Primary care models for treating opioid use disorders: What actually works? A systematic review

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Abstract

Background

Primary care-based models for Medication-Assisted Treatment (MAT) have been shown to reduce mortality for Opioid Use Disorder (OUD) and have equivalent efficacy to MAT in specialty substance treatment facilities.

Objective

The objective of this study is to systematically analyze current evidence-based, primary care OUD MAT interventions and identify program structures and processes associated with improved patient outcomes in order to guide future policy and implementation in primary care settings.

Data sources

PubMed, EMBASE, CINAHL, and PsychInfo.

Methods

We included randomized controlled or quasi experimental trials and observational studies evaluating OUD treatment in primary care settings treating adult patient populations and assessed structural domains using an established systems engineering framework.

Results

We included 35 interventions (10 RCTs and 25 quasi-experimental interventions) that all tested MAT, buprenorphine or methadone, in primary care settings across 8 countries. Most included interventions used joint multi-disciplinary (specialty addiction services combined with primary care) and coordinated care by physician and non-physician provider delivery
models to provide MAT. Despite large variability in reported patient outcomes, processes, and tasks/tools used, similar key design factors arose among successful programs including integrated clinical teams with support staff who were often advanced practice clinicians (nurses and pharmacists) as clinical care managers, incorporating patient “agreements,” and using home inductions to make treatment more convenient for patients and providers.

Conclusions
The findings suggest that multidisciplinary and coordinated care delivery models are an effective strategy to implement OUD treatment and increase MAT access in primary care, but research directly comparing specific structures and processes of care models is still needed.

Introduction
Recent spikes in opioid-related overdoses have led experts to advocate for the creation of primary care-based treatment models to expand access to treatment for Opioid Use Disorders (OUD). [1, 2] OUD is categorized by individuals exhibiting signs and symptoms of compulsive behavior related to the self-administration of opioid substances [3] without a legitimate medical cause or in doses excess of what is clinically [2] necessary. [2] Internationally, of an estimated 48.9 million opioid/opiate users, 187,100 experience drug-related deaths annually. [4] In the US alone, about 2.5 million citizens have OUD, with an estimated 60,000 deaths due to drug overdoses [3] occurring annually. [5] A paucity of specialized substance treatment facilities and rising demand for OUD treatment presents primary care-based models the opportunity to increase access to treatment.

Over the past 15 years, health systems have developed and tested models to incorporate the use of medication-assisted treatment (MAT), also referred to as opioid-assisted treatment, into primary care settings. MAT uses pharmacological treatments such as buprenorphine and methadone coupled with psychosocial care to treat patients with OUD. [6] Primary care-based models for MAT appear to have roughly equivalent efficacy and outcomes to specialty substance treatment facilities in certain populations with the added advantage of managing, and potentially improving, comorbidity outcomes[7–12]. A recent scoping review has only looked at U.S. models, but no systematic, rigorous international comparisons with a focus on implementation structures and processes of OUD MAT in primary care settings exist to date [13]. No studies have attempted to synthesize the core implementation structures of these interventions, and as a result, little is known about the components included in effective models in primary care settings. This gap in the literature demonstrates the need to identify which components of primary care models for OUD treatment have shown success in implementation and acceptance by patients.

This systematic review aims to evaluate the literature on interventions for treating OUD in primary care settings using an established systems design framework: Systems Engineering Initiative for Patient Safety (SEIPS) 2.0 [14]. We use this framework to answer the questions: what structural characteristics and implementation components are described in existing primary care models for treating OUD, and how can we improve upon them in the future? Specifically, we aim to: (1) identify thematic components of primary care OUD MAT models that are accepted by patients and physicians and associated with improved health outcomes (2) use
those findings to guide future policy and provide recommendations on design features of
delivery models found to be effective in the primary care setting.

Methods

Data sources and searches

We followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses
(PRISMA) recommendations in conducting this systematic review (PROSPERO 2016:
CRD42016033762) [15]. With the assistance of a medical research librarian (MC), we per-
formed serial literature searches for English language articles. MEDLINE via PubMed,
CINAHL, EMBASE, and PsychInfo were searched for studies published prior to August 1,
2016 using Medical Subject Headings (MeSH) and keywords based on primary care settings
and treatment of OUDs (S1 Table). All human studies published in full-text were eligible for
inclusion, and no publication date or status restrictions were placed. Additional studies of
interest were identified by hand searches of bibliographies. Authors were contacted by email if
further clarification was needed.

Study selection

Two authors (KK and CB) independently screened titles and abstracts for eligibility. Given the
complexity of designing and evaluating care models [16], we included both experimental
(RCTs) and observational studies (cohort, case-control, cross-sectional) if they met inclusion
criteria. Articles were included if the intervention: (1) evaluated a primary care-based health
delivery model where primary care was defined as care delivered in a general practice setting
(i.e. private practice, academic primary care clinic) by a general medical internist and/or family
medicine physician only, (2) targeted adults (18 years or older) with OUD defined as patients
engaged in care to treat their opioid addiction, (3) evaluated patient-level outcomes (e.g.
patient retention, urine toxicology screens, satisfaction, effect on health screening for comor-
bidities, etc.), and (4) evaluated the care model using qualitative or quantitative methods. Stud-
ies that did not include a description of the care delivery model evaluated (i.e. only discussed
physician perceptions of OUD or drug dosage efficacy studies), focused exclusively on com-
paring intervention settings (e.g. specialty care versus primary care settings) without a detailed
description of the primary care intervention/program design, and concentrated on specialty-
based primary care (e.g. HIV care) outside of a primary care physician (PCP) led primary care
practice were excluded (S2 Table). In the event of a disagreement in exclusion or inclusion
between the two reviewers, a third reviewer (PL) resolved the discrepancy.

Data extraction and quality assessment

Two authors (KK and CB) used a standardized form adapted from the Cochrane Collaboration
[17, 18] to extract data from the included studies, independently and in duplicate. The follow-
ing data was extracted for all studies: location, study design, intervention design and duration,
care model structures and processes, classification, delivery staff, sample size, patient popula-
tion, and primary/secondary outcomes as stated by the authors of each study.

Two authors (KK and CB) independently assessed risk of bias via the validated Downs and
Black tool which utilizes the following elements to assess risk of bias in both experimental and
observational studies: quality of reporting, internal validity of the study and its power, and
external validity and confounding [19]. The tool evaluates each of these elements using 27
questions, allowing each article to receive a sum score of up to 32 points. For the purposes of
this study, the last question assessing statistical power was interpreted as a dichotomous
outcome: 0 for insufficient/no power calculation and 1 for studies that provided evidence of power calculation or reference to statistical power. From this alteration, 28 was the highest score possible. As previously reported [20] [21] the following were the final score ranges: excellent (26–28); good (20–25); fair (15–19); and poor (≤ 14). Any discrepancies or disagreements in data review, extraction, or assessment of risk of bias were resolved by a third author (PL).

Data synthesis and analysis

Given substantial clinical heterogeneity in patient outcomes reported (i.e. retention, relapse rates, comorbidity management, satisfaction, etc.) and variability in the drug treatments and dosages used in the models (e.g. methadone versus buprenorphine) within the included studies, formal meta-analyses were not performed.

Results

Identification of studies

The database search retrieved a total of 1,844 articles and 7 articles identified as related publications to those uncovered in the search through other sources. Initial screening eliminated 1,131 articles at the title and abstract level for not fitting the inclusion criteria. Following full review of each of the remaining 104 articles, 63 articles were eliminated because they did not meet inclusion criteria, leading to 41 included publications (Fig 1). Reasons for exclusion of full-text studies included not a delivery care system, not an intervention, not a primary care setting, opiate addiction not primary care diagnosis, and unreported patient-level outcomes. The qualitative synthesis included 41 publications that described a total of 35 unique interventions. Two included models each had >1 publications that reported different outcomes from the same study (implementation outcomes and patient outcomes), which required inclusion of multiple publications for the same study to best evaluate the model's efficacy. Of these unique interventions (n = 35), there were 10 randomized controlled trials and 25 quasi-experimental or observational studies.

Study findings

We present the general study characteristics including settings and outcomes within the appropriate SEIPS domains to concisely summarize the findings without duplication of reporting. In addition, we present case-by-case examples of barriers and facilitators for the interventions using the SEIPS organizational framework (Table 1).

Definitions of SEIPS domains

The SEIPS 2.0 framework, previously used to evaluate system-level approaches to work systems, was used to evaluate the implementation of included study interventions. [14] The SEIPS model is a widely used healthcare human factors framework adopted by patient safety leaders and applied to multiple health settings including primary care clinics. The three human factor principles this model embraces are 1) evaluating performance from a systems orientation, 2) supporting person centeredness through designing work systems that best fit peoples’ capabilities, limitations and performance needs, and 3) focusing on design-driven improvements to develop structures and processes that enhance patient, provider and organizational outcomes. [14] This framework includes domains regarding the person, organization, technologies and tools, tasks, environment, process, patient outcomes, and employee and organizational outcomes of interventions [14] (Table 2). This framework allowed us to categorize the components across the included studies in a systematic way for better comparisons.
among interventions considering the heterogeneity of study outcomes and processes. Furthermore, SEIPS guided our assessment of the various components that were included in each model to identify what specific processes were impacted and who was involved.

**Environment.** Studies were conducted in the following countries: U.S. (24), U.K. (3), Australia (2), Canada (2), Austria (1), France (1), Ireland (1), and Italy (1). All studies occurred in primary care centers; however, ten studies compared specialty versus primary care settings [27–36]. Some of the studies (n = 14) were conducted in academic primary care centers.
| Author          | Study Design | Environment                  | Organization | Person                           | Tasks                                                                 | Process                                                                 | Tech. & Tools                                                                 | Patient Outcomes                                                                 | Provider Outcomes               | Quality Rating |
|-----------------|--------------|-------------------------------|--------------|----------------------------------|------------------------------------------------------------------------|---------------------------------------------------------------------------|--------------------------------------------------------------------------------|--------------------------------------------------------------------------------|---------------------------------|----------------|
| Alford et al    | QE           | Homeless Clinic vs. traditional PCP setting | Boston, MA, USA, Urban, Academic PCC | Coordinated Care Model between PC physician and Nurse Care Manager Model(s): Coordinated Care | PCP: general internets; NCM: Nurse Care Manager; medications: buprenorphine | Start: NCM: conducted home phone calls; initial assessment; tracked patients, on-call 24/7 | Call phone with NCM 24/7; Patient contact | Retention: 55% in Homeless vs. 61% in Housed at 12mo; Treatment failure, drug use, and utilization of substance abuse treatment services were examined | Not discussed                  | 18 Fair        |
|                 | Comparison group (homeless clinic vs primary care) | Total n = 85 | PCP: overviewed prescribing and confirmed results of physical and overview NCM | PCP: overviewed prescribing and confirmed results of physical and overview NCM | Patient: Encouraged to engage in self-help groups/therapy (recommended and tracked), but no individual counseling explicitly given; "intensified treatment" (substance abuse counseling) was provided to patients with ongoing opioid, other drug, or alcohol use | | | | | |

(Continued)
| Author        | Study Design | Environment                      | Organization                     | Person                                      | Tasks                                                                 | Process                                      | Tech. & Tools | Patient Outcomes | Provider Outcomes | Quality Rating |
|--------------|--------------|----------------------------------|----------------------------------|--------------------------------------------|----------------------------------------------------------------------|---------------------------------------------|--------------|------------------|-------------------|----------------|}
| Alford et al (2011) | QE          | No comparison group             | Total N = 408                     | Multi-disciplinary Care Model with PCP, Nurse Director, and NCM with 1 program coordinator (medical assistant) | Multi-disciplinary Care Model, Nurse care manager with 1-day training in BP | PCP: general internist, NCM: Nurse care manager with 1-day training in BP | Medication: Buprenorphine | PCP: generalists with part-time clinical practices, reviewed and supplemented the NCM assessments (including laboratory results), performed physical examinations, prescribed buprenorphine, and followed patients at least every 6 months (more if needed) | NCM: assessed qualification for OBOT assessment, education, obtained informed consent, developed treatment plans, oversaw medication management (direct supervision of BP), referrals, monitored for treatment adherence, and communicated with PCP, addiction counselors, and pharmacists | Nurse Program Director: oversee the NCM | Program Coordinator: medical assistant trained to collect standardized intake information for individuals requesting OBOT | PCP: generally with part-time clinical practices, reviewed and supplemented the NCM assessments (including laboratory results), performed physical examinations, prescribed buprenorphine, and followed patients at least every 6 months (more if needed) | Shift | The treatment model included 3 stages: (1) NCM and physician assessment (appropriateness for OBOT and intake evaluations), (2) NCM-supervised induction and stabilization (buprenorphine dose adjustments on days 1–7) | (Continued) | Open communication between the NCM and addiction counselors improved patients' ability to comply with addiction care | Patient contract | Retention: 51.3% at 12 mo. At 12 mo, 91.1% of patients remaining in treatment had negative urine drug tests | 18 Fair |
| Author | Study Design | Environment | Organization | Person | Tasks & Tools | Process | Provider Outcomes | Patient Outcomes | Tech. & Tools | Quality Rating |
|--------|--------------|-------------|--------------|--------|--------------|---------|------------------|-----------------|---------------|---------------|
| Carrieri et al (2014) | RCT, Comparison group (primary care vs specialized care) | North, North-Eastern, South-Western and South-Eastern France | PCPs & SCCs | PCP, SCP, Pharmacist & Staff | Staff | BP is accessible in PC as of 2014 in France; only SC provides methadone | SC can transfer patients to PC after methadone stabilization takes place (~14 days, randomized in study) | Retention: Total sample: 73% at 12 mo.; 73% in PC and 50% in SC | + | Good |
| Author          | Study Design | Environment     | Organization                      | Person                                                                 | Tasks                                                                 | Process                        | Tech. & Tools | Patient Outcomes[^1] | Provider Outcomes | Quality Rating |
|-----------------|--------------|-----------------|------------------------------------|------------------------------------------------------------------------|----------------------------------------------------------------------|--------------------------------|---------------|----------------------|------------------|-----------------|
| Colameco et al (2005) | QE           | Philadelphia, PA | Urban Family Practice Center       | Multi-disciplinary Model in which addiction counselor referred patients to PCP who then communicated with other treatment providers, family members, and patient pharmacies Model(s): Coordinated Care, Multi-disciplinary Care | PCP: interviewed the patient over the phone prior to study enrollment, oversaw prescriptions and monitoring | Trained addiction counselors referred patients to PCP | Staff          | Phone calls to patients | Patient contact | 17 Fair         |
|                 | No comparison group | Total n = 35 | | | | | | Retention: 62.9% at 12 mo. | | | | |
| Cunningham et al (2008) | Observational Cohort | FQHC in the Bronx, N.Y., USA | Urban | Team-based care between pharmacist and physician to jointly induce and monitor patients treated with BP Model(s): Coordinated Care, Multi-disciplinary Care, Shared Care | PCP: General Internist, Pharmacist, Patient Social Worker | PCP, collaborated with the pharmacist to induce patient on BP as well as prescribe and monitor patient progress | Pharmacist monitored and observed patient induction on BP, held joint phone/ appointment visits with patient as needed | Social worker: provided routine care as needed, though not required with program | N/A | Retention: 70.7% at 90 days | | 17 Fair |

[^1]: Not discussed
| Author               | Study Design                  | Environment                     | Organization                              | Person                        | Tasks                                                                 | Process                                             | Tech. & Tools                                      | Patient Outcomes* | Provider Outcomes | Quality Rating |
|----------------------|-------------------------------|---------------------------------|-------------------------------------------|-------------------------------|----------------------------------------------------------------------|---------------------------------------------------------------------|---------------------------------------------------|-------------------|------------------|-----------------|
| Cunningham et al (2011) | • QE                          | • Community Health Center in the Bronx, N.Y., USA | • Multi-disciplinary Care Model with patient-centered home-based induction of BP vs. standard of care office-based induction Model(s): Coordinated Care, Multi-disciplinary Care | • PCP (Physician) | • PCP prescribed and monitored patient in either home induction or office-based induction; PCP also available to answer questions & concerns throughout induction and maintenance for patients  | • Staff  <br> • PCP either induced patients in office-based setting or provided patients for patient-induced take home induction with kits and BP education prior to induction  <br> • All prescriptions and dispensing provided by pharmacist at on-site pharmacy  <br> • At all points met with physician and/or pharmacist for visits and provided urine samples as requested  <br> • Home-induced patients were given kit and instructed to follow all directions  | • Home-based induction kit: instruction sheet & BP  <br> • Six sections explaining contents of the kit, when to start taking BPNX, things not to do, how to take BPNX, plans to guide treatment and facilitate follow-up, and a log to track medications taken  | • Retention: N/A  <br> • Self-report of opioid use in previous 6 months  <br> • Results: Among all participants, opioid use declined from 88.6% at baseline to 42.0% at 1 month, 33.3% at 3 months, and 27.3% at 6 months  <br> • Opioid use and any drug use consistently declined at each period in patient-centered home-based inductions  | • Not discussed  | 20 Good |
| DiPaula & Menachery (2014) | • Observational Cohort       | • Maryland, USA                  | • Coordinated care with collaboration between physician and psychiatric pharmacist Model(s): Coordinated Care, Multi-disciplinary Care  <br> • Duration: 12 mo  <br> • Medication: Buprenorphine | • PCP (Physician) | • PCP induced patients on BP, followed up with pharmacist and patient to confirm and document treatment  | • Staff  <br> • Initial visit, pharmacist met with patient to discuss: substance use, mental, and physical history as well as review difficult procedures and complete treatment contract with patient  <br> • Physicians spent ~30 minutes after confirming treatment plan and discussed program with patient  <br> • Attended all scheduled appointments, adhered to prescription and treatment contract  | • Patient contract  <br> • Retention: 75% at 12 mo.  <br> • Substance abuse discovered via urine tox screens  <br> • Results: 96% positive for BP and negative for other substances  | • Physicians favored the take-home BP induction method vs. traditional long-term maintenance  | 18 Fair |

(Continued)
| Author                  | Study Design | Environment | Organization                                      | Person                                                                 | Tasks                                                                 | Process                                                                 | Tech. & Tools                                                                 | Patient Outcomes                                                                 | Provider Outcomes                                                                 | Quality Rating |
|-------------------------|--------------|-------------|--------------------------------------------------|------------------------------------------------------------------------|----------------------------------------------------------------------|--------------------------------------------------------------------------|---------------------------------------------------------------------------------|----------------------------------------------------------------------------------|----------------|----------------|
| Doolittle & Becker      | Observational Cohort | New Haven, CT, USA | Physician-centric model where patients were self-referred. OUD care was provided within the practice with BP in conjunction with other comorbidities Model(s): Physician-Centric | Physician: no extra training in addiction medicine | PCP: counseled patient about opioid withdrawal and the mechanism of action of BP in patient-centered language | Shift | *Buprenorphine contract*: patient agreed to attend all appointments, submit regular urine drug tests, and not receive early refills of BP until next appointment | *BP*: 16 mg dosing with home induction and shared decision-making on length of treatment | *Retention: N/A* | *Home induction helped in ameliorating potential barriers* (e.g., clinic resources and time) for providers | 15 Fair |
| Drainoni et al          | QE, Comparison group (Infectious Disease clinic vs. General Internal Medicine clinic) | Boston, MA | FAST PATH team-based model of integrated care developed by a physician, nurse, and addiction counselor case manager team that used BP in PC with addiction treatment Model(s): Coordinated Care, Multi-disciplinary Care | PCP, RN, Addiction counselor case manager | FAST PATH Team: weekly meetings to discuss all services provided (individual tasks not discussed) | Shift | *Provided ongoing primary care, medication assisted treatment when indicated* (i.e. BPNLX), HIV risk reduction counseling, individual and group counseling, referral to additional SUD treatment | *In FAST PATH the RN/counselor took ownership of the program*—cited as key component to success of the program | *Patients felt most strongly about their interactions with program staff, nonjudgmental, caring attitudes were highly valued* | 15 Fair |
### Table 1. (Continued)

| Author          | Study Design | Environment | Organization | Person | Tasks | Process | Tech. & Tools | Patient Outcomes | Provider Outcomes | Quality Rating |
|-----------------|--------------|-------------|--------------|--------|-------|---------|--------------|------------------|-------------------|-----------------|
| Drucker et al   | Observational Cohort | Lancaster, PA, USA | "Lancaster Model": PCP and community pharmacist worked collaboratively in sharing patient care Model(s): | PCP | provided initial rx and acted as case manager for patients; responsible for meeting with patient at least once a month. | Physician: observed patient taking methadone at clinic, provided them with take-home rx, and communicated patient status and updates with PCP | Logs for rx's and bottle-return monitoring | Retention: 86% at 12 mo. | Provider satisfaction overall very good, staff felt that the bottle returns were not necessary | 17 Fair |
| Ezard et al     | Observational Cohort | Victoria, Australia | Community based service delivery in which patients were prescribed methadone via PCP then received daily dose from pharmacist at a separate site Model(s): | PCP | prescribed the methadone. | Pharmacist: supervised the daily dispensing of methadone | N/A | Retention: 73% at 12 mo. | Not discussed | 16 Fair |
| Fiellin et al   | Comparison group | New Haven, CT, USA | "New Haven Model": treatment 3X weekly with trained RN covering: review of recent drug use, past history, and abstinence self-help groups attendance at self-help groups support for drug reduction/abstinence brief advice on how to achieve or maintain abstinence 3x week urine sample collection Model(s): | PCP | general internists | RN: nursing staff who had no prior experience in substance abuse | Medical management guide | Retention: 79% at 13 wks. | Physician and psychologist provided support for nursing staff, but no real discussion on provider outcomes or perception | 23 Good |

*Note: For more detailed information, please refer to the original research articles.*
| Author      | Study Design                                                                 | Environment         | Organization | Person                                      | Tasks                                                                 | Process                                                                 | Tech. & Tools                                                                 | Patient Outcomes                                                                 |
|------------|-------------------------------------------------------------------------------|----------------------|--------------|---------------------------------------------|------------------------------------------------------------------------|--------------------------------------------------------------------------|--------------------------------------------------------------------------------|---------------------------------------------|
| Fiellin et al (2004) | RCT (Fiellin et al, 2001) Comparison group (office-based treatment vs. opioid-treatment program) | New Haven, CT, USA   | 2 Academic PC practices 1 suburban-based practice | PCP: all general internists, 4/6 certified in addiction medicine, RN: nursing staff, and other office personnel | PCP: during initial visit reviewed patient's medical and substance abuse history and treatment records from the OTP, performed a physical exam, and discussed components of OBOT-M with patient. Mandatory 2x 4 hr training sessions. | Training & Resource Guide (developed specifically for program) | Retention: N/A, Logistics of dispensing, the receipt of urine toxicology results, difficulties arranging psychiatric services, communications with the opioid treatment program, and non-adherence to medication as problematic. | 19 | Fair |

From Fiellin et al (2001): No statistically significant differences between primary care versus narcotic treatment programs for illicit opiate use. PCP patients did think the quality of care was excellent compared to narcotic treatment programs.

- 50% of OBOT-M patients vs. 38% of control had self-report or urine tox for positive illicit drug use.
- Ongoing illicit substance use (defined as clinical instability) found in 18% of OBOT-M patients vs. 21% in control.
- 73% of OBOT-M patients thought quality of care was "excellent" vs. 13% of control.

- Clinical management issues: charting certain findings (i.e., positive urine drug screens), incorrect methadone bottle logs, reformating logs, difficulty referring patients to psychiatric services, problems with patient's medication adherence, and unnecessary required counseling for patients with prolonged abstinence.

- Training adequately prepared MDs.

(Continued)
| Author          | Study Design | Environment | Organization | Person                  | Tasks                                      | Process | Tech. & Tools | Patient Outcomes* | Provider Outcomes | Quality Rating |
|-----------------|--------------|-------------|--------------|-------------------------|-------------------------------------------|---------|---------------|-------------------|------------------|---------------|
| Fiellin et al   | RCT          | New Haven, CT, USA | Academic PCC | Provider                 | Recorded audio for counseling             |         |               |                   |                  |               |
|                 | Comparison group (standard medical management + 1 or 3x medical dispensing) vs. enhanced medical management + 3x medical dispensing) | Total n = 166 | Patient centered model with standard or enhanced medical management given to individual patients. | PCP: met with patients monthly for 20 minutes | Shift | Electronic caps of medication bottles (Medication Event Monitoring System) |                   |                  |               |
|                 |              |             |              | PCP: met with patients monthly for 20 minutes | Nurses dispensed the BP & facilitated weekly manually guided standard or enhanced MM to individual patients. |         |               |                   |                  |               |
|                 |              |             |              | PCP: met with patients monthly for 20 minutes | Psychologist: met weekly with physician and nurse to review counseling |         |               |                   |                  |               |
|                 |              |             |              | PCP: met with patients monthly for 20 minutes | Shift | Recorded audio for counseling |                   |                  |               |
|                 |              |             |              | PCP: met with patients monthly for 20 minutes | Electronic caps of medication bottles (Medication Event Monitoring System) |         |               |                   |                  |               |
|                 |              |             |              | PCP: met with patients monthly for 20 minutes | Nurses dispensed the BP, and were the facilitators for the counseling sessions |         |               |                   |                  |               |
|                 |              |             |              | PCP: met with patients monthly for 20 minutes | The nurses, physician, and psychologist met monthly to discuss the counseling sessions |         |               |                   |                  |               |
|                 |              |             |              | PCP: met with patients monthly for 20 minutes | Patient: | Retention: N/A |                   |                  |               |
|                 |              |             |              | PCP: met with patients monthly for 20 minutes | No statistical significance in negative urine screens, maximum consecutive weeks of abstinence, reduction in frequency of illicit drug use or proportion of patients remaining in study between groups |         |               |                   |                  |               |
|                 |              |             |              | PCP: met with patients monthly for 20 minutes | Overall significant reduction in illicit opioid and cocaine use |         |               |                   |                  |               |
|                 |              |             |              | PCP: met with patients monthly for 20 minutes | Treatment satisfaction was significant with treatment group: higher satisfaction with standard MM and 1x wk medication dispensing* |         |               |                   |                  |               |

(Continued)
| Author | Study Design | Environment | Organization | Person | Tasks | Process | Quality Rating |
|--------|-------------|-------------|--------------|--------|-------|---------|----------------|
| Fiellin et al (2013) | RCT, Comparison group (physician management vs. physician management + cognitive behavioral therapy) | New Haven, CT, USA | Urban PCC | Patient centered model with randomization to 2 groups and followed over 12 weeks | 2 treatment arms: 1) Physician Management 2) CBT Model(s): Coordinated Care, Multi-disciplinary Care | Duration: 24 weeks, Medication: Buprenorphine | Good |

**Tasks & Tools**

- **Self:**
  - Physician Management: Initial 30 minute counseling interaction for first 2 weeks, then every other week for 4 weeks, and then monthly.
  - Topics discussed: recent drug use and efforts to achieve or maintain abstinence, urine analysis results, abstinence advice on achievement/maintenance, review of medical/psychiatric symptoms, assess social, work, and legal function, group attendance, and urine screen results.

- **CBT:**
  - Manual guided, weekly 50 minute sessions provided by Masters and PhD clinicians.
  - Main components: performing functional behavior analysis, promoting behavioral activation, identifying/coping with drug cravings, enhancing drug-refusal skills, enhancing decision-making about high-risk situations, and improving problem-solving skills.

- **Staff:**
  - Physician Management (PM): Manual guided, medically focused, 15–20 minute weekly counseling session for first 2 weeks, every other week for 4 weeks, and then monthly.
  - Topics discussed: recent drug use and efforts to achieve or maintain abstinence, urine analysis results, abstinence advice on achievement/maintenance, review of medical/psychiatric symptoms, assess social, work, and legal function, group attendance, and urine screen results.

- **CBT:**
  - Manual guided, weekly 50 minute sessions provided by Masters and PhD clinicians.
  - Main components: performing functional behavior analysis, promoting behavioral activation, identifying/coping with drug cravings, enhancing drug-refusal skills, enhancing decision-making about high-risk situations, and improving problem-solving skills.

**Provider Outcomes**

- Quality reduction from baseline of opioid use 10/14* of group randomized to CBT model.
- Differences between groups in retention rates.

**Patient Outcomes**

- Significant reductions in opioid use from baseline of opioid use 10/14* of group randomized to CBT model.
- No significant differences between groups.
- Time had significant impact on retention rates.

- However, PCPs cite lack of available ancillary psychosocial services as a barrier.
- For some patients, psych may not be necessary.

**Quality Rating**

- Retention: 45% in PM; 39% in CBT at 6 months.
- Self-reported frequency of illicit opioid use, maximum number of weeks abstinent from illicit opioids evidenced by urine tox and self-report.
- Significant reductions from baseline in both treatments from 5.3 average days of opioid use to 0.4.*
| Author          | Study Design | Environment | Organization | Person | Tasks | Process                          | Tech. & Tools | Patient Outcomes | Provider Outcomes | Quality Rating |
|-----------------|--------------|-------------|--------------|--------|-------|---------------------------------|---------------|------------------|------------------|-----------------|
| Gossop et al.   | QE           | UK National Health System | General practitioners | PCP | General practitioners | PCP, responsible for prescribing medications | Pharmacist | N/A              | Retention: 66% of GP patients; 50% of SC at 6 mo. | 19 Fair         |
|                 | Comparison group (primary care vs specialty care clinic) | Urban | Community-based specialist clinic or GP setting | SCP |      | SCP, provided counseling services | Pharmacist | Staff | Processes differed between groups |                  |
|                 | Total n = 452 | Community-based specialist clinic or GP setting |        |        |       | Supervisor was provided at retail pharmacy | Patient |       | At the program level, differences were found in the manner in which methadone was dispensed |                  |
|                 | SC n = 297, PC n = 155 |        |        |        |       | Data on patient outcomes was collected using interviews, but not discussed who collected them |                   |       | Fewer GP agencies (57%) than clinics (75%) prescribed daily dispensing of methadone |                  |
|                 |              |                  |              |        |       | 6 of the 8 clinics used supervised dispensing procedures (onsite or supervised by a retail pharmacist) |                   |       | 6 of the 8 clinics used supervised dispensing procedures (onsite or supervised by a retail pharmacist) |                  |
|                 |              |                  |              |        |       | Supervision (to be provided at retail pharmacies) was used less often by GP agencies (14%) |                   |       | Supervision (to be provided at retail pharmacies) was used less often by GP agencies (14%) |                  |
|                 |              |                  |              |        |       | Adhered to prescription as well as follow-up appointments |                   |       | Adhered to prescription as well as follow-up appointments |                  |
|                 |              |                  |              |        |       | N/A | Concerns highlighted include: the perception that the methadone maintenance patients may be difficult and upset other patients within the clinic |                  |       | Not discussed |                  |

(Continued)
### Table 1. (Continued)

| Author               | Study Design | Environment | Task & Tools                                                                 | Patient Outcomes |
|----------------------|--------------|-------------|-----------------------------------------------------------------------------|------------------|
| Gruer et al (1997)   | Observational| Glasgow, U.K. | - Galsgow, Scotland, U.K. Urban Health Board | Retention: 60% at 12 mo, Beneficial in establishing the Glasgow drug problem service, Scheme provides detailed guidance on methadone maintenance therapy, Improves managing patients who are entering treatment. |

**Note:**
- **Quality Rating:** Poor (13)
- **Process:** Interprofessional care model, including a multidisciplinary approach with a team of specialists involved in the treatment process.
- **Tasks:**
  - **PCP:** General practitioner focused on providing prescription and attending drug misuse training at least twice a year, completed the opiate treatment index for each patient, and provided routine care as needed.
  - **Nurses:** Trained in counseling and provided services as necessary.
  - **Community pharmacist:** Supervised dosage.
  - **Drug counsellor:** Provided patient counseling.

**Author Study Design Environment Organization Person Tasks Process Tech. & Tools Patient Outcomes**

- **Patient Contract:** Stabilized patient ongoing care returned to PCP with service still available for advice.

**Reference:**
Primary care models for treating opioid use disorders: What actually works? A systematic review. PLOS ONE | https://doi.org/10.1371/journal.pone.0186315 October 17, 2017 17 / 40
| Author                  | Study Design                          | Environment                  | Organization                  | Person                                                                 | Tasks                                                                 | Process                                                                 | Tech. & Tools                                                                 | Patient Outcomes                                                                 | Provider Outcomes | Quality Rating |
|-------------------------|---------------------------------------|------------------------------|-------------------------------|-------------------------------------------------------------------------|----------------------------------------------------------------------|--------------------------------------------------------------------------|--------------------------------------------------------------------------------|------------------------------------------------------------------------|------------------|-----------------|
| Gunderson et al (2010)  | • RCT                                 | • NYC, NY, USA                | • Urban                       | • Patient centered model with unobserved vs. observed induction of BP   | • PCP: BP induction, provided routine care, and provided phone support to induced patients | • Retention: 45% at 3 mo.                                                  | • Subjective Opioid Withdrawal Scale (SOWS) administered via phone       | • Not discussed                                                |                  | 21 Good         |
|                         | • Comparison group (observed vs. unobserved office induction) |                              |                               |                                                                         | • Pharmacists: dispensed BP                                            |                                                                         |                                                                         |                                                                                     |                  |                 |
|                         | • Total n = 20                        |                              |                               |                                                                         | • Study personnel: picked up BP from pharmacy and stored in locked medicine cabinet and phone calls to patients |                                                                         |                                                                         |                                                                                     |                  |                 |
|                         | • Point of care clinic                |                              |                               |                                                                         | • Shift                                                                | • Subjects with daily maintenance dose 12–16 mg with max of 32 mg      |                                                                         |                                                                         |                                                                                     |                  |                 |
|                         | • 12 week followup                    |                              |                               |                                                                         | • Weekly clinical visits during 4-week induction and stabilization phase then decreased to monthly visits |                                                                         |                                                                         |                                                                                     |                  |                 |
|                         | • Medication: Buprenorphine           |                              |                               |                                                                         | • Ulira toxicology with BP-specific immunoassay performed at all clinical visits as well as |                                                                         |                                                                         |                                                                                     |                  |                 |
|                         | • Drug: Buprenorphine                 |                              |                               |                                                                         | • Research visits occurred every 4 wks (urine screen, self-reported substance use assessed, research scale administered) |                                                                         |                                                                         |                                                                                     |                  |                 |
|                         | • PCP: Internist with BP experience   |                              |                               |                                                                         | • Patients receiving clinical dosage suggested to use psychosocial services and counseling support but not enforced |                                                                         |                                                                         |                                                                                     |                  |                 |
|                         | • PCP: BP induction, provided routine care, and provided phone support to induced patients |                              |                               |                                                                         | • No prolonged withdrawal                                              |                                                                         |                                                                         |                                                                                     |                  |                 |
|                         | • Pharmacist                           |                              |                               |                                                                         | • Similar induction rates between groups                                |                                                                         |                                                                         |                                                                                     |                  |                 |
|                         | • Study Personnel                     |                              |                               |                                                                         | • 60% successfully induced in both groups                               |                                                                         |                                                                         |                                                                                     |                  |                 |
|                         | • Study personnel                     |                              |                               |                                                                         | • 30% experienced prolonged withdrawal                                  |                                                                         |                                                                         |                                                                                     |                  |                 |
|                         | • PCP: BP induction, provided routine care, and provided phone support to induced patients |                              |                               |                                                                         | • 80% stabilized by week 4                                              |                                                                         |                                                                         |                                                                                     |                  |                 |
|                         | • Pharmacist                           |                              |                               |                                                                         | • No statistical significance in phone calls for home-induced patients in office vs. unobserved induction |                                                                         |                                                                         |                                                                                     |                  |                 |
|                         | • Study personnel                     |                              |                               |                                                                         | • Patients receiving clinical dosage suggested to use psychosocial services and counseling support but not enforced |                                                                         |                                                                         |                                                                                     |                  |                 |
|                         | • PCP: BP induction, provided routine care, and provided phone support to induced patients |                              |                               |                                                                         | • No prolonged withdrawal                                              |                                                                         |                                                                         |                                                                                     |                  |                 |
|                         | • Pharmacist                           |                              |                               |                                                                         | • Similar induction rates between groups                                |                                                                         |                                                                         |                                                                                     |                  |                 |
|                         | • Study personnel                     |                              |                               |                                                                         | • 60% successfully induced in both groups                               |                                                                         |                                                                         |                                                                                     |                  |                 |
|                         | • PCP: BP induction, provided routine care, and provided phone support to induced patients |                              |                               |                                                                         | • 30% experienced prolonged withdrawal                                  |                                                                         |                                                                         |                                                                                     |                  |                 |
|                         | • Pharmacist                           |                              |                               |                                                                         | • 80% stabilized by week 4                                              |                                                                         |                                                                         |                                                                                     |                  |                 |
|                         | • Study personnel                     |                              |                               |                                                                         | • No statistical significance in phone calls for home-induced patients in office vs. unobserved induction |                                                                         |                                                                         |                                                                                     |                  |                 |

(Continued)
| Author            | Study Design                  | Environment       | Organization                                      | Person                          | Tasks                                      | Process                        | Tech. & Tools                  | Patient Outcomes* | Provider Outcomes | Quality Rating |
|-------------------|-------------------------------|-------------------|--------------------------------------------------|---------------------------------|-------------------------------------------|---------------------------------|------------------------------|------------------|------------------|-----------------|
| Hersh et al       | Observational cohort study    | San Francisco, CA | Patient care delivered in 3 model sites          | PCP, some physicians trained in BP while others not | Physician and NP at the OBIC: induced the patient on BP and stabilized maintenance dose | Phone Screening                 | OBOT electronic database | Retention: 61% at 12 mo | Over time community PCPs grew increasingly comfortable leading to lower pharmacy visits average of 2–3 visits per week to weekly, every other week, or monthly visits | 20 Good          |
|                   | No comparison group           | Urban             | community based, PC office clinics               |                                                |                                            |                                 |                              |                  |                  |                 |
|                   | Total n = 57                  |                   |                                                  |                                                |                                            |                                 |                              |                  |                  |                 |
|                   |                               |                   |                                                  |                                                |                                            |                                 |                              |                  |                  |                 |
|                   |                               |                   |                                                  |                                                |                                            |                                 |                              |                  |                  |                 |
| Hersh et al       | Cohort study                  | Toronto, Ontario, Canada | Multi-disciplinary care program with nurse clinician, family therapist, 6 PCPs, clinical fellow in which patients receive brief counseling intervention, outpatient medical detox, pharmacotherapy & follow-up | PCP: nurse clinician | PCP: Initial physical assessment, pharmacotherapy selection and induction | Staff                            |                              |                  |                  | 20 Good          |
|                   | No comparison group           | Urban             |                                                  |                                                |                                            |                                 |                              |                  |                  |                 |
|                   | Total n = 200                 |                   |                                                  |                                                |                                            |                                 |                              |                  |                  |                 |
|                   |                               |                   |                                                  |                                                |                                            |                                 |                              |                  |                  |                 |
|                   |                               |                   |                                                  |                                                |                                            |                                 |                              |                  |                  |                 |
| Kahan et al       | Observational cohort study    | Toronto, Ontario, Canada | Multi-disciplinary Care                          | PCP: nurse clinician | PCP: Initial physical assessment, pharmacotherapy selection and induction | Staff                            |                              |                  |                  | 20 Good          |
|                   | No comparison group           | Urban             |                                                  |                                                |                                            |                                 |                              |                  |                  |                 |
|                   | Total n = 200                 |                   |                                                  |                                                |                                            |                                 |                              |                  |                  |                 |
|                   |                               |                   |                                                  |                                                |                                            |                                 |                              |                  |                  |                 |
|                   |                               |                   |                                                  |                                                |                                            |                                 |                              |                  |                  |                 |

(Continued)
Table 1. (Continued)

| Author          | Study Design   | Environment                  | Organization                                                                 | Person                                                                 | Tasks                                                                 | Process                                                                 | Tech. & Tools | Patient Outcomes | Provider Outcomes | Quality Rating |
|-----------------|----------------|------------------------------|------------------------------------------------------------------------------|------------------------------------------------------------------------|----------------------------------------------------------------------|------------------------------------------------------------------------|---------------|------------------|-------------------|---------------|
| Lintzeris et al (2004) | RCT             | SC (1) and PC clinics (16) and Community Pharmacies (30) | Melbourne and Victoria, Australia | Urban                                                                  | PCP: General practitioners without BP training                        | PCP: prescribed BP and coordinated patient care                        | Pharmacist     | N/A              | N/A               | 20 Good        |
|                 |                |                              |                                | PCP: prescribed BP and coordinated patient care                        | Supervised dosing by pharmacist                                      | PCP prescribed BP and coordinated patient care                        |               | Retention: 70% in PC, 77% in SC at 3 mo. | Create readily available set of BP guidelines suited for community settings |               |
|                 |                |                              |                                |                                                                       | Patients assigned to either control group (conventional methadone maintenance treatment program) or experimental group (BP treatment with option for methadone transfer) | Subjects followed over 12 mo period with treatment coordinated by prescribing PCP |               | N/A              | N/A               |               |
|                 |                |                              |                                |                                                                       | Daily supervised induction of sublingual BP tablets (2 and 8 mg) with flexible doses | Daily supervised induction of sublingual BP tablets (2 and 8 mg) with flexible doses |               | N/A              | N/A               |               |
|                 |                |                              |                                |                                                                       | Parented transition to alternate-day or 3-day dosing                  |                                                                       |               | N/A              | N/A               |               |
| Lucas et al (2010) | RCT             | Baltimore, MD, USA            | The Johns Hopkins HIV Clinic (single center) where BP treatment was integrated into an HIV primary care clinic | Multi-disciplinary care between 2-5 BP PCPs, social worker, substance abuse counselor, and nursing staff | PCP: consulted with LPN and substance abuse counselor, oversaw prescribing, and met with patients for follow-up | PCP: consulted with LPN and substance abuse counselor, oversaw prescribing, and met with patients for follow-up | Substance abuse counselor | N/A              | N/A               | Not discussed     | 23 Good        |
|                 |                |                              |                                | PCP: consulted with LPN and substance abuse counselor, oversaw prescribing, and met with patients for follow-up | LPN: managed the patients                                            |                                                                       | Substance abuse counselor | N/A              | N/A               | Not discussed     |               |
|                 |                |                              |                                |                                                                       | Substance abuse counselor: met with patients to schedule follow-up and induction education |                                                                       |                                                                       | N/A              | N/A               | Not discussed     |               |
|                 |                |                              |                                |                                                                       | Shift                                                                  |                                                                       |                                                                       | N/A              | N/A               | Not discussed     |               |
|                 |                |                              |                                |                                                                       | Social worker and registered nurse ran the case management program, coordinated appointments, and assisted with overcoming barriers to adherence |                                                                       |                                                                       | N/A              | N/A               | Not discussed     |               |
|                 |                |                              |                                |                                                                       | PCP met with patient after 4 wks                                    |                                                                       |                                                                       | N/A              | N/A               | Not discussed     |               |
|                 |                |                              |                                |                                                                       | Patient initial 2-day BP induction (3x BP daily dose) & progressed to clinic treatment until stabilized |                                                                       |                                                                       | N/A              | N/A               | Not discussed     |               |
|                 |                |                              |                                |                                                                       | Unstructured counseling provided, urine drug tests, and take-home supplies of BP provided each visit |                                                                       |                                                                       | N/A              | N/A               | Not discussed     |               |
|                 |                |                              |                                |                                                                       |                                                                       |                                                                       |                                                                       | N/A              | N/A               | Not discussed     |               |

(Continued)
| Author                        | Study Design | Environment | Organization | Person | Tasks                                                                 | Process | Tech. & Tools | Patient Outcomes* | Provider Outcomes | Quality Rating |
|-------------------------------|--------------|-------------|--------------|--------|----------------------------------------------------------------------|---------|---------------|------------------|------------------|-----------------|
| Michelazzi et al (2008)       | Observational Cohort | Trieste, Italy | CBO(TM) Model(s): Physician-Centric | GP     | GP prescribed methadone, met with patients at least one weekly and provided routine care | Shift | N/A           | Retention, 78% at 12 mo. | N/A              | 17 Fair         |
|                               | RCT          | Urban        | PCP and CS centers | PCP    | PCP led BP treatment with added CBT Model(s): Coordinated Care, Multi-disciplinary Care | Shift | N/A           | Retention: PM-CBT: 19%; PM: 26% at 14 wks. | Difficulties arose with CBT | 21 Good         |
|                               |               | Ireland      | PCP and CS centers | RN     | PCP & RN provided methadone maintenance and psychosocial support as needed and lead SC centers | Staff | N/A           | In SC and PC combined, retention: 61% at 12 mo. | SC has more severe patient population | 22 Good         |

(Table 1. Continued)
| Author          | Study Design | Environment | Organization | Person | Tasks & Tools | Process | Provider Outcomes | Patient Outcomes |
|-----------------|--------------|-------------|--------------|--------|---------------|---------|-------------------|------------------|
| O'Connor et al. | RCT          | PC clinic   | PCP General Internists | N/A    | PCP prescribed treatment and medication | Staff    | Retention: 78% in PC; 52% in SC at 3 mo. | Retention: 78% in PC; 52% in SC at 3 mo. |
|                 |              |             | RN, NPs      |        | NP ran semi-structured weekly group therapy |         | PC patients (63%) had lower rates of opioid use than SC (85%)* | PC patients (63%) had lower rates of opioid use than SC (85%)* |
|                 |              |             | Physician Associates |        | Counselors: in SC provided substance abuse counseling and services |         | PC higher 3+ week abstinence (43%) vs. SC (13%)* | PC higher 3+ week abstinence (43%) vs. SC (13%)* |
|                 |              |             |             |        | PC clinic: Staff: |         | Properly trained General internists can provide OUD treatment | Properly trained General internists can provide OUD treatment |
|                 |              |             |             |        | PC clinic: Patient: |         | Full-risk managed care plan possible | Full-risk managed care plan possible |
|                 |              |             |             |        | SC clinic: Staff: |         | Decreased prescription frequency can diminish long-run retention in treatment | Decreased prescription frequency can diminish long-run retention in treatment |
|                 |              |             |             |        | SC clinic: Patient: |         | Reimbursement method for these services in PC is lacking (capitated vs. full-risk managed care plan) | Reimbursement method for these services in PC is lacking (capitated vs. full-risk managed care plan) |

*Significant difference at p < 0.05
| Author          | Study Design       | Environment     | Organization                  | Person                          | Tasks                                                                 | Process                                      | Tech. & Tools | Patient Outcomes                      | Provider Outcomes | Quality Rating |
|-----------------|--------------------|------------------|-------------------------------|--------------------------------|----------------------------------------------------------------------|----------------------------------------------|---------------|---------------------------------------|------------------|----------------|
| Ortner et al (2004) | Observational Cohort | Austria           | Coordinated Care between SC and PC with long term PC care | PCP in primary care setting with special training for opioid addiction | Induction was initiated by SCP and then care transferred to PCP | N/A                                          | Provider Outcomes | Retention: 57% at 15 wks. (after completion of SC and PC segments) | PCP active involvement in treatment needed for patients to receive adequate care | 19 Fair        |
|                 | No comparison group | Urban             | SC initiation with transfer of care to PC centers | SCP in specialty care setting in short based SC induction and long-term treatment continuation in PC | PCP: prescribed BP and oversee duration of care after induction | PCP, prescibed BP and oversee duration of care after induction | Multi-disciplinary Care | Patient: | N/A                                |                   |                |
|                 | Total n = 60       | SC initiation with transfer of care to PC centers | PCP: prescribed BP and oversee duration of care after induction | PCP: prescribed BP and oversee duration of care after induction | PCP: prescribed BP and oversee duration of care after induction | Provider Outcomes | Patient: | Retention: 57% at 15 wks. (after completion of SC and PC segments) | PCP active involvement in treatment needed for patients to receive adequate care | 19 Fair        |
|                 |                    |                   | PCP: prescribed BP and oversee duration of care after induction | PCP: prescribed BP and oversee duration of care after induction | PCP: prescribed BP and oversee duration of care after induction | Provider Outcomes | Patient: | Retention: 57% at 15 wks. (after completion of SC and PC segments) | PCP active involvement in treatment needed for patients to receive adequate care | 19 Fair        |
|                 |                    |                   | PCP: prescribed BP and oversee duration of care after induction | PCP: prescribed BP and oversee duration of care after induction | PCP: prescribed BP and oversee duration of care after induction | Provider Outcomes | Patient: | Retention: 57% at 15 wks. (after completion of SC and PC segments) | PCP active involvement in treatment needed for patients to receive adequate care | 19 Fair        |
| Roll et al (2015) | Cross-sectional observational study | Revere, M, USA | Shared medical appointments model run by PCP and certified addictions nurse with patients treated with OBOT/BP | PCP: provided general care | PCP: provided general care | N/A                                          | Provider Outcomes | Patient: | Retention: N/A | PCP active involvement in treatment needed for patients to receive adequate care | 19 Fair        |
|                 | No comparison group |                   | PCP: provided general care | PCP: provided general care | PCP: provided general care | N/A                                          | Provider Outcomes | Patient: | Retention: N/A | PCP active involvement in treatment needed for patients to receive adequate care | 19 Fair        |
|                 | Total n = 28       | Safety net primary care center at Revere Family Health Center | PCP: provided general care | PCP: provided general care | PCP: provided general care | N/A                                          | Provider Outcomes | Patient: | Retention: N/A | PCP active involvement in treatment needed for patients to receive adequate care | 19 Fair        |
|                 |                    |                   | PCP: provided general care | PCP: provided general care | PCP: provided general care | N/A                                          | Provider Outcomes | Patient: | Retention: N/A | PCP active involvement in treatment needed for patients to receive adequate care | 19 Fair        |

(Continued)
| Author          | Study Design                  | Environment             | Organization                          | Person                                                                 | Tasks                                                                 | Process                                                                 | Tech. & Tools                                                                 | Patient Outcomes                                                                 | Provider Outcomes                                                                 | Quality Rating |
|-----------------|-------------------------------|-------------------------|---------------------------------------|------------------------------------------------------------------------|----------------------------------------------------------------------|----------------------------------------------------------------------|--------------------------------------------------------------------------------|---------------------------------------------------------------------------------|-------------------------------------------------|-----------------|
| Ross et al      | Observational Cohort          | Edmonton, Alberta, Canada | Urban community-based PCC             | PCP, RN, NP; Psych: Mental Health Workers; Social Workers             | PCP: BP prescription as well as scope of care beyond NP and bridging patient; NP: enrollment of physicians and routine care | Staff: PCP had primary role in prescribing medication and coordinating follow-up care | Staff provided additional services to patient throughout process | PCP oversaw medical issues and prescribing BP beyond NP scope; NP provided limited prescribing and enrollment of physicians; Social workers and mental health workers provided mental health assessment, individual patient counseling, and financial aid housing, and social assistance | Patient: Retention: N/A; Types of medication used for bridging in patients waiting for methadone treatment | 16 Fair       |
| Sohler et al    | QE                            | Bronx, NYC, USA         | Urban community-based health center that provides PC | PCP, RN                                                                 | PCP: oversaw care for patients including BP pre-counselling, induction dosage, and patient follow ups; RN: provided assistance as needed | Staff: PCPs helped determine patient eligibility for office-based versus home-based induction | PCP available via phone; pharmacist contacted via phone to prevent precession misuse | Patient contract                                                                 | Provider: Not discussed                                                                 | 21 Good       |
| Author          | Study Design               | Environment                  | Organization               | Person                      | Tasks                                                                 | Process                                           | Tech. & Tools | Patient Outcomes                                                                 | Provider Outcomes                                                                 | Quality Rating |
|-----------------|----------------------------|------------------------------|-----------------------------|-----------------------------|----------------------------------------------------------------------|----------------------------------------------------|--------------|---------------------------------------------------------------------------------|----------------------------------------------------------------------------------|--------------|
| Tuchman et al (2006) | RCT                        | Albuquerque & Santa Fe, New Mexico, USA                 | PCP                          | Staff                        | Providers (4 PCPs and 1 NP) provided continuous care for assigned methadone maintenance patients | Retention: 100% in office based experimental group; 86% in MMT at 12 mo | EMR          | Retention: N/A                                                                  | Pharmacy dispensing was a critical factor in program; provided a positive environment for patient without any stigma and viewed as strength for rural settings | 20 Good      |
| Walley et al (2015) | Observational cohort study | Urban                        | Team of PCPs, NCM and licensed addiction counselor that collaborated to provide addiction care and patients had established treatment agreements with care teams | Social worker met with each patient for psychosocial treatment once a month | N/A                                                              | Results: patients in the experimental group did as well or better than the control (routine methadone maintenance treatment program) |                   | Patient contact                                                                | Important for PDP to understand which patients more likely to engage | 20 Good      |
| Author                       | Study Design                  | Environment     | Organization                                                                 | Person                                                                 | Tasks                                                                 | Process                                                                 | Tech. & Tools | Patient Outcomes                                                                 | Provider Outcomes | Quality Rating |
|------------------------------|-------------------------------|-----------------|-------------------------------------------------------------------------------|-------------------------------------------------------------------------|------------------------------------------------------------------------|--------------------------------------------------------------------------|---------------|----------------------------------------------------------------------------------|-------------------|----------------|
| Weiss et al (2011)           | Observational cohort study    | No Comparison Group | Total n = 427 included in analyses n = 303 funded program n = 10               | Multi-disciplinary care model with comprehensive medical and social services available to all participants within the BHIVES program in which a “specialist” model of BP/NX treatment [limited number of PCPs oversaw entire pharmacotherapy process] was employed | PCP, NP, RN: registered nurse, Pharmacist, Psychologist, Social Worker, Health Educator, Substance Abuse Specialist | PCP: oversaw entire pharmacotherapy process | BMR | Weiss et al (2017); Evaluation and Support of programs to improve better understanding of BP/NX integration practices, services offered, staffing needs, PCP experiences/perceptions of BP/NX, perception of barriers and facilitators, sustainability measures, and recommendations for replication of integrated care program components | Patient contract | 17 Fair |
| Fiellin et al (2011)          | (23)                          | Urban           |                                                                                           |                                                                                   |                                                                                      |                                                                          |               |                                                                                  |                   |               |
| Korthuis et al (2011)        | Observational cohort study    | Total n = 427 included in analyses n = 303 funded program n = 10               | Multi-disciplinary care model with comprehensive medical and social services available to all participants within the BHIVES program in which a “specialist” model of BP/NX treatment [limited number of PCPs oversaw entire pharmacotherapy process] was employed | PCP, NP, RN: registered nurse, Pharmacist, Psychologist, Social Worker, Health Educator, Substance Abuse Specialist | PCP: oversaw entire pharmacotherapy process | BMR | Weiss et al (2017); Evaluation and Support of programs to improve better understanding of BP/NX integration practices, services offered, staffing needs, PCP experiences/perceptions of BP/NX, perception of barriers and facilitators, sustainability measures, and recommendations for replication of integrated care program components | Patient contract | 17 Fair |
| Altice et al (2011)          | Observational cohort study    | Total n = 427 included in analyses n = 303 funded program n = 10               | Multi-disciplinary care model with comprehensive medical and social services available to all participants within the BHIVES program in which a “specialist” model of BP/NX treatment [limited number of PCPs oversaw entire pharmacotherapy process] was employed | PCP, NP, RN: registered nurse, Pharmacist, Psychologist, Social Worker, Health Educator, Substance Abuse Specialist | PCP: oversaw entire pharmacotherapy process | BMR | Weiss et al (2017); Evaluation and Support of programs to improve better understanding of BP/NX integration practices, services offered, staffing needs, PCP experiences/perceptions of BP/NX, perception of barriers and facilitators, sustainability measures, and recommendations for replication of integrated care program components | Patient contract | 17 Fair |
| Egan et al (2011)            | Observational cohort study    | Total n = 427 included in analyses n = 303 funded program n = 10               | Multi-disciplinary care model with comprehensive medical and social services available to all participants within the BHIVES program in which a “specialist” model of BP/NX treatment [limited number of PCPs oversaw entire pharmacotherapy process] was employed | PCP, NP, RN: registered nurse, Pharmacist, Psychologist, Social Worker, Health Educator, Substance Abuse Specialist | PCP: oversaw entire pharmacotherapy process | BMR | Weiss et al (2017); Evaluation and Support of programs to improve better understanding of BP/NX integration practices, services offered, staffing needs, PCP experiences/perceptions of BP/NX, perception of barriers and facilitators, sustainability measures, and recommendations for replication of integrated care program components | Patient contract | 17 Fair |
| Korthuis, Tozzi, et al (2011) | Observational cohort study    | Total n = 427 included in analyses n = 303 funded program n = 10               | Multi-disciplinary care model with comprehensive medical and social services available to all participants within the BHIVES program in which a “specialist” model of BP/NX treatment [limited number of PCPs oversaw entire pharmacotherapy process] was employed | PCP, NP, RN: registered nurse, Pharmacist, Psychologist, Social Worker, Health Educator, Substance Abuse Specialist | PCP: oversaw entire pharmacotherapy process | BMR | Weiss et al (2017); Evaluation and Support of programs to improve better understanding of BP/NX integration practices, services offered, staffing needs, PCP experiences/perceptions of BP/NX, perception of barriers and facilitators, sustainability measures, and recommendations for replication of integrated care program components | Patient contract | 17 Fair |
| Egan et al (2011)            | Observational cohort study    | Total n = 427 included in analyses n = 303 funded program n = 10               | Multi-disciplinary care model with comprehensive medical and social services available to all participants within the BHIVES program in which a “specialist” model of BP/NX treatment [limited number of PCPs oversaw entire pharmacotherapy process] was employed | PCP, NP, RN: registered nurse, Pharmacist, Psychologist, Social Worker, Health Educator, Substance Abuse Specialist | PCP: oversaw entire pharmacotherapy process | BMR | Weiss et al (2017); Evaluation and Support of programs to improve better understanding of BP/NX integration practices, services offered, staffing needs, PCP experiences/perceptions of BP/NX, perception of barriers and facilitators, sustainability measures, and recommendations for replication of integrated care program components | Patient contract | 17 Fair |

Weiss et al (2011): 78.4% of patients receiving buprenorphine remained on treatment at 3 mo, 72.7% at 6 mo, 62.9% at 9 mo, & 53.1% at 12 mo
| Author            | Study Design | Environment | Organization | Person | Tasks | Process | Tech. & Tools | Patient Outcomes | Provider Outcomes | Quality Rating |
|-------------------|--------------|-------------|--------------|--------|-------|---------|-------------|----------------|------------------|-----------------|
| Korthuis, Tozzi, et al (2011) | • Mean summary quality score increased over 12 mo from 45.6% to 51.6% for bup/nx patients |  |  |  |  |  |  |  |  |  |
| Egan et al (2011) | • At 12 mo, average composite mental health-related quality of life (HRQOL) improved (38.3 to 43.4) and composite physical HRQOL did not change |  |  |  |  |  |  |  |  |  |
|                   | • Bup/nx associated with improvements in HRQOL |  |  |  |  |  |  |  |  |  |
|                   | • Patients satisfied with Buprenorphine/Naloxone and reported overall increased quality of life |  |  |  |  |  |  |  |  |  |
|                   | • Counseling seen as an important component |  |  |  |  |  |  |  |  |  |
|                   | • All patients strongly positive about integrated care model |  |  |  |  |  |  |  |  |  |
|                   | • Retention on BUP/NX for 3+ quarters, significantly associated with increased ART initiating |  |  |  |  |  |  |  |  |  |
|                   | • Prescription of BUP/NX for 3+ quarters for patients on ART (at baseline) was not associated with statistically significant improvements in viral suppression and CD4 counts |  |  |  |  |  |  |  |  |  |

*Patient outcomes ranged from retention rate, increase in comorbidity screening, etc.

*statistically significant (p < 0.05) outcomes

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Table 2. SEIPS model, current state, and areas for improvement.

| SEIPS DOMAINS  | DEFINITIONS                                                                 | CURRENT STATE                                                                                       | AREAS FOR IMPROVEMENT                                                                                     |
|----------------|------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|
| ENVIRONMENT    | • **Environment**: the physical environment and location of the system       | • 8 countries globally (U.S., UK, Australia, Canada, Austria, France, Ireland, Italy)               | • Expand primary care interventions to more community health settings                                       |
|                |                                                                               | • Highly variable setting                                                                           |                                                                                                           |
|                |                                                                               | • Primarily health centers affiliated with academic institutions                                     |                                                                                                           |
|                | **Organization**: includes concepts such as relationships between healthcare workers and patients as well as coordination, collaboration, and communication between those involved in the system | **Existing Care Organization Models**                                                               | **Implement Coordinated Care models with non-physician team members (i.e. RNs) to help manage patient appointments and lab results** |
|                |                                                                               | • Coordinated Care: minimum 2–3 professions working to coordinate care to deliver best practices (e.g. NCM, Pharmacist & Physician) | **Evaluate effectiveness of multidisciplinary teams in providing comprehensive behavioral counseling and better outcomes** |
|                |                                                                               | • Multi-disciplinary Care: 2 disciplines working together (e.g. Psych & GIM)                         | **Determine appropriate skillset needed by non-physician team members to appropriately delegate tasks for high quality care** |
|                |                                                                               | • Shared Care: specialty services (e.g. addiction psychiatry) lead the induction process & hands off to Internal Medicine/Primary Care to share longitudinal care |                                                                                                           |
|                |                                                                               | • Chronic Care: utilizing healthcare resources to self-empower individual management of chronic disease |                                                                                                           |
|                |                                                                               | • Physician Centric: single physician (or group of only physicians) working with available resources to manage OUD with BP/Methadone/NX |                                                                                                           |
| PERSON/TASKS   | • **Person**: all of the individuals, both healthcare workers and patients, involved in the design of the work system | • Large variation in type of skilled professionals providing support (e.g. nurses, pharmacists, counselors) | **Capitalize on various providers’ skillsets to deliver high quality care**                                 |
|                | • **Tasks**: clinical processes and responsibilities of both the healthcare workers involved in the system as well as responsibilities for the patient (i.e. receiving medication, counseling attendance, etc.) | • Pharmacists roles and tasks (i.e. supervising dispensing, clinical appointments, management) dependent upon intervention | **Employ clinical pharmacists for complicated medication dosing and management**                           |
|                |                                                                               | • Behavioral health providers ranged in training (i.e. PhD psychologists, certified addiction counselors, social workers) | **Increase clinical support (i.e. nursing) responsibility in management of patients**                    |
| PROCESS        | • **Process**: the flow of actions or steps taken to provide patient care (e.g. order of delivery for intake, induction, maintenance, and follow up) | • Use of non-physician staff to conduct patient intakes decreased physician work load | **Understand which patients can safely undergo home inductions**                                           |
|                |                                                                               | • Home inductions allowed patient autonomy and less frequent initial appointments                      | **Streamline home induction process to decrease care utilization during induction time period**            |
|                |                                                                               | • Limited studies evaluated behavioral counseling approaches compared to medical management          | **Utilize non-physician team members to conduct patient intakes**                                         |
| TECHNOLOGY & TOOLS | • **Technology and Tools**: components of the system including various information technologies like electronic health records, human factors characteristics of technologies (i.e. usability), and other technologies incorporated | • Only 10 studies explicitly noted using patient treatment agreement | **Develop technologies and systems providing after hour support for patient care, data collection, & feedback** |
|                |                                                                               | • Most studies used some form of a urine drug screen to monitor adherence                             | **Promote PCP management of stabilized patients on maintenance medications within specialty addiction treatment programs** |
|                |                                                                               | • Only 3 studies used panel management structure to keep track of patient level data                  | **Standardize important tools (i.e. toxicology screenings & management structures) to monitor patient and population level outcomes** |

(Continued)
Organization. All of the studies meeting inclusion criteria studied buprenorphine (n = 25) and/or methadone (n = 12) treatment in primary care settings. Due to large variability in terminology and reporting, the interventions were grouped into at least one of five care models (e.g. collaborative care vs. integrated care). The most common type was a coordinated care model which had at least two different types of healthcare professionals actively communicating and working together to share care responsibilities (e.g. nurse case manager or pharmacist plus physician). Of the 32 “coordinated care” models, twelve relied upon a nurse case manager or other skilled nursing staff to lead and provide logistical support to the PCP [8, 10, 32, 35, 38, 51, 58, 60–64]. Often the nurse received training to provide some behavioral counseling [38, 58, 60, 65]. Pharmacists also provided assistance to PCPs by supervising medication dosages [49, 51, 53, 66, 67]. Multi-disciplinary models consisted of two physician disciplines working closely together within the same clinic (e.g. addiction psychiatry and internal medicine). For example, one study specifically evaluated the benefit of adding in-clinic behavioral counseling to standard medical management provided by a general internist for patients receiving methadone for heroin use [61]. Shared care models had specialty services lead the medication induction process (the first week of MAT where the physician determines the dosing, timing and treatment goals of the medication) and then later “handed-off” patients to general internal PCPs [33, 45, 56, 58]. In Cunningham et al (2008), patient induction was initiated by the pharmacist before transfer to the physician’s care [56]. The chronic care model, utilized healthcare resources to increase patients’ self-efficacy in managing their chronic disease [57]. Only two studies met this criterion [10, 34]. For example, one study used this framework to design a home induction protocol to empower patients to self-administer medications [34]. Last, the physician-centric model had a single physician or group of physicians working together to provide patient-centered MAT without major structural support from other provider types or disciplines. In Doolittle & Becker (2011), the physician independently counseled and treated the patient [68].

Studies were assigned to models via the criteria outlined above and could be categorized more than once to best capture treatment delivery. Most included studies (n = 32) had coordinated care models with 32 studies falling into two or more care models (e.g. coordinated care

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Table 2. (Continued)

| SEIPS DOMAINS | DEFINITIONS | CURRENT STATE | AREAS FOR IMPROVEMENT |
|---------------|-------------|---------------|-----------------------|
| PATIENT/ PROVIDER OUTCOMES | • Patient Outcomes: participant perceptions of the care delivery model, retention rates in the intervention, and health outcomes for the participant <br> • Provider Outcomes: provider perceptions of the care delivery model and system | • The most commonly measured patient outcomes were retention in intervention, self-reported abstinence, and abstinence via/urine toxicology screens <br> • Less than half of the studies collected outcomes regarding other common primary care based comorbidities <br> • Provider outcomes were only discussed in 10 included trials <br> • Provider outcomes did highlight the benefits of coordinated care models | • Gather patient-centered outcomes including management of physical and mental comorbidities <br> • Collect outcomes related to social determinants, social support, and improvement in work/personal level functioning <br> • Collect provider outcomes regarding appropriate levels of training to provide care <br> • Develop and evaluate provider support systems to provide ongoing education and prevent provider burnout |

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and multi-disciplinary care) [8, 10–12, 28–30, 32, 33, 38, 43, 45, 48–51, 56–58, 60, 61, 63, 64, 66, 67, 69–75]. Only three physician-centric studies existed, predominantly in community health centers, where physicians independently provided MAT [34, 68, 76].

Person/Tasks. Thirty-one studies included non-physician providers (e.g. nurses, pharmacists, counselors) to carry out tasks. [8, 10, 11, 27–30, 32, 33, 38, 45, 49–51, 56–60, 62–67, 69–73, 75, 77] The level of training and specific tasks managed by each non-physician provider varied across interventions. First, multiple studies used nurses as liaisons in coordinating care between PCPs and behavioral specialists. [8, 10, 32, 51, 58, 63] This configuration improved performance processes and collaborative work[14]. Both licensed practicing nurses (LPN) and advanced practicing nurses (NPs) were used as program coordinators to lead the intervention while supporting both patients and staff [10, 38, 60]. For example, Lucas et al (2010) had LPNs oversee patient-physician scheduling and assist with induction. Other studies used nursing staff to not only provide care collaboration, but to lead patient visits [8, 10, 32, 38, 51, 60, 62, 64–66]. However, only physicians could prescribe medications. Second, pharmacist roles and tasks varied across interventions. Multiple studies had pharmacists supervise dispensing of buprenorphine or methadone [27–30, 33, 49, 51, 56, 57, 63, 67, 71, 75, 77, 78]. The majority of these were conducted in the Europe [27–30, 51]. One U.S. study used a clinical pharmacist to provide physician guidance regarding appropriate dosing/tapering strategies [75] and to lead most patient follow-up appointments. Third, heterogeneity in formal training among clinicians for providing addiction counseling emerged. Behavioral counseling providers ranged from PhD-trained psychologists [65, 70] to certified addiction counselors [8, 10, 11, 32, 51, 58, 73, 74] to nurses with brief training in addiction counseling [38, 50, 66].

Process. Process focused on the flow of patient care within organizational models. Seven studies had a non-physician (e.g. nurse case manager) perform an initial detailed intake that often consisted of a physical and mental health history, allowing PCPs to focus their time on medication management [10, 38, 45, 49, 60, 74, 75]. Following the intake visit, studies varied on how they handled medication induction. Twenty-nine studies supervised patient induction with frequent appointments and supervised medication dosing [8, 10, 11, 27–30, 32–34, 38, 49–51, 56–58, 60, 62, 63, 65, 67, 69–72, 75–77]. In contrast, four studies evaluated “home” inductions, which increased patient autonomy via a specific plan for how to first begin self-treatment with the chosen medication [55, 57, 68, 71]. Following induction, frequency of appointments with staff ranged from daily to quarterly depending upon patient needs and intervention design. Behavioral counseling appointments were often coordinated with medical management appointments [11, 62, 65, 69, 70, 72]. In cases requiring more intense addiction counseling/treatment, nineteen studies had a plan for referral to specialty services [8, 11, 12, 27, 30, 32, 37, 38, 50, 51, 56, 62, 63, 70, 72–75, 79].

Only four studies formally tested if counseling modality or duration affected treatment outcomes [9, 43, 80, 81]. Of these four studies, only two demonstrated that their form of counseling was more efficacious (e.g. patients undergoing CBT had higher rates of negative urine toxicology screens or >80% Quality Health Indicator score) than medical management alone possibly because of their adaptive, stepped-care treatments or highly integrated care teams with numerous support staff [9, 81].

Technology/Tools. Technology/Tools focused on electronic and non-electronic tools that helped manage data and monitor patient outcomes like patient agreements, drug screenings, and electronic information technology systems. Ten studies had formal treatment agreements (“contract”) between patients and providers to outline consequences for continued drug misuse. [8, 11, 37, 38, 51, 68, 69, 75, 77] Most interventions (n = 29) noted that they used urine drug screening as a tool to monitor adherence to medication and drug misuse; although, there was no standardization in what drugs were screened or how often.
Regarding technologies, three studies noted that they had a panel management structure to monitor patient level data (i.e. urine toxicology screens, drug tests, etc.) [10, 75, 81]. Four studies noted using electronic medical records to facilitate treatment team member communication and to document patient updates [58, 63, 72, 75]. No studies utilized home-based or web-based counseling modalities [73].

**Patient outcomes.** Reported patient outcomes varied. However, most studies (n = 25) reported patient-level retention within treatment. At 3 months, nineteen interventions achieved at least 60% retention. Some studies evaluated if patients had self-reported abstinence (n = 15) while others incorporated quantitative measures of abstinence (i.e. urine toxicology screens; n = 22).

Few studies asked about patient perceptions of the care delivery models. One study evaluating a coordinated care model for patients receiving MAT obtained patient feedback regarding care with 90% of patients reporting overall satisfaction with the care model [52]. Additionally, less than half of the interventions (n = 11) assessed management of other common primary-care comorbidities and age-appropriate screenings [10, 12, 38, 45, 49, 50, 57, 58, 60, 64, 68]. One of these studies evaluated what percentage of patients were meeting nine quality health indicators (QHI) of an age appropriate health screening per CDC criteria via retrospective chart review [58]. Greater than 3 months of treatment on buprenorphine was positively associated with achieving a recommended QHI screening score [(AOR) = 2.19; 95% confidence interval (CI) = 1.18–4.04]. Similarly, Roll et al (2015) surveyed 28 patients receiving shared medical appointments for buprenorphine management therapy. They found that 60% of patients reported learning more about comorbidities like Hepatitis C and 43% reported receiving appropriate immunizations since starting the intervention. [54] The BHIVES collaborative was a ten site intervention evaluating the use of buprenorphine/naloxone for patients with both HIV and OUD. The evaluation used mixed-methods and reported patient outcomes on OUD treatment, HIV treatment, HIV related quality of life, patient perspectives on the intervention, and overall quality of life. [12, 22, 23, 25–27, 82].

**Provider outcomes.** Provider level outcomes were only reported in ten of the included studies [28, 30, 32, 49, 63, 69, 72, 74, 77, 83]. Of these, six studies asked providers qualitatively about barriers and facilitators of the intervention’s success [12, 32, 49, 50, 69, 74].

Themes that emerged from provider outcome data included provider education, cost-related barriers, and benefits of a coordinated-care approach. Three studies noted that providers felt under-trained or that some training in providing the chosen medication (i.e. buprenorphine or methadone) or substance abuse treatment was important. O’Connor et al (1998) found that the intervention itself increased provider confidence in treating patients with OUD. [32, 50, 69, 77]. However, Fiellin et al (2004) reported that physicians felt “adequately prepared for much of the care they provided,” but requested that further training be offered with respect to medication tapering, billing, and additional training for support staff [52]. Nine studies reported that providers felt that there were benefits of coordinated care [8, 38, 49, 51, 58, 60, 75, 77, 81]. In Drainoni et al (2014), providers noted that the RN/Counselor taking ownership of the program was pivotal to program success [8]. Likewise, in Weiss et al (2011), providers noted that coordinated care is crucial in a busy academic setting where physicians had limited availability during clinic hours [12].

**Presence of SEIPS domains in good quality studies with high patient retention.** There was heterogeneity in study caliber, medications and dosages, reported patient outcomes, and duration of study making it difficult to perform any meta-analysis with the 35 included studies. However, in order to describe which SEIPS domains may be associated with successful treatment and establish a level of standardization, we defined successful studies as interventions that achieved 60% retention rates at 3 months and received a good score with our validated...
risk assessment tool. Seven studies met this metric for success (Fig 2) [27, 31, 32, 42, 52, 84, 85].

All seven successful studies used coordinated care models with multidisciplinary teams. Six of the studies used buprenorphine as the medication, had a modality for delivering behavioral counseling (although not necessarily through trained behavioral health specialists), used nurses as part of the care team, and monitored treatment outcomes with urine toxicology screens. With respect to technology/tools none of the included studies used patient and provider contracts or panel management structures. In addition, only 4/7 included studies provided additional educational training for the clinical staff.

Risk of bias

No study scored an excellent quality/risk of bias score: sixteen interventions scored good, seventeen scored fair, and two were poor for their reporting of patient outcomes significance (i.e. power within the study to detect differences in outcomes) and their lack of both external and internal validity [51, 54].

Discussion

Few comparisons of primary care models for OUD exist. Our study addresses this gap in knowledge by using the SEIPS domains to categorize features of MAT interventions to better understand specific structural, process and outcome elements of primary care models. The range of studies spanned small physician-led interventions within single clinics to large RCTs with multi-disciplinary teams in academic settings. Based on our synthesis of peer-reviewed literature, we report the current structures and processes of primary care-based OUD MAT models and present a proposed research agenda for future studies within each SEIPS domain.

Coordinated care models (with non-physician team members such as RNs helping manage patient appointments and lab results) are by far the most common delivery structures studied. There was some indication that physicians felt this program model allowed for improved team communication and higher quality of care delivery [8, 12, 47, 51, 52, 66, 86]. Similarly,
multidisciplinary teams can promote comprehensive behavioral health counseling in addition to standard PCP-led counseling during routine primary care appointments. However, future studies will need to further delineate the cost and feasibility of these resources in settings where multidisciplinary care is inaccessible or not viable. Ideally, studies would evaluate a physician-centered model against models with varying degrees of care coordination with randomized controlled trials but such studies are costly. With the need to rapidly disseminate primary care based models to provide MAT, this study highlights that policy makers and health care professionals should strive to provide and pragmatically evaluate at the very least, the provision of some coordinated care. These models may include smaller teams or clinical partnerships (i.e. physician-RN teams, physician-pharmacist teams) that are more common across resource settings.

The effective use of clinicians’ skillsets can improve overall care delivery. For example, clinical pharmacists can provide medication dosing and management rather than only supervised medication-taking. In terms of behavioral counseling, more research is needed to identify the optimal level of training necessary for OUD care delivery. Studies have suggested that additional counseling beyond the scope of the physician is ineffectual for certain outcomes [43, 87]. However, future research will need to understand whether certain patient populations benefit more or less from additional counseling to help allocate limited behavioral health resources to those patients that would derive the most benefit.

Home inductions proved successful (≥ 60% retention) for select patients, but future research is still needed to recommend the routine use of home inductions [55, 57, 71] and to identify the patient characteristics that are associated with successful and non-successful home inductions. Furthermore, the use of RNs or other support staff to conduct patient intakes (i.e. physicals, mental health screenings) helped disencumber physician responsibilities. [8, 10, 11, 32, 38, 50, 51, 58, 60, 62–64, 78] Providing patients with “after hours” support was another component of care noted in numerous studies. [39, 45, 55–57, 60, 71, 74] More research is needed to assess the effects of augmenting such support with the use of mobile technology (i.e. telehealth, text messages, emails) to improve the process of providing 24-hour support. Only three studies examined the influence of addiction specialists transferring stabilized patients to primary care [30, 33, 63]. This approach may appeal to primary care workforces wanting to expand access to MAT through a stepped-care approach (i.e. providing stabilized patients maintenance dosing and managing comorbidities), but who are less comfortable providing initial MAT induction.

Wide variation in the use of toxicology screens, patient contracts, and data management structures existed and were largely underdeveloped. Our conclusions correlated with findings from a systematic review examining the use of urine drug screens and treatment agreements in patients with chronic pain, and found that more research is needed to standardize these tools to not only monitor patient level outcomes, but provide population-level feedback to care teams [88]. Additionally, much of the technological aids discussed were relatively nascent with Mullen et al (2012) noting that a more sophisticated data management structure would be helpful [31]. There was substantial heterogeneity with respect to patient and provider outcomes measured. Patient retention was the most common outcome reported, yet there was no uniform definition given dissimilar program lengths between studies (i.e. 1 month to 2 years). Additionally, there was a lack of consideration given to the remitting nature of OUD. Many of the study samples excluded co-dependence on other illicit substances like benzodiazepines, leading to possible confounders that could affect the analyses.

Few studies evaluated provider outcomes such as quality of medical care, physician perceptions, and factors related to care delivery in relation to a primary care-based MAT intervention. While other studies in the literature measure provider barriers to delivering OUD
treatment in primary care settings [89–91], these studies do not measure provider outcomes concurrently to testing patient level outcomes within specified care model structures. This gap indicates key areas for future research such as determining the appropriate level of provider training, testing provider training and mentoring support mechanisms such as the Providers’ Clinical Support System for Medication Assisted Treatment [92] and Project ECHO (Extension for Community Health Outcomes) a video-based distance education program, and determining how to prevent physician burnout. [85]

Our study could not make any definitive statements regarding whether particular care models or treatment elements are strongly associated with favorable patient outcomes compared to alternatives. However, when we did look across studies with good quality and high patient retention there was a pattern suggesting that successful studies used coordinated, multidisciplinary models to support physicians in delivering MAT. The majority of the seven studies did not use tools such as patient/provider contracts nor did they provide additional clinical staff training suggesting that they may not be necessary to successfully carry out primary care based MAT.

Our study has limitations. First, because of both the heterogeneity in reporting of outcomes and variability in medications used and dosages, we were unable to perform a pooled meta-analysis to clearly link structural domains identified via SEIPS to health outcomes. Second, not all of the studies included had randomized designs. Potential for bias and confounding should be considered, though it was formally assessed within our methods. Third, we were unable to quantitatively evaluate which particular SEIPS domains contributed to intervention success or failure. Fourth, we only included studies that were published in peer-reviewed literature. Therefore, we did not capture interventions that may be in the pilot phase or have outcomes presented via other “grey” literature such as websites/forums.

Our study has several strengths. To our knowledge, this is the first systematic review that describes both patient outcomes and structural organization of interventions to treat OUD in primary care settings both domestically and internationally. Second, by using the SEIPS framework, we described systems design elements within each intervention rather than focusing only on the broad organizational framework of the intervention. Not all primary care settings have access to the same resources with some unable to structurally accommodate a multi-person coordinated care team. However, we provide details on how to improve systems (e.g. person, tasks, and process) depending on the resources that are available in various settings.

There is variability in regulations for treatment programs, payment models, and provider training structures which may limit or enhance the ability of health systems to provide high quality multidisciplinary, coordinated care with the most cost-effective, efficacious OUD interventions. As the US allocates funding towards expanding MAT access, programs receiving such funding would benefit from considering the intervention models found to support MAT implementation in prior studies [93]. By evaluating not only patient efficacy, but also structural characteristics of primary care models for delivering MAT, this review provides key insights for PCPs and researchers about ways to build upon existing resources and personnel to more effectively deliver OUD treatment. Specifically, this study identified key components of primary care OUD delivery models. As we continue to grapple with the global rise of opioid-related morbidity and mortality, this review can help enhance the rapid dissemination of effective OUD treatment programs across diverse settings.

Supporting information
S1 Table. Search terms.

(TIFF)
S2 Table. Inclusion and exclusion criteria.
(TIFF)

S1 Fig. PRISMA checklist.
(TIFF)

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