


# A Taxonomy of Hospital-Based Addiction Care Models: a Scoping Review and Key Informant Interviews



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**BACKGROUND:** There is pressing need to improve hospital-based addiction care. Various models for integrating substance use disorder care into hospital settings exist, but there is no framework for describing, selecting, or comparing models. We sought to fill that gap by constructing a taxonomy of hospital-based addiction care models based on scoping literature review and key informant interviews.

**METHODS:** Methods included a scoping review of the literature on US hospital-based addiction care models and interventions for adults, published between January 2000 and July 2021. We conducted semi-structured interviews with 15 key informants experienced in leading, implementing, evaluating, and practicing hospital-based addiction care to explore model characteristics, including their perceived strengths, limitations, and implementation considerations. We synthesized findings from the literature review and interviews to construct a taxonomy of model types.

**RESULTS:** Searches identified 2,849 unique abstracts. Of these, we reviewed 280 full text articles, of which 76 were included in the final review. We added 8 references from reference lists and informant interviews, and 4 gray literature sources. We identified six distinct hospital-based addiction care models. Those classified as addiction consult models include (1) interprofessional addiction consult services, (2) psychiatry consult liaison services, and (3) individual consultant models. Those classified as practice-based models, wherein general hospital staff integrate addiction care into usual practice, include (4) hospital-based opioid treatment and (5) hospital-based alcohol treatment. The final type was (6) community-based in-reach, wherein community providers deliver care. Models vary in their target patient population, staffing, and core clinical and systems change activities. Limitations include that some models have overlapping characteristics and variable ways of delivering core components.

**DISCUSSION:** A taxonomy provides hospital clinicians and administrators, researchers, and policy-makers with a framework to describe, compare, and select models for

implementing hospital-based addiction care and measure outcomes.

**KEY WORDS:** addiction consult service; psychiatry consult liaison service; hospital-based opioid treatment; substance withdrawal syndrome; substance-related disorders; hospitalized patient; referral and consultation.

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## BACKGROUND

Amidst an unrelenting substance use disorder (SUD) epidemic, SUD-related hospitalizations are rising across the USA.<sup>1–4</sup> One in nine hospitalized adults has SUD.<sup>5</sup> Most hospitalized patients with SUD are not engaged in addiction care or seeking treatment at admission<sup>6,7</sup>; yet hospitalization is a critical touchpoint to engage and intervene with people with SUD.<sup>8,9</sup> Hospital-based SUD care can improve patient and provider experience,<sup>10,11</sup> increase trust in hospital physicians,<sup>12</sup> increase adoption of evidence-based treatment,<sup>13</sup> increase post-hospital SUD treatment engagement,<sup>7,14</sup> reduce substance use severity,<sup>14,15</sup> reduce death,<sup>16</sup> and transform health systems to be more healing for people who use drugs.<sup>11</sup> Despite its effectiveness, few hospitals offer evidence-based SUD care.<sup>6</sup>

The opioid crisis has spurred new efforts to address SUD in hospitals, propagating new care models, often without formal guidance. While there is growing consensus that all hospitals must be able to provide a basic level of SUD care, in reality, hospitals have widely varied readiness to embrace SUD care, expertise, resources, and needs. To date, there is no framework that categorizes, compares, and contrasts hospital-based addiction care models. This limits clinicians and policy-makers' ability to select approaches. It also poses a barrier to understanding effectiveness of various approaches and to informing best practice guidelines, because of the heterogeneity of the models being tested.

To fill this gap, we constructed a taxonomy of hospital-based addiction care models. Better classifying and characterizing these models can promote more rigorous evaluation and

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broader adoption and implementation of such models as clinicians, hospital leaders, payers, and policy-makers work to meet urgent and widespread clinical needs.

## METHODS

We constructed a taxonomy of hospital-based addiction care models in four steps: (1) generating a preliminary list of model types, including representative examples; (2) performing a scoping literature review; (3) conducting key informant interviews; and (4) analyzing findings to construct a taxonomy. The OHSU institutional review board approved this study (#00022957).

### Generating Preliminary List of Model Types

Authors generated an initial list of model types, including representative examples, based on our knowledge of the literature and the field. We identified an initial list based on models' adoption in current clinical practice, innovativeness, or focus on specific populations or settings. We reviewed published examples of representative models and abstracted data about staffing, clinical infrastructure, core clinical activities, educational and other activities, funding, service scope and size, and keyword search terms and MeSH headings to inform step 2. We also used this step to refine the interview guide and identify informants for step 3.

### Scoping Review

We conducted a scoping review using PRISMA-ScR reporting guidelines.<sup>17</sup> In July 2021, a trained medical librarian (TR) searched for studies describing hospital-based addiction care models published after 2000 without language restrictions in the MEDLINE, Embase, and PsycInfo databases using the Ovid search platform and the CINAHL databases using the Ebsco search platform (see [Appendix](#) for full search). We expanded our initial list of search terms by reviewing reference lists and tailored terms to each database using key words and control vocabulary.

Included studies described an SUD care model or clinical intervention serving adults ( $\geq 18$  years) in a US general hospital setting. We included models that addressed any SUD, but not those addressing tobacco use disorder alone. Excluded were studies published before 2000 because of the transformative impact of the Drug Addiction Treatment Act of 2000, which allowed buprenorphine to be administered outside of opioid treatment programs, including in hospitals.<sup>18</sup> Additional exclusion criteria were studies without an inpatient general hospital component (e.g., Emergency Department only); that focused solely on screening or withdrawal management; that had no medical component (e.g., peer-only interventions); or were medication trials or guidelines only and did not describe a hospital-based delivery model or its outcome. Finally, we

excluded abstracts and titles without full text articles and studies not published in English.

We used Covidence software to conduct screening.<sup>19</sup> At least two authors reviewed each title and abstract for inclusion, and resolved any disagreements by consulting additional authors. Two authors (H. E., A. J.) reviewed each full text article and met to resolve disagreements. We added additional articles and gray literature identified from reference lists and key informant interviews. We did not register this protocol.

### Key Informant Interviews

We identified informants based on the literature review and professional networks. We purposively selected informants across diverse regions, organizations, and professional backgrounds with experience leading, implementing, evaluating, and practicing hospital-based addiction care, recruiting informants who could represent diverse model types, including published and unpublished models. We used the Consolidated Framework for Implementation Research to create a semi-structured interview guide.<sup>20</sup> We conducted interviews via videoconference. One interviewer (H. E.) conducted individual interviews (and one two-person interview) and one researcher (A. J.) took detailed field notes. We asked participants to describe hospital-based addiction care models they have seen in practice and to specify key components, perceived strengths and limitations, and implementation considerations. We presented patient scenarios to clarify model details and distinguishing features. We recruited informants until we reached saturation and had clearly defined model components and distinguishing features.

### Analysis of Findings to Construct a Taxonomy

We conducted a content analysis of informant interviews based on model components of interest, including target patient population, staffing, core clinical activities, efforts to direct system-change, and necessary resources. The research team (H. E., A. J., N. K., A. P., J. M.) met regularly to discuss findings from the scoping review and interviews, and formed definitions of models' fundamental parameters and characteristics, which led to a final taxonomy. Model definitions emphasized essential elements and distinguishing features as described by informants and the literature. We aimed to create meaningful categories with defined minimum criteria that reflect current practice. If manuscripts did not fit into our categories because they had some but not all elements of a given model type, we grouped them with the model where they met all minimum criteria.

## RESULTS

Searches identified 2,849 unique abstracts. Of these, we reviewed 280 full text articles, 75 of which met inclusion criteria. We identified an additional 8 references from reference lists and informant interviews. We identified 4 gray

Table 1 Sources of hospital-based addiction care models

Model	Published literature	Gray literature	Key informant interview
<b>Addiction consult models</b>			
Interprofessional addiction consult service	Reports with multiple ACS sites <sup>21–25</sup> Boston Medical Center <sup>26–31</sup> Massachusetts General Hospital <sup>14,32–35</sup> New York City Hospital + Health Systems <sup>36</sup> Oregon Health & Science University <sup>7,8,10,11,12,13,15,37–42</sup> Rush (Chicago) SUI <sup>43–45</sup> University of California San Francisco <sup>46</sup> University of Colorado <sup>47</sup> University of Maryland <sup>48–50</sup> Yale University <sup>51</sup> Unspecified site <sup>52,53</sup>	Allegheny Health Network <sup>54</sup>	✓
Psychiatry consult liaison service	Brigham and Women's Hospital (Boston) <sup>55–58</sup> Montefiore (Bronx) <sup>59,60</sup> University of California Davis <sup>61</sup> University of California Los Angeles <sup>62</sup> University of Hawaii <sup>63</sup> University of Minnesota <sup>64</sup> University of Texas San Antonio <sup>65</sup> Yale University <sup>66</sup> York Hospital, PA <sup>67</sup> Unspecified site <sup>62,68</sup>	Brigham and Women's Hospital (Boston) <sup>69</sup>	✓
Individual consultant	Aurora St. Luke's, Milwaukee <sup>70</sup> Harborview, Seattle <sup>71,72</sup> University of Alabama at Birmingham <sup>73–75</sup> University of Kentucky <sup>76,77</sup> Washington University St Louis <sup>78–80</sup> University of Wisconsin <sup>81</sup>		✓
<b>Practice-based models</b>			
Hospital-based opioid treatment (HBOT)	CA Bridge (multiple hospitals) <sup>82</sup> Concord, NH <sup>83</sup> BI Deaconess, Boston <sup>84</sup> Duke University <sup>85</sup> Johns Hopkins <sup>86</sup> Lehigh Valley <sup>87</sup> Maryland <sup>88</sup> Rutgers <sup>89</sup> University of California San Francisco <sup>90</sup> University of Louisville <sup>91</sup> University of Miami <sup>92</sup> University of Texas at Austin <sup>93,94</sup> University of California San Francisco <sup>96</sup>	CA Bridge (multiple hospitals) <sup>95</sup>	✓
Hospital-based alcohol treatment			✓
<b>In-reach models</b>			
Community-based in-reach	Boston Medical Center <sup>97</sup>	Boulder Care <sup>98</sup>	✓
<b>Multiple model types</b>	N/A <sup>99,100</sup>		

literature sources. The literature flow diagram (Appendix) summarizes search results and the study selection process. Table 1 summarizes final sources.

We interviewed 15 informants (13 individual and one two-person interview) between June and October 2021. Because physicians led most published models, most informants were physicians. Informants included experts with experience across wide-ranging disciplines, practice settings, and geographic regions (Table 2).

We identified six distinct hospital-based addiction care models. Those classified as addiction consult models include (1) interprofessional addiction consult services (ACSSs), (2) psychiatry consult liaison (PCL) services, and (3) individual consultant models. Those classified as practice-based models, wherein general hospital staff integrate addiction care into usual practice, include: (4) hospital-based opioid treatment (HBOT) and (5) hospital-based alcohol treatment (HBAT). The final type was

(6) community-based in-reach, wherein community providers deliver care. Models vary in their target patient population, staffing, and core clinical and systems change activities.

Table 3 defines each model's fundamental components. In practice, models may include additional components. For example, while not all PCL services offer medication for OUD, some do. Further, models may deliver core clinical activities differently and to varied degrees. For example, an ACS may arrange for a hospital-based peer to accompany patients to follow-up appointments, whereas a practice-based model might schedule an appointment; however, both meet the criteria for providing post-discharge treatment pathways.

Table 4 describes how models deliver various components. Below, we summarize the six model types, comparing and contrasting model strengths, limitations, and implementation considerations.

Table 2 Key informant participants

Key informants (n=15)	N (%)
<b>Profession (n=15)</b>	
Physician	12 (80)
Advanced practice provider	1 (7)
Peer support specialist	1 (7)
Healthcare technology CEO	1 (7)
<b>Medical specialty* (n=13)</b>	
Addiction medicine	7 (46)
Hospital medicine	6 (40)
Addiction psychiatry	2 (15)
Family medicine	2 (15)
Infectious diseases	2 (15)
General internal medicine	2 (15)
<b>Primary practice setting (n=15)</b>	
Academic medical center	8 (53)
Telehealth	2 (13)
Community-based organization	2 (13)
Veterans Affairs hospital	1 (7)
Community hospital	1 (7)
Community clinic	1 (7)
<b>US geographical region (n=15)</b>	
West	8 (53)
Northeast	2 (13)
Midwest	2 (13)
Southwest	2 (13)
Southeast	1 (7)

\*Categories not mutually exclusive

### Addiction Consult Models

**Interprofessional Addiction Consult Services** include comprehensive care from an expert addiction provider, a dedicated coordinator (e.g., social work or case manager), and staff focused on patient engagement (e.g., peers), and often other roles including nurses or pharmacists.<sup>21,36,37,43,46,48</sup> ACSs

work with patients with any substance type and all stages of change. ACSs address broad patient complexity, including polysubstance use, serious medical illness (e.g., end of life care), complex medical decision making (e.g., valve surgery, transplant<sup>101</sup>), and complex behavioral issues (e.g., active substance use during admission). ACSs provide comprehensive assessments<sup>102</sup> and care includes an explicit focus on patient engagement and harm reduction tailored to patient priorities and risks.<sup>103</sup> ACSs typically promote staff and trainee education and hospital culture change<sup>11</sup> (e.g., leading hospital-wide stigma reduction efforts). Further, ACSs can serve as a platform for population health improvement efforts<sup>101</sup> and respond to emerging needs such as COVID.<sup>22,38</sup> ACSs do not necessarily include psychiatry expertise and may be less prepared to provide comprehensive care for patients with co-occurring psychiatric illness than PCL. Several informants described ACS partnering with PCL to address this gap, and some ACSs include addiction psychiatrists within their multidisciplinary teams. Informants stressed that ACS' ability to support post-hospital treatment linkages depends on community resources; some ACSs have developed new treatment pathways<sup>8</sup> and/or partnered to expand community access (e.g., developed bridge clinics).<sup>32,104</sup>

Informants noted ACS implementation considerations related to staffing, resources, and funding. Lack of qualified addiction providers can be a significant obstacle to initiating or scaling up ACS.<sup>105</sup> One hospital addressed this gap by training hospitalists in addiction medicine, protecting their time, and encouraging them to pursue board certification while

Table 3 Fundamental components for each model, including target patient population, required staffing, and core clinical and systems change activities

	Any SUD/ polysUD	Any stage of change (pre-contemplative to active)	expert addiction medicine provider (e.g. MD, NP)	expert psychiatric provider	coordinator (e.g. SW, CM, navigator)	peers or other staff focused on patient engagement	hospital champion (with buy-in w/ or w/o DUD)	community partner(s)	withdrawal mgt	SUD dx/assessment	patient engagement	MOUD / MAUD initiation	harm reduction	co-manage complex psychiatric needs	address social determinants of health	provide comprehensive dx/change planning	staff / trainee education	hospital policies, order sets	population level advocacy within hospital systems
	Target pop'n	Key Staff roles					Core clinical activities					Systems change							
<i>Consult Models</i>																			
<b>Interprofessional Addiction Consult Service (ACS):</b> provides comprehensive SUD care, regardless of substance type or readiness to change																			
	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
<b>Psychiatry Consult Liaison (PCL) Service:</b> Addresses SUD and co-occurring psychiatric needs.																			
	+	+		+															
<b>Individual Consultant:</b> care from individual Board certified addiction medicine physician																			
	+	+	+																
<i>Practice Based Models</i>																			
<b>Hospital Based Opioid Treatment (HBOT):</b> Primary team (e.g. hospitalist) or specialist (e.g. infectious disease) offer MOUD and post-hospital referral																			
					+						+								+
<b>Hospital Based Alcohol Treatment (HBAT):</b> Primary team (e.g. hospitalist) or specialist (e.g. hepatologist) offer medication for alcohol use disorder																			
					+						+								+
<i>In-Reach Models</i>																			
<b>Community-based medical providers</b> reach in to hospital provide remote (phone/ video) MOUD with community referral after discharge.																			
																			+
<small>                     OUD = opioid use disorder; AUD = alcohol use disorder; SUD = substance use disorder; MOUD = medication for opioid use disorder; MAUD = medication for alcohol use disorder. DC = discharge. MD = Medical doctor; NP = Nurse Practitioner; SW = social worker; CM = case manager;                 </small>																			

Table 4 Taxonomy: model descriptions

Addiction consult models	Target patient population	Staffing	Core clinical activities	Systems change activities
<p><b>Interprofessional addiction consult service (ACS):</b> Provides comprehensive care for people SUD. Educates staff and trainees. Creates hospital and health system-level change.</p>	Any substance, any readiness for change	<p>Team-based care that, at minimum, includes (1) medical provider (addiction physician or advanced practice practitioner), (2) dedicated social worker or case manager with addictions expertise.</p> <p>Often includes others, including peers, navigators, nurses, pharmacists</p> <p>Care is typically delivered in-person, though some telehealth ACS exist. Staff may have longitudinal relationship with patients over multiple admissions and across varied stages of change.</p> <p>Staff have dedicated time and funding, which may include come from hospital, grants, and billing revenue.</p>	<p>Provide comprehensive SUD assessment and diagnosis (e.g., DSM-5, ASAM assessments)</p> <p>Identify and treat withdrawal (including polysubstance)</p> <p>Offer evidence-based treatment with medications (e.g., methadone, buprenorphine, acamprosate); provide buprenorphine at discharge</p> <p>Provide supported pathways to various community SUD services (e.g., opioid treatment programs, harm reduction services, residential programs).</p> <p>Explicit engagement efforts (e.g., peers)</p> <p>Emphasize trauma-informed care and harm reduction.</p> <p>Support complex acute medical needs (e.g., pain)</p> <p>Advocate for patients to receive needed care (e.g., valve replacement surgery, hepatitis treatment)</p> <p>Provide early comprehensive discharge planning that address social determinants of health.</p>	<p>Widespread hospital staff education (bedside and didactics), often addressing stigma</p> <p>Include trainees (e.g., fellow, resident, interdisciplinary students).</p> <p>Improve hospital practices (e.g., endocarditis care) and policies (e.g., active use)</p> <p>Lead large scale quality improvement efforts, including responding to emerging needs (e.g., COVID, changes in drug supply)</p>
<p><b>Psychiatry consult liaison service (PCL):</b> Typically focuses on addressing SUD and co-occurring psychiatric needs. Not all offer MOUD or MAUD.</p>	Patients with co-occurring SUD and other mental health condition.	<p>Typically includes psychiatrist (general or addiction psychiatry) and a psychiatric social worker who is familiar with local mental health resources.</p> <p>Staff have dedicated time/funding; typically on site and in person. Staff typically funded by hospital and billing revenue.</p>	<p>Comprehensive psychiatric diagnosis (e.g., DSM-5)</p> <p>May offer motivational interviewing or behavioral therapies</p> <p>Psychiatric medication management; <i>though some do not offer MOUD.</i></p> <p>Make recommendations for post-hospital treatment setting (e.g., detoxification, community dual diagnosis treatment); less likely than ACS to have established community partnerships and supported treatment pathways.</p>	Rare; not explicit focus of model.
<p><b>Individual consultant:</b></p>	All patients, regardless of interest in changing use, substance type, or interest in a particular treatment	<p>Addiction physician (backgrounds vary, include psychiatry, toxicology, internal medicine/family medicine)</p> <p>Typically funded through billing revenue, sometimes with additional grant or hospital funding.</p> <p>May partner with other disciplines (e.g., infectious</p>	<p>Diagnose and treat SUD. Identify and treat withdrawal.</p> <p>Offer evidence-based medication for all SUD and provide bridge buprenorphine prescription at discharge.</p> <p>Sometimes partner with other disciplines to guide hospital care (e.g., multidisciplinary endocarditis management).</p>	May develop order sets, protocols, and general provider education materials.

(continued on next page)

Table 4. (continued)

Addiction consult models	Target patient population	Staffing	Core clinical activities	Systems change activities
		disease consultants) to address specific disease conditions (e.g., endocarditis).	Usually partner with general hospital staff (e.g., unit social worker) who may make treatment referrals.	
		Does not include a team member whose primary focus is engagement (such as peers or social workers).		
<b>Practice-based models</b>	Target patient population	Staffing	Core clinical activities and notable features	Systems change activities
<b>Hospital-based opioid treatment (HBOT):</b> Primary team (e.g., hospitalist) or specialist consultant (e.g., infectious disease provider) offer medication for opioid use disorder as part of their standard practice.	Patients with OUD interested in medication treatment.	Requires general hospital providers (e.g., hospitalists, residents) or subspecialists with buprenorphine waiver.  Some HBOT models have additional supports such as dedicated navigator.  Staff often connected with formal and informal mentoring, warm lines, and other training/clinical supports.  Typically no dedicated funding.	Offer MOUD (buprenorphine; may or may not also offer methadone, naltrexone intramuscular).  Some offer naloxone kits and overdose education.  Refer to post-hospital OUD treatment, including prescription for buprenorphine at discharge.  Typically model does not address co-occurring pain, complex clinical decision-making (e.g. assessing appropriateness for surgery) or explicit efforts around motivational enhancement or patient engagement.	Prescribers commonly rely on buprenorphine and/or methadone protocols/order sets and policies.
<b>Hospital-based alcohol treatment (HBAT):</b> Primary team or specialist consultant (e.g., hepatology) offer medication for alcohol use disorder as part of standard practice.	Patients with AUD interested in medication treatment.	Care delivered by general hospital providers (e.g., hospitalists, residents) or subspecialists as part of their usual care. Example of RN-driven HBAT.  Typically no dedicated funding.	Offer medication for alcohol use disorder (e.g., naltrexone, acamprosate) in hospital.  Refer to post-hospital AUD treatment, typically through primary care medication based treatment and/or recommending fellowship resources (e.g., alcoholics anonymous).	May include order sets and protocols to guide care.
<b>In-reach models</b>	Target patient population	Staffing	Core clinical activities and notable features	Systems change activities
<b>Community-based provider in-reach</b> provides remote support to initiate or sustain MOUD during admission.	Patients interested in initiating MOUD or already on MOUD at time of admission	Typically, community medical providers with buprenorphine waiver (e.g., primary care or specialty addictions providers).  Example of RN-based in-reach with community nurse who is connected to outpatient substance use treatment programs.  Staff are not formal part of hospital care teams.  Typically no dedicated funding and may be difficult for providers to bill encounters if not credentialed at hospital.  Typically providers are local clinicians, though telehealth opportunity exists.	General hospital providers contact community providers who may provide brief assessment (typically by phone or video).  Offer guidance to primary teams re initiation and provision of MOUD.  For buprenorphine, typically offer bridge prescription and follow up appointment in their ambulatory practice at discharge.  Staff typically do not document in the hospital record.	N/A; focus is direct patient contact with referral after discharge.

fulfilling their ACS roles.<sup>47</sup> Several informants discussed the potential for telehealth to address staffing shortages, including existing or planned tele-ACS that includes addiction physicians, peers, and coordinators. Informants described potential for tele-ACS in rural settings where ACS could be deployed regionally as an extension of an existing ACS. Another common ACS challenge is funding non-revenue generating staff (e.g., peers).<sup>23</sup> Informants described pursuing grant funding, demonstrating length of stay and quality benefits, and aligning efforts with hospital priorities as strategies for supporting and sustaining ACS.

**Psychiatry Consult Liaison Services** provide expert management of patients with complex psychiatric illness, often including SUD. PCLs are staffed by psychiatrists and frequently include a social worker or psychologist with expert knowledge of community mental health resources.<sup>55,59,61,62,64,106</sup> Commonly, PCLs have a diagnostic focus, and provide psychiatric medication management (e.g., for psychosis or depression) and behavioral interventions, including motivational interviewing and cognitive behavioral therapies.<sup>66,106</sup> In academic settings, medical trainees are often integral members of the PCL team.

Informants and literature support that historically, many PCLs have not included SUD in their primary scope, and not all PCLs offer medication for opioid use disorder (MOUD).<sup>55,59,106</sup> Informants felt that this can occur because PCLs may be under-staffed, or that some psychiatrists have limited training in addiction and MOUD. Compared to ACSs, PCLs focus less on acute medical and surgical complications of SUD (e.g., pain, infectious complications of SUD).<sup>107</sup> Informants noted that PCL may have clearer connections to community mental health and less comprehensive pathways to community SUD services than ACS.

In the **individual consultant model**, a single physician with board certification in addiction offers consultation that includes acute medical needs such as withdrawal and MOUD and/or medication for alcohol use disorder (MAUD) initiation.<sup>81</sup> Physicians may draw from multiple disciplines (e.g., internal medicine, toxicology, psychiatry), and they may partner with specialty teams for specific health conditions or populations.<sup>70,71,76,81,108</sup> Typically, individual consultants partner with general hospital staff (e.g., social workers, discharge planners) to support post-hospital treatment referrals.

Informants described one advantage of the individual consultant model is feasibility; it is less resource intensive than ACS, and physician billing can help finance service delivery. Many informants described that the individual consultant can be a stepping stone to developing a full ACS. Informants highlighted that without dedicated interdisciplinary staff, individual consultants may be less able to engage pre-contemplative, non-treatment seeking patients; address comprehensive complex discharge needs; and fully address social determinants of health. Individual consultants also typically have other clinical commitments (e.g., outpatient practice) that compete for their attention to hospitalized patients. Others noted inefficient use of consultants' time spent coordinating care that non-physician staff with SUD expertise could address. Informants also noted that unless

the consultant has a psychiatry background, the model has a less robust focus on behavioral health than does PCL.

### Practice based models utilize general hospital staff and do not rely on expert addiction consultants

In **Hospital-Based Opioid Treatment**, generalists (e.g., hospitalists) or non-addiction specialists (e.g., infectious diseases) integrate MOUD as part of routine hospital care.<sup>84–86,92,93</sup> Informants emphasized that necessary components for HBOT implementation include medical providers with basic MOUD knowledge and a Drug Enforcement Agency waiver to prescribe buprenorphine at discharge,<sup>18</sup> availability of MOUD on hospital formularies, and hospital policies that support MOUD. Many HBOT programs rely on standard protocols and order sets.<sup>83</sup> Informants noted that successful HBOT may rely on a strong clinical champion to garner hospital support, lead staff education, and drive quality improvement. Commonly, champions are hospital-based physicians who volunteer or have a small amount of protected time for program start-up. HBOT tends to focus on motivated patients who want MOUD, and this model does not generally incorporate motivational interviewing or other engagement strategies (e.g., peers). While HBOT can include protocol-driven naloxone prescribing, it does not typically include the broader range of harm reduction services common in ACS (e.g., tailored safer use education, fentanyl test strips). Increasingly, however, infectious disease physicians are addressing SUD-related population health gaps and expanding their scope of practice to include buprenorphine and infection-focused harm reduction education.<sup>84,92</sup> While most HBOT models are physician-driven, examples of pharmacist-led HBOT also exist.<sup>89</sup>

Informants noted HBOT advantages over ACS include lower costs, normalizing MOUD delivery like any other medication, and scalability to hospitals lacking local addiction expertise. Informants noted that many HBOT champions seek training and mentoring through local,<sup>87</sup> regional,<sup>109</sup> and national outlets.<sup>99</sup> One notable example of highly structured and intensive implementation support is the CA Bridge program, which has expanded HBOT statewide by supporting local hospital champions with intensive HBOT technical assistance and training, and by funding navigators.<sup>82,95</sup>

Informants described that HBOT has limited ability to perform formal OUD assessments, manage complex SUD (e.g., polysubstance, acute pain) or advocacy (e.g., cardiac valve surgery), and risks methadone or buprenorphine dosing errors. Many felt that HBOT may be a first step toward building an ACS, and HBOT can integrate more comprehensive supports. For example, one volunteer HBOT team partners with pharmacy, palliative care, and chaplaincy to expand their service scope.<sup>93</sup>

While most practice-based models focused on opioids, there are examples of **Hospital-Based Alcohol Treatment (HBAT)** that integrate medications for alcohol use disorder (MAUD) as part of routine hospital care.<sup>96</sup> Informants hypothesized that because alcohol is legal and less stigmatized, and

because MAUD has few side effects or risks, MAUD adoption may be easier and require less support from a clinical champion. Informants noted examples of nurse-led HBAT, where dedicated nurses make protocol-guided MAUD recommendations and make post-hospital treatment referrals.

## In-reach

**Community-Based In-Reach** Though not well captured in the literature, informants described examples of community-based providers from primary care or specialty addiction care “reaching in” to offer hospital-based MOUD and follow-up. Informants noted that in-reach can support hospitalists who lack buprenorphine training or licensing,<sup>18</sup> and may include MOUD continuation or initiation. In one published example, a community-based nurse came in to the hospital and supported methadone linkage and treatment linkage.<sup>97</sup> In-reach requires little or no hospital financial investment, and community providers typically volunteer their time without billing an inpatient visit. In the examples we learned of—unlike ACS or individual consultant models—in-reach focuses on OUD, lacks capacity to support polysubstance use or complex medical or behavioral health needs, and focuses on patients with high treatment-readiness. Informants noted flexibility—including telehealth potential—as a model strength. Informants noted that in hospitals with no addiction expertise, in-reach could provide individual staff education and patient-level advocacy. Informants noted for the model to work, hospital providers have to recognize OUD and contact in-reach providers, which may fall through with high census or staff turnover. They also noted that insurance barriers can interfere with treatment linkage (e.g., if outpatient clinic does not accept all insurance), that there may be challenges if community providers are unable to obtain hospital credentials, that the intervention does not create systems change within hospitals, and that it depends on motivated outpatient providers willing to offer services for little-to-no reimbursement. Informants acknowledged a potential pitfall of hospital leaders thinking the model supports sufficient SUD care, where informants viewed this approach as a temporary solution to bigger need.

## DISCUSSION

Addressing SUD in US hospitals will require diverse approaches across many years. We constructed a taxonomy that includes the six models that are most commonly found in current practice. Summarizing the characteristics of these models provides a framework to guide the adoption, expansion, and evaluation of hospital-based addiction care across diverse hospital settings. This study builds on prior work which characterized the ACS model,<sup>21</sup> but did not contextualize it in a broader service delivery landscape or compared it to other hospital-based approaches addressing SUD.

The most comprehensive, intensive, and rigorously studied models are ACS, which manage high patient and system complexity. ACSs provide an important clinical, education, health system, and research platform. ACS, however, may not be feasible at all hospitals. PCLs are long-established services in many US hospitals, and offer unique strengths in their ability to address complex psychiatric needs. Though historically many have not addressed SUD as a central practice, they may be well positioned to expand their scope to include SUD and offer MOUD, MAUD, and community treatment referrals, much the way generalists have with HBOT/HBAT. The individual consultant model may be less resource intensive and easier to implement than ACS or PCL in settings with existing ambulatory addiction specialists. Further, they can serve as starting point on which to build more robust SUD services. Many ACSs started with an individual consultant and subsequently added broader supports including dedicated social workers, peers, and robust hospital-to-community pathways.

Practice-based models, HBOT and HBAT, are delivered by staff already involved in patients’ care who have expanded their scope to encompass MOUD and/or MAUD and post-hospital treatment linkage. These models often rely on protocols and order sets, and are not designed to manage complex SUD or co-occurring medical or behavioral health needs. Compared to addiction consult models, they are less resource intensive and may be more easily scaled-up. Community in-reach is the least intensive intervention, and may be well suited to hospitals with no internal champion or dedicated SUD resources.

While the taxonomy defines six unique models, models can co-exist or build on each other. For example, a large health system might deploy HBOT for patients interested in MOUD who have fewer psychosocial needs, while also offering an ACS for patients with complex withdrawal, polysubstance use, co-occurring pain, or complex illness such as endocarditis requiring valve replacement. Combining models this way may allow efficient resource allocation. Similarly, a rural hospital with little local addictions expertise could implement HBOT/HBAT and partner with telehealth addiction specialists to provide in-reach, affording patients MOUD/MAUD access during and after hospitalization, enriching community treatment options, and expanding access to addiction expertise among hospital staff. Conceptualizing hospital-based addiction care this way is similar to how palliative care has evolved. In many hospitals, generalists offer core palliative care elements such as basic code status discussions and symptom management, whereas specialists—often in interdisciplinary teams—support complex needs such as negotiating conflict within families, addressing existential distress, or managing refractory symptoms.<sup>110</sup>

Approaches combining SUD and infectious diseases care are emerging—particularly for people needing prolonged intravenous antibiotics.<sup>92,111</sup> These approaches span SUD models, including ACS, individual consult, and HBOT, and highlight opportunities for interprofessional team-based care that bridge hospital and community settings.<sup>73,76,77,108,112</sup> Though



primarily observed in infectious diseases, specialists in hepatology<sup>113</sup> or palliative care<sup>114,115</sup> could consider similar models.

While these hospital-based models have great promise for improving addiction care, all require access to post-discharge SUD services for long-term effectiveness. Hospitalization is an important touchpoint, but the benefits of hospital-based intervention will only be fully realized if patients can receive ongoing care. Community treatment offerings may be limited due to geography (such as rural settings or areas without access to methadone or harm reduction programs), patient characteristics (such as insurance coverage), and systemic barriers (such as discrimination based on race/ethnicity).<sup>116-124</sup>

Our study has potential limitations. First, we describe a representative taxonomy rather than an exhaustive list. Second, models may have overlapping characteristics and variable ways of delivering specific components that are adapted to local settings and resources. Third, there are no studies comparing outcomes of different models, which limits the ability to provide recommendations regarding model effectiveness. Future research should explore this. Fourth, some models may exist that are not described in the published literature. We tried to address this by using key informants, but it is possible that our taxonomy misses some models. Most informants are from Western USA, which may have biased their input to reflect regional practice. Finally, little evidence describes model sustainability and the policy context needed to support and spread models. This is also an area for future research.

## CONCLUSION

Hospital clinicians and administrators working to improve and expand addiction care need guidance on treatment models that best match local needs and resources. This taxonomy provides a set of models to consider, which can then be adapted and further developed in specific settings. For health services researchers, a taxonomy creates a framework to describe and compare interventions on implementation, effectiveness, and other outcomes. Finally, policy-makers can use a taxonomy to guide funding initiatives and generate guidelines and metrics that support SUD treatment standards across hospitals, measure hospital performance, and assess hospitals' ability to meet needs of people with SUD. Given the high prevalence, morbidity, mortality,<sup>125</sup> and cost of untreated SUD, all hospitals should be prepared to provide basic SUD care. This taxonomy can be the first step in developing a path toward broad adoption and implementation of hospital-based SUD care.

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