

Primary Care–Based Models for the Treatment of Opioid Use Disorder

A Scoping Review

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Greater integration of medication-assisted treatment (MAT) for opioid use disorder (OUD) in U.S. primary care settings would expand access to treatment for this condition. Models for integrating MAT into primary care vary in structure. This article summarizes findings of a technical report for the Agency for Healthcare Research and Quality describing MAT models of care for OUD, based on a literature review and interviews with key informants in the field. The report describes 12 representative models of care for integrating MAT into primary care settings that could be considered for adaptation across diverse health care settings. Common components of existing care models include

pharmacotherapy with buprenorphine or naltrexone, provider and community education, coordination and integration of OUD treatment with other medical and psychological needs, and psychosocial services and interventions. Models vary in how each component is implemented. Decisions about adopting MAT models of care should be individualized to address the unique milieu of each implementation setting.

Ann Intern Med. 2017;166:268-278. doi:10.7326/M16-2149 **Annals.org**
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 This article was published at Annals.org on 6 December 2016.

Opioid use disorder (OUD) is a national crisis in the United States (1). In 2014, approximately 1.9 million Americans aged 12 years or older were estimated to have an OUD related to prescription opioids, and nearly 600 000 used heroin (2). In 2013, an estimated 16 000 persons died as a result of prescription opioid overdose, and approximately 8000 died of heroin overdose (3).

Medication-assisted treatment (MAT) for OUD, also referred to as “pharmacotherapy,” decreases illicit opioid use, prevents relapse, improves health, and reduces the risk for death from OUD (4). Medications approved by the U.S. Food and Drug Administration include a full agonist (methadone), partial opioid agonists (buprenorphine, buprenorphine-naloxone, and implantable buprenorphine), and opioid antagonists (oral and extended-release naltrexone). These medications block the euphoric and sedating effects of opioids, reduce craving for opioids, and mitigate opioid withdrawal symptoms. Medication-assisted treatment more effectively reduces opioid use than behavioral treatment alone (5, 6). Behavioral therapy addresses the psychosocial contributors to OUD and may augment retention in treatment. The Office of National Drug Control Policy and the U.S. Department of Health and Human Services recently prioritized increasing access to MAT (1, 7).

Integrating MAT into primary care settings expands access to OUD treatment (8). The Drug Addiction Treatment Act of 2000 enabled physicians to prescribe buprenorphine for treatment of OUD, but its use remains limited (3, 9, 10). Understanding the most effective and promising models of care is critical for optimizing initiatives to expand access to MAT (1). Because not all MAT models are published and outcomes of different MAT models have not been compared, the Agency for

Healthcare Research and Quality (AHRQ) commissioned a scoping review to develop a taxonomy of MAT models of care for OUD, with a focus on primary care settings.

METHODS

Scope of the Review

The review protocol and methods are detailed in the full report (11) (www.effectivehealthcare.ahrq.gov/reports/final.cfm). The review describes representative MAT models of care in primary care settings and does not provide an exhaustive list of models for MAT integration. Representative models were selected on the basis of their influence on current clinical practice, their innovativeness, or their focus on MAT for specific primary care populations or settings.

Eleven key informants (8 nonfederal and 3 federal) with experience implementing MAT for OUD in primary care settings were interviewed between March and June 2016 (Table 1). We facilitated small group telephone discussions using a semistructured guide (Appendix Table 1, available at Annals.org), asking participants to identify MAT models used in primary care (regardless of whether they were published) and to specify key model components. Calls were recorded, summarized, and shared with the group for clarification and additional input. On the basis of key informant input, we developed a framework categorizing key components of MAT models to provide a structure for future research and discussion. We then integrated input from the key informants with the available literature.

We searched for literature describing MAT models in primary care settings or their effectiveness from 1995 through June 2016 using Ovid MEDLINE, PsycINFO, the Cochrane Library, SocINDEX, and CINAHL (Appendix Table 2, available at Annals.org); reviewed reference lists; and solicited additional references from key informants. We also searched gray literature sources (ClinicalTrials.gov, Health Services Research Projects in Progress, Google Scholar, NIH RePORTER, and Web sites of government agencies with MAT initiatives) and

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e-mailed stakeholders about the opportunity to submit scientific information packets for ongoing or unpublished research. The literature review provided descriptive and contextual information on the models to supplement key informant interviews. The search identified 5892 abstracts; we reviewed 475 full-text articles (27 of which informed descriptions of MAT models of care) and 14 gray literature citations (Table 2).

Role of the Funding Source

This topic was selected by the AHRQ for systematic review by an Evidence-based Practice Center. A representative from the AHRQ who served as a Contracting Officer's Technical Representative provided technical assistance during the conduct of the full evidence review and provided comments on draft versions of the full evidence report. The AHRQ did not directly participate in the literature search; determination of study eligibility criteria; data analysis or interpretation; or preparation, review, or approval of the manuscript for publication.

RESULTS

Key informants consistently noted 4 key components of MAT models in primary care: pharmacotherapy with buprenorphine or naltrexone, provider and community educational interventions (such as in-person, Web-based, and telehealth provider continuing medical education [CME] activities; community-based advertising campaigns; and stakeholder conferences), coordination and integration of OUD treatment with other medical and psychological needs, and psychosocial services (such as counseling on-site or by referral). Models varied in the degree of component implementation.

Table 3 summarizes 12 representative models of MAT care and how the 4 key components are addressed. We included models that contained all 4 key components and that met criteria for effectiveness, innovation, and addressing special populations (for example, rural settings, patients with HIV, and prenatal care). Ten models were described by key informants, 6 were described in the published literature, and 7 were described in gray literature sources (Table 2). We categorized 4 models as primarily practice-based and 8 as systems-based, though most have elements of both. For each model, we discuss clinician-, practice-, and system-level factors, including financing, evidence of effectiveness, challenges, and situations in which the model is most likely to be feasible and effective.

Practice-Based Models

Office-Based Opioid Treatment

In office-based opioid treatment (OBOT), physicians who complete 8 hours of training and receive a Drug Enforcement Administration waiver number may prescribe buprenorphine-naloxone in the context of primary care (12, 13). Although many providers offer OBOT without staff assistance, some practices designate a clinic staff member (often a nurse or social worker) to coordinate buprenorphine prescribing (14–

Table 1. Key Informants (*n* = 11)

Representative, by Stakeholder

Clinicians with experience treating OUD in the primary care setting (*n* = 5)

Internal medicine/addictionologist
Family medicine/addictionologist
Addiction psychiatrist
Psychologist
Registered nurse

Policy experts in OUD treatment implementation (*n* = 4)

Health Resources and Services Administration HIV/AIDS Bureau
Substance Abuse and Mental Health Services Administration
National Institutes of Health, National Institute on Drug Abuse
National Association of State Alcohol and Drug Abuse Directors

Professional societies (*n* = 1)

American Association for the Treatment of Opioid Dependence

Patient perspective (*n* = 1)

Patient in recovery who also directs an opioid treatment program

OUD = opioid use disorder.

16). Psychosocial services include brief counseling provided on-site by the physician or other staff and off-site referrals. Office-based opioid treatment is financed through provider reimbursement of billable visits. Medicare and many state Medicaid programs cover buprenorphine, though prior authorization is frequently required. The Providers' Clinical Support System for MAT (<http://pcssmat.org>), funded by the Substance Abuse and Mental Health Services Administration, is a free systems-level resource that supports OBOT implementation nationally with provider education and mentoring. Retention in treatment and opioid use outcomes with OBOT are similar to those in methadone treatment programs, with 38% retention at 2 years and 91% of urine toxicology screens negative for opioids among those retained in 1 long-term cohort study (14).

Office-based opioid treatment may be particularly advantageous for reaching persons with OUD who are already engaged in primary care and offers an alternative for patients who cannot access methadone treatment programs. Challenges include a variable scope of psychosocial services and structure required for management of complex patients. Also, nurse practitioners and physician assistants—important providers of primary care in rural areas—are currently not eligible to prescribe buprenorphine.

Buprenorphine HIV Evaluation and Support Collaborative Model

The Buprenorphine HIV Evaluation and Support (BHIVES) Collaborative model adapted the OBOT framework to integrate buprenorphine treatment into primary care for HIV-infected patients (17–26). Primary care providers in 9 HIV clinics provided buprenorphine, facilitated by a nonphysician coordinator and variable on-site psychosocial services. The BHIVES cohort of 303 participants receiving buprenorphine showed 49% treatment retention at 12 months, and opioid use in the previous 30 days decreased from 84% at baseline to

Table 2. Sources for MAT Models of Care

Model	Published Literature	Gray Literature	Key Informant Interview
Practice-based models			
OBOT	Fiellin et al, 2002 (16)* Fiellin et al, 2006 (15)* Fiellin et al, 2008 (14)	-	✓
Buprenorphine HIV Evaluation and Support Collaborative model	Altice et al, 2011 (17) Chaudhry et al, 2011 (56) Cheever et al, 2011 (57) Egan et al, 2011 (58) Fiellin et al, 2011 (18) Finkelstein et al, 2011 (59) Friedland and Vlahov, 2011 (60) Korthuis et al, 2011 (19) Korthuis et al, 2011 (20) Lucas et al, 2010 (21)* Lum et al, 2011 (61) Schackman et al, 2011 (62) Sullivan et al, 2006 (23)* Sullivan et al, 2011 (63) Vergara-Rodriguez et al, 2011 (64) Weiss et al, 2011 (25) Weiss et al, 2011 (26)	www.careacttarget.org/library/bee-hive-buprenorphine-program-tools (24) www.slideshare.net/SarahCookRaymond/buprenorphine-therapy-in-the-hiv-pruma (22)	✓
One-stop shop model	-	www.lifespringhealthsystems.org/about-us/locations (33)	✓
Integrated prenatal care and MAT (expert suggestion)	-	-	-
Systems-based models			
Hub-and-spoke model (Vermont)	-	www.pcpc.org/initiative/vermont-hub-and-spokes-health-homes (39) www.healthvermont.gov/adap/documents/HUBSPOKEBriefingDocV122112.pdf (40) www.leg.state.vt.us/reports/2014ExternalReports/299315.pdf (38) www.achp.org/wp-content/uploads/Vermont-Health-Homes-for-Opiate-Addiction-September-2013.pdf (41)	✓
Medicaid health home model	-	www.medicaid.gov/Federal-Policy-Guidance/Downloads/CIB-07-11-2014.pdf (36) www.medicaid.gov/state-resource-center/medicaid-state-technical-assistance/health-homes-technical-assistance/downloads/hh-irc-health-homes-opiod-dependency.pdf (37)	✓
Project ECHO (New Mexico)	Komaromy et al, 2016 (42)	http://echo.unm.edu/wp-content/uploads/2014/10/Opioid-Abuse-and-Addiction-Management-Protocol.pdf (43) www.aafp.org/news/chapter-of-the-month/20140930nmaf-chapspot.html (44)	✓
Collaborative opioid prescribing model (Maryland)	Stoller, 2015 (46)	www.atforum.com/pdf/CoOPTalkforONDCP_SAMHSA-Aug2015Stoller.pdf (45)	✓
Massachusetts nurse care manager model	Alford et al, 2007 (65) Alford et al, 2011 (47) LaBelle et al, 2016 (48)	www.mass.gov/eohhs/gov/departments/dph/stop-addiction/get-help-types-of-treatment.html (66)	✓
ED initiation of OBOT	D'Onofrio et al, 2015 (49)*	-	✓
Inpatient initiation of MAT	Liebschutz et al, 2014 (50)*	-	-
Southern Oregon model	-	www.oregonpainguidance.org (67)	✓

ECHO = Extension for Community Healthcare Outcomes; ED = emergency department; MAT = medication-assisted treatment; OBOT = office-based opioid treatment.

* Randomized, controlled trial evaluating the model of care.

42% at 12 months (18). The BHIVES model is recommended as the standard of care for engaging HIV-infected patients with OUD in treatment (27–29). Buprenorphine and HIV care are typically covered by patient insurance. Funding from the Ryan White Comprehensive AIDS Resources Emergency Act (30) supplements medication coverage, care coordination, and counseling services in some states. An advantage of the BHIVES model is that it addresses MAT, HIV care, and primary care within a single setting (31). Chal-

lenges include limited financial support for on-site counseling in clinics without designated Ryan White funding. The Providers' Clinical Support System for MAT includes physician mentors with expertise in HIV care.

One-Stop Shop Model

The one-stop shop model was developed in response to an outbreak of HIV infection in rural Indiana that was due to sharing infected syringes (32) where

Table 3. Overview of MAT Models of Care for OUD in the Primary Care Setting*

Model	Summary	Components				
		Pharmacologic	Education/Outreach	Coordination/Integration of Care	Psychosocial	Other
Practice-based models						
OBOT	Buprenorphine prescribed by primary care providers who complete DATA 2000 waiver training	Primarily buprenorphine-naloxone	Not a major component; PCSS-MAT available to mentor primary care providers	A nonphysician clinic staff member is sometimes used to coordinate MAT prescribing and integrating with primary and mental health care	Physician or other on-site or off-site counseling at least monthly; other psychosocial services vary, including integrated cognitive behavioral therapy and motivational enhancement therapy; some psychosocial services off-site	-
Buprenorphine HIV Evaluation and Support Collaborative model	OBOT adaptation for providing buprenorphine-naloxone in an HIV primary care clinic setting	Buprenorphine-naloxone	Patient and provider educational material available online	Treatment for OUD and primary care, including HIV care integrated in the same setting. A nonphysician clinic staff member coordinates care and collaborates with the HIV primary care provider	On-site psychological services vary, including individual and group counseling	Coordination with OTP for patients switching to or from methadone
One-stop shop model	Integrated model based in mental health clinic to provide "one-stop," comprehensive management of HIV/HCV infection and MAT	Primarily naltrexone	Provider education in MAT and management of HIV/HCV infection	Treatment for OUD, mental health, and primary care (including HIV/HCV care) provided in the same setting. Peer navigators and social workers provide coordination with primary care providers	Centered in a mental health clinic that provides comprehensive psychological services; psychiatrist once weekly	Syringe exchange and other services also available; model developed to respond to specific outbreak of HIV and HCV infection in rural area
Integrated prenatal care and MAT	Model providing prenatal care to pregnant women who are treated with buprenorphine	Buprenorphine	Not a major component, though PCSS-MAT available	Primary care clinic provides MAT, as well as prenatal and postpartum care; care continued in office-based setting for 1 y after delivery. In some programs, women can work with doulas	Services provided on-site or via partnering OTP	-
System-based models						
Hub-and-spoke model (Vermont)	Centralized intake and initial management (buprenorphine induction) at "hub"; patients are then connected to "spokes" in the community for ongoing management	Primarily buprenorphine-naloxone	Outreach to prescribers in the community to increase the number of physicians with buprenorphine prescribing waivers	Coordination/integration between hub and spoke as well as within each primary care site spoke. Registered nurse clinician case manager and/or care connector (peer or behavioral health specialist) for coordination/integration of care at spokes	Embedded in spoke sites, including social workers, counseling, and community health teams	Hubs provide consultative services and are available to manage clinically complex patients; support tapering of MAT; or prescribe methadone, if needed.

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Table 3–Continued

Model	Summary	Components				
		Pharmacologic	Education/Outreach	Coordination/Integration of Care	Psychosocial	Other
Medicaid health home model	A flexible model that provides MAT in combination with behavioral health therapies and integrated with primary care	Primarily buprenorphine-naloxone	Provider and community education emphasized to increase uptake and decrease stigma	Required component, but mechanism of coordination varies	6 core psychosocial services are required: comprehensive care management, care coordination, health promotion, comprehensive transitional care/follow-up, individual and family support, and referral to community and social support services	Some telehealth services offered
Project ECHO (New Mexico)	Model of care for linking primary care clinics in rural areas with a university health system, emphasizing NP or PA screening and MAT (physician prescribing) combined with counseling and behavioral therapies	Primarily buprenorphine-naloxone	Mentored buprenorphine prescribing for providers, including an Internet-based, audiovisual network for provider education. Free buprenorphine training provided several times yearly. ECHO staff provide patient education 1-to-1 or in group setting	NP/PA performs initial evaluation and screening to educate patient and refer to collaborating physician for treatment. NP/PA performs monitoring treatment and follow-up appointments, including laboratory tests, urine testing, monitoring, patient education and support, and other coordination (e.g., vaccinations)	Counseling and behavioral therapies offered from all ECHO team members, including CHWs; however, CHWs and NPs provide education/support; psychosocial support, including 12-step programs; crisis counseling; referrals; and relapse-prevention plans	Refer any patients with high or moderate risk scores for opioid use to NP for further assessment and/or referral to OTP
Collaborative opioid prescribing model (Maryland)	Links OTPs with office-based buprenorphine providers; initial intake, induction, and stabilization performed at OTP then shifted to primary care clinic	Buprenorphine-naloxone	Outreach performed by counselors to community physicians	Initial assessment, psychosocial treatment, and expert consultation initiated in drug treatment program and patients transitioned to primary care in a federally qualified health center after stabilization	Provided concurrently via OTP, including ongoing counseling and monitoring	In Baltimore, Maryland, supports to facilitate access to health coverage through Medicaid and to coordinate care through HealthCare Access Maryland

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there were no existing OUD or HIV treatment services. Based in an existing mental health clinic, the model provides integrated care for HIV and hepatitis C virus infection, MAT, mental health, primary care, and syringe exchange (33). A primary care provider embedded in the mental health clinic prescribes extended-release naltrexone and antiretroviral therapy. Financing is from a combination of existing Medicaid and federal

funding. Although comprehensive care is attractive in any setting, this model might be particularly useful for quick deployment in other specific OUD and HIV outbreaks. However, it requires rapid training of willing local providers and state and federal resources for outbreak response, and its effect on outcomes and reproducibility in other settings have not been assessed.

Table 3—Continued

Model	Summary	Components				
		Pharmacologic	Education/Outreach	Coordination/Integration of Care	Psychosocial	Other
Massachusetts nurse care manager model	A primary care-based model that teams nurse care managers with primary care physicians; nurse care managers generally perform initial screening, intake, education, observed/supports induction, follow-up, maintenance, stabilization, and medical management with the physician and team	Primarily buprenorphine-naloxone, with recent addition of extended-release naltrexone	A training program exists to get more physicians (especially residents) and faculty on board. The Department of Public Health trains staff on best practices. Nurse care managers receive 8 h of training in MAT, shadowing in model MAT site, site visits, e-mail and telephone support, case review, quarterly training, and an addiction listserv	Nurse care managers (registered nurses or family NPs) manage 100 to 125 patients alongside primary care clinicians, with assistance from a medical assistant. Alternatively, care partners (usually persons with a master's degree) assist the primary care staff with screening, brief intervention, and referral to treatment	Psychological services are integrated on-site or nearby	Patients who require a higher level of care can be expedited into an OTP, assistance with transfers of care, and day-support programs
ED initiation of OBOT	Model involving ED identification of OUD; buprenorphine-naloxone induction initiated in the ED; coordination with OBOT, nurse with expertise in buprenorphine working in collaboration with primary care clinician	Buprenorphine-naloxone	Not a major component	OUD identified in ED and patients started on buprenorphine therapy and connected to ongoing OBOT provided by physicians and nurses for 10 wk, then transferred to office-based ongoing maintenance treatment or detoxification	"Medical management" counseling visits with physician and nurse	-
Inpatient initiation of MAT	Model involving identification of OUD in the hospital and connecting patients to office-based MAT and primary care	Buprenorphine-naloxone and naltrexone	Not a major component	MAT started by multidisciplinary addiction consult service during medical hospitalization and connected with primary care. Treatment continued in primary care; some programs have buprenorphine "bridge" clinic before transition to primary care	Provided at primary care site	-
Southern Oregon model	A local and informal model for delivery of MAT in a rural primary care network	Almost exclusively buprenorphine-naloxone	A group of local stakeholders from many perspectives who prescribes opioids (Oregon Pain Guidance) meets regularly to develop guidance and provide education	Relatively limited support for coordination/integration of care	On-site licensed clinical social worker with experience in treating patients for pain and addiction, not necessarily in MAT	Access to OTPs for complex patients not formally integrated

CHW = community health worker; DATA 2000 = Drug Addiction Treatment Act of 2000; ECHO = Extension for Community Healthcare Outcomes; ED = emergency department; HCV = hepatitis C virus; MAT = medication-assisted treatment; NP = nurse practitioner; OBOT = office-based opioid treatment; OTP = opioid treatment program; OUD = opioid use disorder; PA = physician assistant; PCSS-MAT = Providers' Clinical Support System for Medication-Assisted Treatment.

* Includes rural or other underserved settings.

Integrated Prenatal Care and MAT

The integrated prenatal care model integrates buprenorphine treatment with primary and prenatal care for pregnant women with OUD. Office-based buprenorphine maintenance therapy is continued after delivery. Psychosocial services are provided on-site in some practices or through affiliated opioid treatment programs (OTPs). Although outcomes in primary care-based settings have not been assessed, outcome studies conducted in OTPs suggest a reduction in neonatal abstinence syndrome when pregnant women with OUD receive maintenance treatment with buprenorphine rather than methadone (34, 35). This model is typically financed through existing Medicaid and other insurance reimbursement. Advantages include identification of women not previously engaged in OUD care, increased maternal motivation for OUD treatment due to concerns about the fetus, and provision of ongoing MAT maintenance in the postpartum period. A potential challenge is that the physician may reach their buprenorphine prescribing limit as more women seek to continue maintenance treatment after delivery.

Systems-Based Models

Medicaid Health Home Model

The Medicaid health home model is a flexible federal program through the Centers for Medicare & Medicaid Services that allows states that apply for a Medicaid waiver to integrate MAT and behavioral health therapies with primary care for patients with OUD (36, 37). Primary care physicians prescribe buprenorphine as the primary pharmacotherapy, with financing through usual Medicaid coverage. Provider and community education (for example, provider outreach, CME conferences, and community advertising) is emphasized to increase uptake by clinicians and patients and to decrease stigma. Robust psychosocial services are required. Demonstrations in Rhode Island and Maryland implemented Medicaid health home models in OTPs or psychiatric clinics rather than in primary care clinic settings (37). States determine the structure of health care delivery (for example, hub-and-spoke models in Vermont) and the approach to payment, which may include per-member, per-month payments (Maryland) and weekly bundled payments (Rhode Island) that fund care coordinators in addition to other billable health care services. Advantages include required care coordination and core psychosocial services, an emphasis on provider and community education, and flexibility in enabling service delivery and provision according to the needs and resources of a particular state. Medicaid health home models may be particularly well-suited for states with a high prevalence of OUD and state governments seeking payment structures that promote broader integration of primary care, psychosocial, and MAT services for OUD.

Hub-and-Spoke Model

The hub-and-spoke model, developed in Vermont, triages patients to 2 levels of care on the basis of need during initial screening (38–41). “Spokes” are primary

care clinics that provide MAT for less complex patients by using an OBOT approach. “Hubs” are regional OTPs that care for more complex patients, dispense methadone if needed, support tapering off MAT, and provide consultative services to the spokes. Patients may transfer between a hub and a spoke on the basis of changing care needs.

Buprenorphine has been the primary pharmacotherapy in this model. Vermont incentivized implementation of buprenorphine prescribing by funding online buprenorphine waiver training for spoke physicians and other technical assistance. It also incentivized hubs by funding behavioral health specialists. Coordination and integration occur between the hub and the spoke and within each spoke and are typically carried out by a registered nurse or a case manager. Psychosocial services are embedded within spokes, including social workers, counselors, and community health teams. The model is financed through a Medicaid health home model waiver state block grant. Its effect on outcomes has not been published.

The hub-and-spoke model may be particularly well-suited for states with rural OUD populations where treatment services are limited. Important advantages include availability of tiered care and integration of primary care with regional OUD management expertise, use of care coordinators, and embedded psychosocial services at the spoke sites. Potential challenges include the unavailability of OTP hubs in all settings that wish to implement MAT.

Project Extension for Community Healthcare Outcomes

Project Extension for Community Healthcare Outcomes (ECHO) links primary care clinics in rural New Mexico with a university health system utilizing an Internet-based audiovisual network for mentoring and education (42–44) and has also been adapted to support rural primary care providers in MAT management. It emphasizes nurse practitioner- or physician assistant-based screening, with referral to a collaborating physician before initiation of MAT and for ongoing treatment. Counseling and behavioral therapies are offered by all ECHO team members during weekly teleconferences. Complex patients can be referred to an OTP. Project ECHO recruits physicians for buprenorphine waiver training and provision of CME in OUD management. The ECHO model may be considered a rural adaptation of the hub-and-spoke model or the collaborative opioid prescribing model. It is financed through various federal grants and Medicaid.

Patient-level outcomes have not been assessed, but the ECHO model has increased per capita numbers of rural primary care providers with buprenorphine prescribing waivers in New Mexico (42). Advantages include a strong emphasis on psychosocial services, CME credits for teleconference participation, and collaboration with mid-level rural providers for initial screening. This model aims to enhance the capacity of rural primary care providers to treat OUD. Challenges include

limited availability of face-to-face expertise in MAT for high-risk patients and a lack of direct contact between off-site experts and patients.

Collaborative Opioid Prescribing Model

The collaborative opioid prescribing model, developed in Maryland (45, 46), is another tiered model of care with centralized initial intake, buprenorphine induction and stabilization at an OTP, and transfer to primary care clinicians for ongoing MAT. Unlike in the hub-and-spoke model, OTPs perform intake, induction, and stabilization in all patients and provide ongoing psychosocial services for patients transferred to primary care. Its effect on patient outcomes has not been assessed. This model is likely to be well-suited for primary care practices that are geographically close to OTPs. Financing is through Medicaid and private insurance. Advantages are similar to those of the hub-and-spoke model, with the added benefit of ongoing OTP psychosocial services. Challenges include the geographic proximity required between OTPs and primary care sites and limited OTP capacity.

Massachusetts Nurse Care Manager Model

Massachusetts Medicaid reimburses nurse care managers in federally qualified health centers who are supporting physicians in the provision of buprenorphine or naltrexone for OUD treatment. The nurse care manager performs screening, intake, and education of patients and scheduling with a prescriber and facilitates ongoing medical and OUD management. The prescribing physician confirms the OUD diagnosis and appropriateness of MAT and comanages the patient with the nurse care manager. Psychosocial services are integrated on-site or nearby. Patients who require a higher level of care receive expedited OTP referral. The model is financed through direct Medicaid reimbursement to federally qualified health centers for nurse care manager time as a billable service, in addition to usual Medicaid coverage for pharmacotherapy and physician visits.

A pilot study of 408 patients enrolled in this program reported that 51% had received buprenorphine treatment at 1 year, and 91% of those retained on a regimen of buprenorphine at 12 months had urine toxicology screens that were negative for opioids (47). Advantages include utilization of a skilled nonphysician to offload prescribing physician burden, an emphasis on provider training, and financial sustainability through Medicaid-reimbursed nurse care manager visits. This model may be attractive over a wide range of primary care practices in states with Medicaid programs or other payers that could adopt reimbursement of nurse care manager visits for OUD. An evaluation of state-wide scale-up noted a 375% increase in the number of physicians with buprenorphine prescribing waivers within 3 years (48). Challenges include variable availability of psychosocial services and nurse care managers and, in most states, a lack of Medicaid coverage for nurse care management of OUD.

Emergency Department Initiation of OBOT

This model focuses on emergency department (ED) identification of OUD and initiation of buprenorphine treatment (49). Emergency department physicians assess patients for OUD and begin buprenorphine induction in appropriate candidates during their ED visit. Patients are discharged with instructions for continuation of home induction and stabilization doses and are connected to primary care OBOT for ongoing management. Brief physician counseling is performed during the ED visit, and other psychosocial services vary.

A randomized trial of ED-initiated buprenorphine treatment versus referral or brief intervention showed 78% engagement in buprenorphine treatment at 30 days compared with 37% in the referral group and 45% in the brief intervention group. The number of days of illicit opioid use per week decreased from 5.4 to 0.9 in the buprenorphine group versus 5.4 to 2.3 in the referral group and 5.6 to 2.4 in the brief intervention group (49).

Medications, ED visits, and OBOT are funded through patient Medicaid and other insurance plans. This model is promising for scale-up to other ED settings with high prevalence of OUD and strong linkages to primary care OBOT. Advantages include enhanced access to MAT for patients who may not be accessing primary care or OTPs and improved engagement in OUD treatment compared with passive referral. Potential challenges include patient reliance on EDs to access treatment.

Inpatient Initiation of MAT

This model identifies OUDs among hospitalized patients, initiates MAT, and links to ongoing community-based treatment after discharge (50–52). Financing is from Medicaid and other insurance coverage, often requiring prior authorization for outpatient prescriptions before hospital discharge. Linkage with ongoing psychosocial services varies. In 1 study, 72% of inpatients with OUD who were randomly assigned to buprenorphine stabilization engaged in OBOT versus 12% of those randomly assigned to buprenorphine detoxification (50). This model requires hospital support for inpatient consult services. Advantages include identification of patients with complex morbidity and high risk for death who may not otherwise access MAT, increased retention in care, and potential for linkage to OBOT for ongoing management. Patients initiating methadone treatment, which cannot be prescribed by primary care providers for OUD, would not be eligible for OBOT referral.

Southern Oregon Model

The Southern Oregon model is an example of a local, informal model for MAT delivery in a network of rural primary care clinics. It focuses on OBOT with buprenorphine and uses regular meetings of regional stakeholders, including regional Medicaid accountable care organizations (53) and primary care providers, for

education, training, and development of practice standards around opioid prescribing for chronic pain and OUD treatment. Coordination or integration of care is variable and often limited, though an on-site clinical social worker is available in some clinics. The model is financed through direct support from accountable care organizations and usual fee-for-service billing.

The Southern Oregon model may be well-suited for rural health providers in states that have implemented the Patient Protection and Affordable Care Act and have accountable care organizations that can promote community-wide support for MAT. An advantage of this model is that it is community-based, which may help to overcome stigma and resistance to MAT use. Challenges include a lack of well-defined key components and limited psychosocial services and care coordination and integration.

DISCUSSION

Addressing the OUD epidemic in the United States will require diverse approaches over many years. We identified 12 representative models of integration of MAT into primary care that may be considered for adaptation and expansion across diverse health care settings.

All models contained some degree of 4 key components: pharmacologic therapy, psychosocial services, integration of care, and education and outreach. Models varied in their relative emphasis on these components, though common themes included the importance of a nonphysician coordinator and the use of tiered approaches. The ideal model of care for a particular setting likely depends on local factors, such as available expertise, the population, proximity to an addiction center of excellence, reimbursement policies, and geography. Decisions about MAT models of care should therefore be individualized to address the unique milieu of each implementation setting. It may be appropriate to combine elements of different models of care (for example, to implement care coordination by a nurse care manager within a hub-and-spoke model) or to link models of care (for example, ED- or inpatient-based screening and initiation of treatment linked with OBOT).

Ten of the 12 MAT models provided sublingual buprenorphine-naltrexone pharmacotherapy. Although implantable buprenorphine was approved by the U.S. Food and Drug Administration in 2016, research on its use in primary care settings is lacking. Two randomized trials showed efficacy of extended-release naltrexone for OUD in addiction treatment settings (54, 55), but its effectiveness for OUD in primary care settings has not been studied and its use is limited. Expanding evidence-based, long-acting MAT options could broaden patient choice, reduce the risk for diversion, and decrease the need for frequent follow-up in appropriate patients.

Barriers to implementing MAT include a lack of trained primary care providers, reimbursement models that do not support care coordination and psychosocial

services, persistent stigma associated with MAT, and long travel times for patients in rural areas (11). Strategies to address these barriers include integration of training and education, use of nonphysicians, development of reimbursement models to support MAT delivery, use of tele-education, tiered care models, and stakeholder engagement.

Our report has potential limitations. The specific models described provide a representative taxonomy of ways to integrate MAT into primary care rather than an exhaustive list. No study has compared outcomes of different MAT models of care, and some models have not been reported in the published literature. Other challenges include overlapping characteristics of care models, variable levels of structure, and adaptation to specific settings.

Important areas of uncertainty include optimal methods for measuring quality of MAT care; assessment tools to better individualize care; optimal psychosocial components of MAT; cost and cost-effectiveness; methods for reducing diversion; optimal methods for coordination and integration of care; and the effectiveness of mid-level prescribing, newer MAT, and telehealth and telemedicine approaches (11). Research in these areas is needed.

Existing MAT models of care can inform expanded implementation in primary care settings. Decisions about adopting MAT models of care should be individualized to address the unique milieu of each implementation setting.

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Financial Support: This project was funded under contract HHS2902015000091, Task Order 4, from the AHRQ, U.S. Department of Health and Human Services.

Disclosures: Dr. McCarty reports research services agreements with Alkermes and Purdue Pharma outside the submitted work. Dr. Weimer reports personal fees from Indivior, the American Academy of Addiction Psychiatry, InforMED, and CODA outside the submitted work. Authors not named here have disclosed no conflicts of interest. Disclosures can also be viewed at www.acponline.org/authors/icmje/ConflictOfInterestForms.do?msNum=M16-2149.

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Appendix Table 1. Sample Questions for Key Informants

Key Informant Perspective	Sample Questions
Researchers and clinicians (including professional societies and organizations)	<p>Guiding questions 1, 2, and 4 from full AHRQ report (11). In addition:</p> <ol style="list-style-type: none">1. What outcomes should be prioritized?2. In your experience, what MAT models of care have been particularly successful and why?3. Are there models of care that are particularly suited (e.g., feasibility, applicability) for rural or other underserved settings?4. How would you categorize the components of MAT models of care?5. What MAT models of care components are most critical for effectiveness?6. What are barriers to implementation of MAT in primary care settings?7. What are specific barriers to implementation of community-based psychosocial programs in MAT?8. How could barriers to implementation be overcome?9. Are you aware of new or innovative models of care that warrant additional research?10. What are key research needs to understand effectiveness and implementation of MAT models of care?11. What types of study designs would be useful for studying new or innovative MAT models of care?12. What is a meaningful length of follow-up?13. Are there specific areas related to effectiveness or implementation of MAT models of care that have been sufficiently studied to warrant a systematic evidence review?
Health policy and implementation arenas	<ol style="list-style-type: none">1. What outcomes of MAT are important from a health policy/payer perspective?2. What policies do payers put in place to influence use of MAT for treatment of opioid use disorder?3. How are decisions to cover or implement MAT made at a policy level or at an institutional/clinical setting level?4. What are some research questions about MAT that you would like answered to inform policy and implementation decisions?5. Are you considering new policies to improve the use of MAT, particularly in primary care, including rural or other underserved populations?6. What are cost and/or economic efficiency considerations that impact diffusion, decision making, and/or conceptual thinking around MAT?
Patient perspective	<ol style="list-style-type: none">1. What values do patients place on various non-substance-use-related outcomes, and how do patients weigh tradeoffs related to different pharmacological and nonpharmacological approaches?2. What factors or themes are most important to patients receiving MAT?3. What components of MAT are important for patients to know that they may not be aware of?4. What common experiences do patients in MAT programs describe?5. Should the use of MAT programs be expanded, and if so, what settings for patients are most amenable to the implementation of MAT?6. What barriers do patients experience in obtaining MAT?7. What suggestions do patients have for improving MAT models of care?8. What are ethical, privacy, equity, or cost considerations that impact patients' use of MAT?

AHRQ = Agency for Healthcare Research and Quality; MAT = medication-assisted treatment.

Appendix Table 2. Search Strategies

Ovid MEDLINE

- 1 exp Opiate Substitution Treatment
- 2 exp Opioid-Related Disorders/dt, pc, px, rh, th
- 3 methadone.mp. or exp Methadone
- 4 buprenorphine.mp. or Buprenorphine
- 5 naltrexone.mp. or Naltrexone
- 6 suboxone.mp.
- 7 3 or 4 or 5 or 6
- 8 2 and 7
- 9 (medicat* adj3 assist* adj3 (treat* or therap* or regimen* or interven* or program*)).mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier]
- 10 ((opiate* or opioid* or narcotic*) adj2 (substitut* or replac* or maint*) adj2 (treatment* or therap* or regimen* or program* or interven*)).ti,ab.
- 11 9 or 10
- 12 2 and 11
- 13 1 or 8 or 12
- 14 limit 13 to english language
- 15 exp Comprehensive Health Care/
- 16 exp Community Health Services/
- 17 exp Outpatients/
- 18 exp Ambulatory Care/
- 19 exp Ambulatory Care Facilities/
- 20 exp General Practice/
- 21 general practitioners/ or physicians, family/ or physicians, primary care/
- 22 exp Health Services Accessibility/
- 23 15 or 16 or 17 or 18 or 19 or 20 or 21 or 22
- 24 (((primary or ambulatory) adj3 care) or ((family or general) adj3 (medicine or practice* or physician* or doctor* or practitioner* or provider*)) or outpatient* or ((communit* or comprehensiv*) adj3 (health* or care))).mp.
- 25 (rural* or underserv* or frontier* or (geograph* adj3 (isolat* or remot*))).mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier]
- 26 24 or 25
- 27 23 or 26
- 28 14 and 27
- 29 limit 28 to yr="2005 -Current"
- 30 limit 28 to yr="1902 - 2004"
- 31 limit 14 to systematic reviews
- 32 limit 14 to (controlled clinical trial or guideline or randomized controlled trial)
- 33 exp epidemiologic study/
- 34 14 and 33
- 35 Comparative Study/
- 36 14 and 35
- 37 exp "Outcome and Process Assessment (Health Care)"/
- 38 14 and 37
- 39 mo.fs.
- 40 exp Death/
- 41 exp Vital Statistics/
- 42 39 or 40 or 41
- 43 14 and 42
- 44 exp Evaluation Studies as Topic/
- 45 14 and 44
- 46 exp "costs and cost analysis"/
- 47 14 and 46
- 48 exp Sociological Factors/
- 49 14 and 48
- 50 exp quality of life/
- 51 14 and 50
- 52 exp health behavior/
- 53 14 and 52
- 54 exp attitude to health/
- 55 14 and 54
- 56 31 or 32 or 34 or 36 or 38 or 43 or 45 or 47 or 49 or 51 or 53 or 55
- 57 28 or 56

Appendix Table 2—Continued

EBM reviews—Cochrane Database of Systematic Reviews

- 1 [exp Opiate Substitution Treatment/]
- 2 [exp Opioid-Related Disorders/dt, pc, px, rh, th]
- 3 methadone.mp. or exp Methadone/
- 4 buprenorphine.mp. or Buprenorphine/
- 5 naltrexone.mp. or Naltrexone/
- 6 suboxone.mp.
- 7 3 or 4 or 5 or 6
- 8 2 and 7
- 9 (medicat* adj3 assist* adj3 (treat* or therap* or regimen* or interven* or program*)).mp.
- 10 ((opiate* or opioid* or narcotic*) adj2 (substitut* or replac* or maint*) adj2 (treatment* or therap* or regimen* or program* or interven*)).ti,ab.
- 11 9 or 10
- 12 1 or 8 or 11

EBM reviews—Cochrane Central Register of Controlled Trials

- 1 exp Opiate Substitution Treatment/
- 2 exp Opioid-Related Disorders/dt, pc, px, rh, th
- 3 methadone.mp. or exp Methadone/
- 4 buprenorphine.mp. or Buprenorphine/
- 5 naltrexone.mp. or Naltrexone/
- 6 suboxone.mp.
- 7 3 or 4 or 5 or 6
- 8 2 and 7
- 9 (medicat* adj3 assist* adj3 (treat* or therap* or regimen* or interven* or program*)).mp.
- 10 ((opiate* or opioid* or narcotic*) adj2 (substitut* or replac* or maint*) adj2 (treatment* or therap* or regimen* or program* or interven*)).ti,ab.
- 11 9 or 10
- 12 1 or 8 or 11

PsycINFO

- 1 exp opiates/
- 2 exp drug rehabilitation/
- 3 exp drug dependency/
- 4 2 or 3
- 5 exp drug therapy/
- 6 exp methadone maintenance/
- 7 methadone.mp. or exp Methadone/
- 8 buprenorphine.mp. or Buprenorphine/
- 9 naltrexone.mp. or Naltrexone/
- 10 suboxone.mp.
- 11 5 or 6 or 7 or 8 or 9 or 10
- 12 1 and 4 and 11
- 13 (medicat* adj3 assist* adj3 (treat* or therap* or regimen* or interven* or program*)).mp.
- 14 ((opiate* or opioid* or narcotic*) adj2 (substitut* or replac* or maint*) adj2 (treatment* or therap* or regimen* or program* or interven*)).ti,ab.
- 15 13 or 14
- 16 1 and 4 and 15
- 17 12 or 16
- 18 limit 17 to english language
- 19 exp Primary Health Care/
- 20 exp community services/
- 21 exp Outpatients/
- 22 exp outpatient treatment/
- 23 exp Maintenance Therapy/
- 24 exp Ambulatory Care/
- 25 exp Ambulatory Care Facilities/
- 26 exp General Practitioners/
- 27 exp Family Medicine/
- 28 exp Family Physicians/
- 29 exp Treatment Barriers/
- 30 exp health disparities/
- 31 exp health care utilization/
- 32 19 or 20 or 21 or 22 or 23 or 24 or 25 or 26 or 27 or 28 or 29 or 30 or 31

Continued on following page

Appendix Table 2—Continued

- 33 (((primary or ambulatory) adj3 care) or ((family or general) adj3 (medicine or practice* or physician* or doctor* or practitioner* or provider*)) or outpatient* or ((communit* or comprehensiv*) adj3 (health* or care))).mp.
34 (rural* or underserv* or frontier* or (geograph* adj3 (isolat* or remot*))).mp.
35 33 or 34
36 32 or 35
37 18 and 36
38 limit 18 to systematic reviews
39 exp treatment outcomes/ or exp treatment effectiveness evaluation/
40 18 and 39
41 exp "Death and Dying"/
42 exp mortality rate/
43 41 or 42
44 18 and 43
45 exp "costs and cost analysis"/
46 18 and 45
47 exp Sociocultural Factors/
48 exp socioeconomic status/
49 47 or 48
50 18 and 49
51 exp quality of life/
52 18 and 51
53 exp health behavior/
54 18 and 53
55 exp attitudes/
56 18 and 55
57 38 or 40 or 44 or 46 or 50 or 52 or 54 or 56
58 37 or 57

CINAHL

- S1 (MH "Substance Use Disorders+")
S2 (MH "Narcotics+")
S3 S1 AND S2
S4 "methadone"
S5 "buprenorphine"
S6 "naltrexone"
S7 suboxone
S8 S4 OR S5 OR S6 OR S7
S9 S1 AND S8
S10 (medicat* n3 assist* n3 (treat* or therap* or regimen* or interven* or program*))
S11 ((opiate* or opioid* or narcotic*) n2 (substitut* or replac* or maint*) n2 (treatment* or therap* or regimen* or program* or interven*))
S12 S10 OR S11
S13 S1 AND S12
S14 S3 OR S9 OR S13
S15 S3 OR S9 OR S13
S16 (MH "Primary Health Care")
S17 (MH "Community Health Services+")
S18 (MH "Outpatients") OR (MH "Outpatient Service") OR (MH "Ambulatory Care Facilities+")
S19 (MH "Family Practice")
S20 (MH "Physicians, Family")
S21 (MH "Health Services Accessibility+")
S22 S16 OR S17 OR S18 OR S19 OR S20 OR S21
S23 (((primary or ambulatory) n3 care) or ((family or general) n3 (medicine or practice* or physician* or doctor* or practitioner* or provider*)) or outpatient* or ((communit* or comprehensiv*) n3 (health* or care)))
S24 (rural* or underserv* or frontier* or (geograph* n3 (isolat* or remot*)))
S25 S23 OR S24
S26 S22 OR S25
S27 S15 AND S26
S28 (MH "Systematic Review")
S29 (MH "Meta Analysis")
S30 (MH "Practice Guidelines") OR (MH "Guideline Adherence")
S31 (MH "Randomized Controlled Trials")
-

Appendix Table 2—Continued

- S32 (MH "Epidemiological Research+")
S33 (MH "Prospective Studies+")
S34 S28 OR S29 OR S30 OR S31 OR S32 OR S33
S35 S15 AND S34
S36 (MH "Outcomes (Health Care)+")
S37 (MH "Vital Statistics+")
S38 (MH "Evaluation Research+")
S39 (MH "Costs and Cost Analysis+")
S40 (MH "Socioeconomic Factors+")
S41 (MH "Cultural Values")
S42 (MH "Quality of Life+")
S43 (MH "Quality-Adjusted Life Years")
S44 (MH "Health Behavior+")
S45 (MH "Attitude+")
S46 S36 OR S37 OR S38 OR S42 OR S43
S47 S15 AND S46
S48 S15 AND S46
S49 S15 AND S34
S50 s48 NOT s49

SocINDEX

- S1 (MH "Substance Use Disorders+")
S2 (MH "Narcotics+")
S3 S1 AND S2
S4 "methadone"
S5 "buprenorphine"
S6 "naltrexone"
S7 suboxone
S8 S4 OR S5 OR S6 OR S7
S9 S1 AND S8
S10 (medicat* n3 assist* n3 (treat* or therap* or regimen* or interven* or program*))
S11 ((opiate* or opioid* or narcotic*) n2 (substitut* or replac* or maint*) n2 (treatment* or therap* or regimen* or program* or interven*))
S12 S10 OR S11
S13 S9 OR S12
-

EBM = evidence-based medicine.