higher vs. lower proportion in poverty (ARR: 1.02, 95% CI: 1.01-1.04); Middle Atlantic vs. New England (ARR: 1.52, 95% CI: 1.13-2.04); Mountain vs. New England (ARR: 1.43, 1.02-2.00); Medium vs. Large Central Metropolitan area (ARR: 1.32, 95% CI: 1.10-1.59); Small vs. Large Central Metropolitan area (ARR: 1.70, 95% CI: 1.44-2.00); Micropolitan vs. Large Central Metropolitan area (ARR: 2.09, 95% CI: 1.67-2.62); Noncore vs. Large Central Metropolitan area (ARR: 2.13, 95% CI: 1.68-2.71); **Negative associations:** Greater county-level population of 25-44 vs. 11-17 years (ARR: 0.96, 95% CI: 0.94-0.99);
Hand (2017)[20]	Compare data related to self-reported substance used leading to treatment admission, characteristics of treatment received, and demographic characteristics between US Census regions	Age, Race/Ethnicity, Education, Employment, Insurance status, Marital status, Primary substance use, Injection drug use, Treatment history	Differences in demographic characteristics by census region	N=3,975 accessed MOUD N=1,519 (54.1%) in the Northeast USA N=921 (47.7%) in the Midwest USA N=876 (49.7%) in the West USA N=659 (30.6%) in the South USA	**Positive associations:** Northeast vs. South census region (AOR: 2.84, 95% CI: 2.51-3.22), Midwest vs. South census region (AOR: 2.08, 95% CI: 1.82-2.37), West vs. South census region (AOR: 2.03, 95% CI: 1.76-2.33); **Negative associations:** NR;
Knittel (2020)[21]	Quantify the extent to which pregnant women in a Southeastern prison received MOUD during incarceration	Age, Race/Ethnicity, Custody status, Admitted to health unit, Pregnancy trimester, Substance use history, MAT history and type, Delivery prior to release	Receipt of MOUD MOUD versus non-standard treatment (no MOUD, oxycodone taper, brief oxycodone maintenance)	N=51 (28.5%) received MOUD N=20 (11.2%) received buprenorphine N=31 (17.3%) received methadone N=41 (22.9%) received oxycodone taper or brief maintenance	**Positive associations:** Second vs. first trimester (AOR: 5.42, 95% CI: 1.18-25.01); Third vs. second trimester (AOR: 8.30 (1.78-38.74); Yes vs. no pre-incarceration MAT (AOR: 25.15, 95% CI: 10.07-62.79); **Negative associations:** NR;
Krans (2016)[22]	Characterize and compare patients who initiated methadone vs. buprenorphine during their pregnancy and identify patient characteristics predictive of buprenorphine use during pregnancy	Age, Race, Marital status, Employment, Education, Medicaid, Primiparous, Care provider information, Medical comorbidities, Substance use history and route, Treatment history, Social risk factors	Receipt of buprenorphine vs. methadone	N=711 (100%) accessed MOUD N=608 (76.9%) accessed methadone N=183 (23.1%) accessed buprenorphine	**Positive associations:** Older age (AOR: 1.01, 95% CI: 1.02-1.11), Employed vs. unemployed (AOR: 1.87, 95% CI: 1.20-2.90), Pre-pregnancy MOUD vs. none (AOR: 2.68, 95% CI: 1.78-4.02); **Negative associations:** Benzodiazepine use vs. none (AOR: 0.48, 95% CI: 0.30-0.77), Children not in maternal custody vs. being in maternal custody (AOR: 0.63, 95% CI: 0.40-0.99), Partner with substance use vs. none (AOR: 0.37, 95% CI: 0.22-0.63);
Krans (2019)[23]	Evaluate individual-level factors associated with MOUD use during pregnancy and temporal	Age, Race/Ethnicity, County of residence, Medica co-morbidities, Pregnancy-	Receipt of methadone or buprenorphine	N=7,034 (55.9%) accessed MOUD N=3,618 (28.7%) accessed methadone N=3,416 (27.1%) accessed buprenorphine	**Positive associations:** Buprenorphine use increased from 15.8% (95% CI: 13.9-17.8) in 2009 to 30.9% (95% CI: 28.8-33) in 2015);

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	trends in methadone versus buprenorphine use across rural and geographic regions	associated comorbidities, Substance use in pregnancy, MOUD utilization			**Negative associations:** Methadone use decreased from 31.6% (95% CI: 29.3-33.9) in 2009 to 25.2% (95% CI: 23.3-27.1);
Krebs (2021)[24]	Estimate the OUD cascade of care for all adolescents and young adults compared to older adults	Gender, Income assistance, Rurality, OUD-related comorbidities	Describe key factors associated with MOUD engagement	N=163 (36.5%) 12-18 years received MOUD 60.1% received buprenorphine-naloxone 38% received methadone N=2,572 (71.4%) 19-24 received MOUD 48.3% received buprenorphine-naloxone 49.5% received methadone	**Positive associations:** Older vs. younger age (71.4% vs. 36.5%, p-value: NR); Older vs. younger age and methadone access (49.5% vs. 38%, p-value: NR); Younger vs. older age and buprenorphine-naloxone access (60.1% vs. 48.3%, p-value: NR) **Negative associations:** NR;
Larney (2017)[25]	Explore the intentions of opioid-dependent prisoners with regards to MOUD in custody and following release	NR	NR	NR	**Positive associations:** Fear of contracting Hepatitis C in a prison setting motivated MOUD use; **Negative associations:** NR;
Liebling (2016)[26]	Assess patient-level, provider-level, health care system, and structural factors associated with SUD treatment access among young adults who report NMPOU	Age, Gender, Race/Ethnicity, Sexual orientation, Education, Employment, Monthly income, Geographic residence type, Overdose, Substance use type, Injection drug use, Mental illness, Prescribed opioids, Discrimination due to drug use, Imprisonment or juvenile detention, Homelessness, Recruitment period	Substance use treatment access	N=48 (24%) accessed MAT (not specified)	**Never attempted vs. successfully enrolled:** **Positive associations:** Monthly income $501-$1,500 vs. <$501 (ARR: 3.93, 95% CI: 1.53-10.12), Non-white vs. white (ARR: 3.16, 95% CI:1.28-7.83); **Negative associations:** Hispanic or Latino vs. non-Hispanic (ARR: 0.30, 95% CI: 0.10-0.95), Drug-related discrimination by medical community vs. no (ARR: 0.25, 95% CI: 0.10-0.62), Ever incarcerated in jail or prison vs. no (ARR: 0.31, 95% CI: 0.14-0.66); **Unsuccessfully attempted vs. successfully enrolled:** **Positive associations:** Monthly income $501-$1,500 vs. <$501 (ARR: 5.36, 95% CI: 1.79-16.03), Ever overdosed by accident (ARR: 2.71, 95% CI: 1.06-6.91); **Negative associations:** NR;
Maremmani (2015)[27]	To evaluate patients entering a Northern and Southern Italian out-patient OAT program	Age, Gender, Treatment history, Early relapse, Employed, Primary substance use, Recent substance use	Entering OAT program in Northern vs. Southern Italy	N=317 (100%) accessed OAT (not specified)	**Northern vs. Southern Italy:** **Positive associations:** Older vs. younger age (AOR: 4.97, 95% CI: 2.19-11.3), ≤1 month vs. >1 month since last treatment (AOR: 1.52, 95% CI: 1.53-13.8); **Negative associations:** Buprenorphine use vs. none (AOR: 0.041, 95% CI:0.006-0.284), Codeine use vs. non (AOR: 0.008, 95% CI: 0-0.197), Heroin use vs. none (AOR: 0.031, 95% CI: 0.005-0.203), Methadone use (AOR: 0.02, 95% CI:0.003-0.15), Oxycodone vs. none (AOR: 0.011, 95% CI: 0-0.486), Tramadol vs. none (AOR: 0.013, 95% CI: 0.001-0.276), Combined heroin & NMPOU (AOR: 0.025, 95% CI: 0.002-0.280);

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Mills (2004)[28]	Examine the rate of progression from initial heroin use to first treatment episode among younger vs. older people who use heroin	Age, Gender, Education, Living with parents, Main source of income, Imprisonment	Rate of progression from initial heroin use to first treatment for heroin use	N=78 (37%) accessed methadone	**Positive associations:** Younger age of treatment initiation based on age of first regular heroin use (age 19.3 vs. 26.2, p<0.001), Years from regular heroin use to first treatment entry (2.4 vs. 5.1 years, p<0.001), Being a woman (β=1.35, 95% CI: 0.57-2.13); **Negative associations:** NR;
Paino (2015)[29]	Examine the relationship between the proportion of adolescent clients in a treatment program and the availability of MOUD	Proportion of adolescent clients, Treatment funding arrangement, Treatment accredited, Organization size, Client admission, Age, Inpatient services, 12-step orientation, Proportion of counselors with Graduate degrees, Proportion of counselors with alcohol/drug accreditation, Geography, Competition density	Extent to which a treatment centre provides acamprosate, tablet naltrexone, buprenorphine, injectable naltrexone or disulfiram	N= 24 (17%) provided acamprosate N= 16 (11%) provided tablet naltrexone N= 16 (11%) provided buprenorphine N= 14 (10%) provided injectable naltrexone N= 13 (9%) provided disulfiram	**Positive associations:** Privately vs. publicly funded (OR: 2.36, p<0.001), Accredited vs. not (OR: 2.14, p<0.05), Larger vs. smaller organization (OR: 2.07, p<0.001), Greater vs. smaller proportion of counselors with Graduate degrees (OR: 1.02, p<0.001); **Negative associations:** Greater vs. smaller proportion of adolescent clients (OR: 0.964, p<0.001), Clients admitted for treatment (OR: 0.765, p<0.10);
Patrick (2020)[30]	Obtain estimates of differences in buprenorphine and methadone access for pregnant vs. nonpregnant women of reproductive age	Age, Race/Ethnicity, Insurance status, State	Success rate for pregnant vs. nonpregnant callers	N=2,312 (67.6%) received an appointment with buprenorphine clinician N=1,055 (61.4%) pregnant callers N=1,257 (73.9%) nonpregnant callers N=477 (13.9%) received an appointment at an opioid treatment program for methadone N=240 (88.6%) pregnant callers N=237 (89.4%) nonpregnant callers	**Positive associations:** NR; **Negative associations:** Pregnant vs. nonpregnant (RR: 0.83, 95% CI: 0.79-0.87); Nonpregnant women with Medicaid vs. private insurance (40.3% vs. 49.2%, p<0.001);
Quigley (2012)[31]	Examine extent to which maternal race and ethnicity is associated with the use of MOUD in the year before delivery	Age, Education, Medicaid enrolment in month of delivery, Marital status, Rurality, Mental health, Health care utilization during pregnancy, Opioid-related variables, MOUD receipt	Extent of MOUD use and type of MOUD used	N=3,474 (66.2%) received any MOUD Buprenorphine: N=1,617 (35.5%) white women N=NA (0%) Hispanic women N=96 (20.8%) non-Hispanic Black women Methadone: N=1,265 (27.8%) white women N=59 (25.2%) Hispanic women N=110 (23.8%) non-Hispanic Black women Both: N=253 (5.6%) white women N=NA (0%) Hispanic women N=22 (4.8%) non-Hispanic Black women None: N=1,416 (31.1%) white women	**Any MOUD use in year before delivery:** **Positive associations:** NR; **Negative associations:** Non-Hispanic Black vs. white ≤25 years (AOR: 0.23, 95% CI: 0.14-0.38); Hispanic vs. white ≤25 years (AOR: 0.29, 95% CI: 0.20-0.42); Non-Hispanic Black vs. white 26-34 years (AOR: 0.46, 95% CI: 0.32-0.67); Hispanic vs. white 26-34 years (AOR: 0.46, 95% CI: 0.35-0.60); **Buprenorphine vs. methadone:** **Positive associations:** NR; **Negative associations:** Non-Hispanic Black vs. white with no maternal depression or anxiety (AOR: 0.41, 95% CI: 0.25-0.69), Hispanic vs. white with no maternal depression or anxiety (AOR: 0.59, 95% CI: 0.39-0.85);

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				N=126 (53.9%) Hispanic women N=234 (50.7%) non-Hispanic Black women	**Buprenorphine vs. no MOUD access:** **Positive associations:** NR; **Negative associations:** Non-Hispanic Black vs. white with depression or anxiety (AOR: 0.49, 95% CI: 0.28-0.87); Hispanic vs. white with depression or anxiety (AOR: 0.56, 95% CI: 0.39-0.85); Black vs. white with no depression or anxiety (AOR: 0.20, 95% CI: 0.12-0.33); Black vs. white with no depression or anxiety (AOR: 0.27, 95% CI: 0.20-0.38);
Schiff (2020)[32]	Understand the knowledge and attitudes related to methadone among this population	Demographic characteristics, Substance use, Treatment knowledge and attitudes	Motivating factors for seeking methadone	N=77 (100%) accessed methadone	**Positive associations:** Concern of how drug use was hurting their baby (96%, N=74); **Negative associations:** NR;
Smyth (2012)[33]	Providing a descriptive analysis of the experience of heroin-dependent adolescents entering a substitution treatment program over an 8-year period	Demographic characteristics, Education, Parental support, Familial substance use, Homelessness, Incarceration, Criminal activity, Substance use patterns, Infectious diseases, Treatment history, Route of discharge	Characteristics of adolescents presenting for methadone by gender	n=100 (100%) accessed methadone	**Positive associations:** Men vs. Women: Younger age (13.8 vs. 14.9 years, p=0.002), Sibling opiate use (56% vs. 32%, p=0.02), Previous criminal convictions (59% vs. 29%, p=0.004), Ever incarcerated (41% vs. 14%, p=0.004), Discharged from prison (14% vs. 2%, p=0.05); Women vs. Men: Current relationship (64% vs. 16%, p<0.001), History of self-harm (41% vs. 18%, p=0.01); **Negative associations:** NR;
Stancliff (2012)[34]	Demonstrate that buprenorphine could be successfully provided to people who use heroin from lower socioeconomic populations	Gender, Ethnicity, Insurance status, Employment, Opioid type and route, Age applied for buprenorphine, Age of first opioid use, Previous methadone treatment involvement	Requesting buprenorphine detoxification vs. maintenance	N=16 (10.5%) requested buprenorphine detoxification	**Buprenorphine detoxification vs. maintenance** **Positive associations:** Younger age when applying for buprenorphine (23.4 vs. 40.2 years, p<0.05), Younger age of first opioid use (18.8 vs. 21.3 years, p<0.05), white (87.5% vs. 27.7%, p<0.05), Injection drug use (100% vs. 49.6%, p<0.05); **Negative associations:** Latino (6.3% vs. 44.5%, p<0.05), Insured (12.5% vs. 80%, p<0.05), Employed (6.3% vs. 45.3%, p<0.05);
Stine (2009)[35]	Evaluate the association between sociodemographic factors, substance use history, gestational age, and treatment history variables and consent for participation in a methadone RCT	Age, Race, Marital status, Gestational age, Education, Employment, Current methadone enrolment, Number of previous drug treatments, Cocaine use in past 30 days	Consenting to participate in a methadone RCT	N=208 (48.7%) participated in methadone RCT	**Positive associations:** NR; **Negative associations:** Currently enrolled in maintenance (AOR: 0.46, 95% CI: 0.26-0.79);
Winkelman (2020)[36]	Examine trends in MOUD among pregnant women	Age, Race/Ethnicity, Education, Employment, Census region,	Receipt of MOUD	Adjusted receipt of MOUD from 1992-2017:	**Positive associations:** MOUD receipt increased from 1992 to 2017 for individual and other referral sources,

First author (Year)	Objective(s)	Covariate(s)/Predictor(s)	Outcome indicator(s)	Proportion of AYA that accessed MOUD	Factors associated with MOUD access
	referred to treatment before and after Medicaid expansion	Treatment service setting, Treatment referral source		Criminal justice referral: 26.3% (95% CI: 25.7-27.0, p<0.001) Individual referral: 59.1% (95% CI: 58.8-59.5, p<0.001) Other referral source: 51.3% (95% CI: 50.8-51.7, p<0.001)	Criminal justice referral in US State that participated in Medicaid expansion; **Negative associations:** Criminal justice vs. individual referral in 2017 (ARR: 0.52, 95% CI: 0.48-0.55), Criminal justice vs. other referral in 2017 (ARR: 0.59, 95% CI: 0.55-0.64);
Yang (2011)[37]	Identify sociodemographic characteristics, substance use patterns, traumatic life events, and other factors associated with methadone use among Indigenous AYA	Age, Gender, Relationship status, Pregnancy, Child previously apprehended, Family Residential School history, Removed from custody of biological parents, Homelessness, Incarceration, Been to a reserve, Suicidality, Treatment history	Lifetime or past six-month methadone use	N=93 (23.4%) ever used methadone	**Positive associations:** Older vs. younger age (AOR: 1.17, 95% CI: 1.08-1.28), Women vs. Men (AOR: 3.76, 95% CI: 2.00-7.07), HCV-positive vs. negative (AOR: 1.53-4.95), Daily injection drug use (AOR: 2.59, 95% CI: 1.46-4.61); **Negative associations:** Weekly or more vs <weekly alcohol use (AOR: 0.43, 95% CI: 0.21-0.87)

Abbreviations: AD, Adjusted Difference; AHR, Adjusted Hazard Ratio; AOR, adjusted odds ratio; ARR, Adjusted Risk Ratio; CI, Confidence Interval; HCV, hepatitis C virus; MOUD, medications for opioid use disorder; NR, none reported; OR, odds ratio; OUD, opioid use disorder; P, p-value; RCT, randomized controlled trial; SUD, substance use disorder; TEDS, Treatment Episode Dataset; USA, United States of America.

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