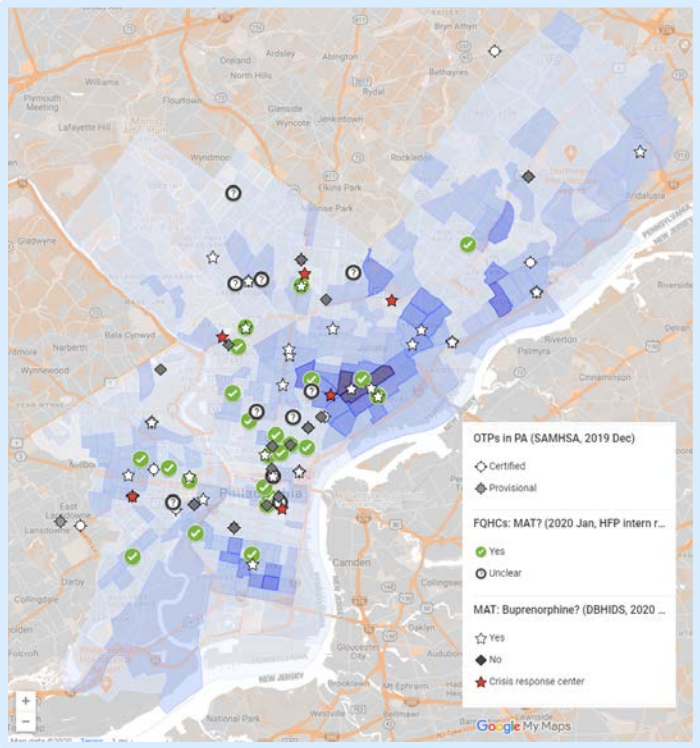
MATchmaker: Mapping buprenorphine access & need

§1. Executive Summary

Helpful information about medication-assisted treatment (MAT) in Philadelphia is scattered across diverse databases. This project created a more comprehensive reference by layering multiple sources into one Google Map that focuses especially on buprenorphine. In its current form, MATchmaker offers users a research tool:

- **To improve the accuracy and completeness of frequently used MAT directories**.

  Program layers (*shown here*) depict 80 MAT locations by combining three lists of Philadelphia sites. Prescriber layers (*shown later*) tentatively increase the subset of sites that offer buprenorphine from 37 to 55.



- **To identify areas that may have too little buprenorphine access relative to need**. Parts of Northeast and South Philadelphia are potentially underserved. Near-future work should evaluate the capacity of the relatively few programs in each area.
- **To identify medical providers who may benefit from support** to increase patient limits or pursue certification to prescribe buprenorphine.

Acronyms

DBHIDS: Department of Behavioral Health and Intellectual disAbility Services (Philadelphia)
DPH: Department of Public Health (Philadelphia)

FQHC: federally qualified health center
HFP: Health Federation of Philadelphia
MAT: medication-assisted treatment
NPI: National Provider Identifier
OTP: opioid treatment program
OUD: opioid use disorder

SAMHSA: Substance Abuse and Mental Health Services Administration
TAD: "Treatment Availability Database" for MAT in Philadelphia (5-page PDF by DBHIDS)

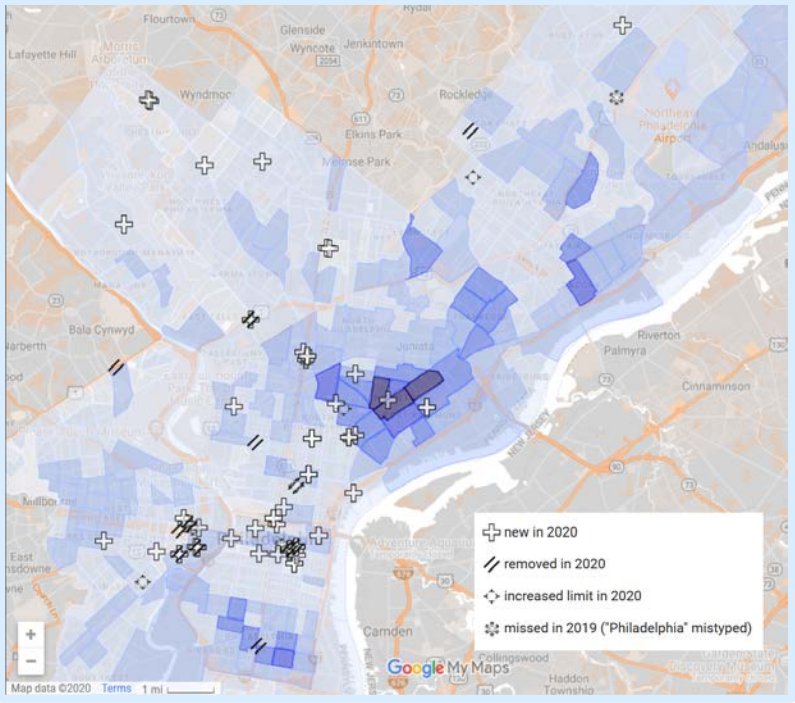
While robustly useful in its current form, MATchmaker is also a work in progress.

To help busy readers use this map effectively for your work on the front lines, green boxes highlight **quick tips & takeaways**.

To explain present limits and upcoming potential, blue **look-ahead** boxes note aspects for further development. (Key points are re-collected and synthesized in **§6**–**§7**.)

SAMHSA's Buprenorphine Practitioner Locator supplies MATchmaker's most valuable and problematic dataset:

- Mapping prescriber data can help substantially with **supporting medical providers** and **making the most of existing MAT resources**.
- But the landscape of buprenorphine practitioners in Philadelphia changes rapidly! At the end of 2019, SAMHSA's locator listed **407 individuals** for this city. By late March 2020, this list had gained **over 60 new entries** (and lost >10).



- In each case, the locator listed about **60% of the city's total** licensed practitioners. The other 40% are publicly invisible.
- Some of the 60% listings are unreliable. In checking just a subset so far (<90), we have found records that >15 individuals are no longer practicing in the city (one is under arrest with his medical license suspended), plus >10 outdated or residential addresses to re-map to current practice sites.
- To make MATchmaker shareable as a pilot tool ASAP, we plan to finish **cross-checking providers' data for current accuracy** and update the map within **May 2020** for review by interested stakeholders.

§2. Contributors & Project Context

Team 8, a collection of mostly former strangers, came together in February–March 2020 for a seven-week "data hackathon" convened to help with the opioid crisis in our city. We are grateful to the following groups, and especially the individuals who contributed *foundational research*.

- Organizers: **Code for Philly, DataPhilly, R Ladies Philly, the Philly Data Jawn**
- Partners: **Health Federation of Philadelphia, Prevention Point, the City of Philadelphia**
- Sponsors: **AT&T, CompassRed**
- Fellow hackathon participants

For further details, see the event's GitHub page and other teams' projects. Partner presentations by **Teams 2, 4, 6, 7, and 11** are also available in the video link below.

Team 8

For **questions** about MATchmaker, please email any or all of us. To review our hackathon presentation from **17 March 2020**, see: slides and/or video (cued to our segment of 15 min + 10 min Q&A). This written report includes further research and analysis.

Informational **updates** from programs or practitioners represented on this map—and **ideas or requests** about making MATchmaker more useful to people providing or supporting services—are heartily welcome!

David Bowden (*dbowden88@gmail.com*) is a Lecturer in International Relations at Penn where he teaches courses on research methods. He was drawn to this project by a desire to apply his skills to a problem closer to home. He works primarily in R, but also used this project as an opportunity to learn some Python.

Yuxin Chen is a Data Scientist at Vanguard with a PhD in Applied Mathematics from Northwestern University. She was drawn to this hackathon by her interest in contributing to health care issues. For this project she mapped data using Python.

Josephine Dru (*jdru@alumni.nd.edu*) loves interdisciplinary collaborations, research, UI/UX, and cats. Having squandered entire weeks on e-games during seasons of stress, she believes in diverse strategies and multiple second chances to fight our addictions. Her top tools for this project were Excel, GIMP, and Google Suite. She is studying Data Analytics with Springboard.

Holly Giang is a Philadelphia native passionate about connecting and mobilizing assets for building strong and resilient communities. She was drawn to this hackathon by her interest in civic tech and the organizers' vision for bringing neighbors together to work on an issue that profoundly affects communities across the country.

Becca Nock (*beccanock@gmail.com*) is the Manager of Data Analytics at HealthVerity and a registered nurse. She previously worked in community health and has past experience working with clients who are experiencing homelessness, are on MAT for opioid use disorders, or are in need of mental health support. Becca enjoys exploring lots of different health care data sources, and she was excited to work on a project where she could use her past clinical experience and current data skills.

Luke Shi is a Data Scientist at Colgate-Palmolive. His educational background spans materials science and wearable devices research to robotics, and his professional experience includes Machine Learning and Cloud Computing. For this project he mapped data using Python.

Dave Slinger (*david.s.slinger@gmail.com*) is a business analyst at Community Brands. He was particularly drawn to this hackathon as a number of members of his family have struggled with substance or opioid abuse issues. For this project he utilized Python, pandas, GeoPandas, and Jupyter notebooks. He is very interested in continuing to learn how to create customized maps.

Sam Tan (*stan1@haverford.edu*) is a prospective Physics and Computer Science major at Haverford College. He enjoys developing software and applications that process data and derive interdisciplinary insights. He was drawn to this project out of a desire to apply his skills for social good. Sam used Pandas, Google Cloud API, and Social Explorer extensively in this project.

Foundational research

In December 2019, **Marieke Jackson** (*mjackson@codeforphilly.org*), Code for Philly Co-Director, compiled the SAMHSA datasets for this hackathon. After downloading "providers" from the Buprenorphine Practitioner Locator, she collected "Bup.Rx" waiver limits by ***manually searching over 400 names*** using the Buprenorphine Pharmacy Lookup form. Throughout February and March 2020, she provided further crucial context and guidance.

In January 2020, **Anya Slizik**, Health Federation Intern, compiled the MAT-access research reflected in the FQHCs map layer by phoning the offices and/or consulting the websites of every health center with a Philadelphia address on the HFP webpage for Member Locations.

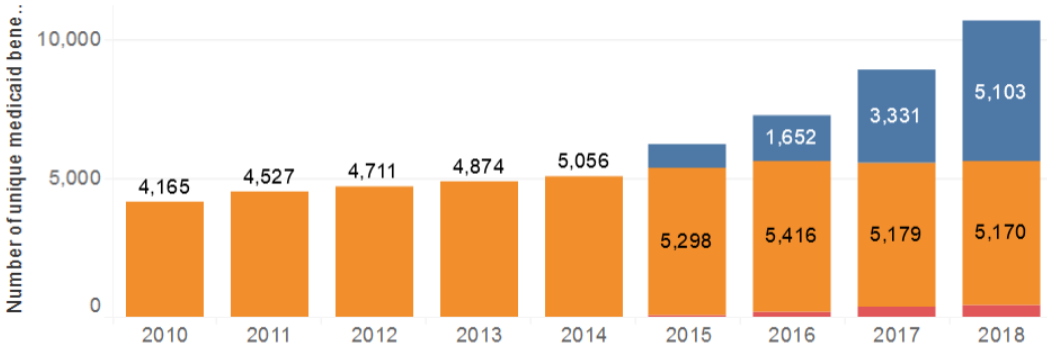
This project also benefited from valuable background orientation provided in February 2020 by **Catherine Abrams** (*cabrams@healthfederation.org*), Health Federation's Opioid Response Program Coordinator, and a substantial followup conversation in late March 2020 (after our presentation), plus insightful UX-research notes compiled in February by **Team 12**: Keon Monroe, Megan Yinh, Gabe Eipper, Matthew Rose, et al.

§3. Problem Definition

How does the **availability** of licensed buprenorphine prescribers and programs in Philadelphia compare with the geographic areas of greatest **need** for MAT? Prompted by Health Federation's request for this hackathon: "**Can you help us identify what [buprenorphine] access really looks like in [our city]?**", this research question is motivated by a striking contrast.

On the one hand, Philadelphia has made remarkable progress in initiatives to expand access to MAT, and especially buprenorphine, from 2015 through 2019. When presenting HFP's request during the hackathon orientation on 7 February 2020, Catherine Abrams noted:

- Pennsylvania has one of the highest totals for **waivered prescribers** in the nation.[1]
- DPH data for Philadelphia documents **steadily dramatic increases** in the number of **Medicaid beneficiaries** receiving buprenorphine (*blue*) every quarter and every year:



(from Tableau visualizations for "Medication Assisted Treatment" by DPH's Opioid Program, initially published 21 June 2018 and last updated 17 Oct 2019).

On the other hand, people who need buprenorphine for OUD are still not consistently getting access in our city:

- In early 2019, **waiver limits** and **staff turnover** created a notable shortage in Philadelphia prisons,[2] highlighting both the importance of provider capacity and its potential transience.
- Other bottleneck factors include **high prices** and mismatches between which form of buprenorphine is prescribed vs. supported by **insurance** and **pharmacies**.[3]

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[1] **6,595** at last count, according to SAMHSA's latest update on 9 March 2020, surpassed only by California (**10,975**), New York (**10,117**), and Massachusetts (**6,729**), and slightly ahead of Ohio (**6,005**).

[2] "Philly jails offer Suboxone but prescribing limits prevent treatment" (Jan 2019, WHYY); "Using opioids to treat addiction is considered the gold standard. So why aren't more doctors prescribing them?" (Feb 2019, *Inquirer*).

[3] "This addiction treatment medicine is often sold on the streets—and may be preventing overdoses" (Feb 2020, *Inquirer*); "Getting on board Philly's buprenorphine bus" (Mar 2019, WHYY).

How might mapping resources help to close this gap further?

Access involves multiple factors—including reliable information about them all!

For people who want MAT to help them overcome OUD, as well as service providers making referrals, our project engages three **potential barriers to practical access**:

a. **Location**: Is a suitable buprenorphine prescriber or program available nearby?
b. **Information**: Is it reasonably easy to find—and contact—such a provider?
c. **Capacity**: Does this provider have room to take on more patients?[4]

Other aspects of "suitable availability" are beyond the scope of our current project, but also need attention for holistic effective solutions:

d. **Affordability**
e. **Setting and level of care** (e.g. primary care, short- or long-term rehab, crisis response; inpatient, intensive outpatient, outpatient, etc.)
f. **Complementary services** (e.g. childcare, counseling, housing, translation, etc.)
g. **Hours & walk-in options**[5]
h. **Overcoming stigma**

Future map revisions might add **information** to help with some of these considerations, but we need further dialogue with stakeholders about what to include and how.

Resources for finding MAT in Philadelphia are abundant but confusing

Even with significant help from hackathon leaders and partner organizations, it took Team 8 many weeks to find and learn to navigate the **wealth of scattered resources** about MAT in Philadelphia. The difficulties we experienced recommend continuing work to connect key information with busy or lost users.

Appendix II collects key resources and data-finding tips for future reference. We hope the lessons we learned from trial and error can save you time!

[4] Without data for how many patient slots are currently ***in use*** (individually or in aggregate), we cannot answer this question for ***actual*** availability, but we can start by estimating ***total*** prescribing limits citywide and per region.

[5] "Though the city has worked to expand the availability of medications like buprenorphine, convincing people to enter treatment can be difficult. For people in active addiction, ***avoiding the pain of withdrawal is paramount, and can make long waits for a prescription or a spot in a treatment program impossible***." Quoted from "A mobile addiction treatment center battles stigma, shame, and rising overdoses in South Philly" (Dec 2019, *Inquirer*).

Keeping information current is a work in progress and a moving target

Rapid growth in MAT services makes it an ongoing—though welcome!—challenge to **update** information for accurate analyses and **disseminate** it effectively for referrals. Inconsistently reported address changes (practitioners leaving or moving to Philadelphia as well as moving to different or multiple sites within the city) further complicate accurate mapping.

§4. Tools & Data Sources

Faced with diverse datasets and frequent updates, we needed a tool to guide us in how to frame analyses and design a useable product.

§4.1. Google Maps offers notable advantages for both builders and users

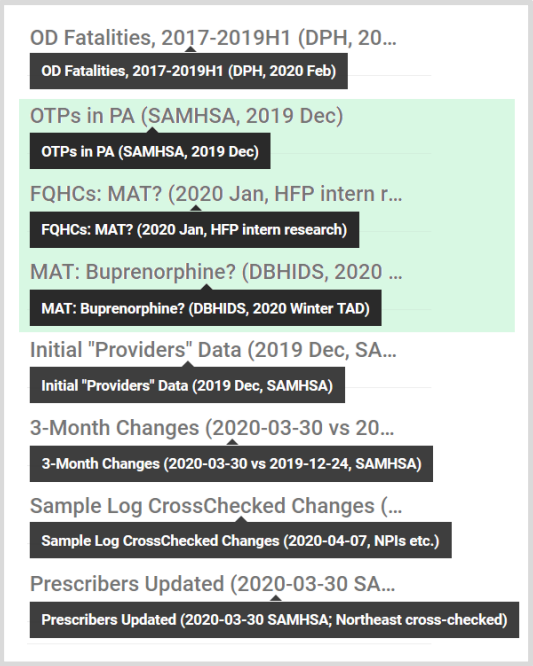
- Multiple layers make it easy to **centralize** and **compare** information.
- Its simple interface for translating data tables into map visuals makes it easy to **customize** and **update** layers.
- Its ability to handle both **geocodes** and **street addresses** (and even some **site names**), with higher than average tolerance for typos, makes it easy to map imperfect data—although fixing address typos and stylistic consistency still matters for precise mapping.
- It **runs stably and swiftly** on both computers and phones, almost never crashing.
- Its **navigation options** are intuitive or familiar to most. Users can easily:
    - **Choose which datasets to view**: Toggle layers on/off
    - **View MAT for the entire city**: Zoom out [–]
      (if map markers get too large, shrink browser view)
    - **Examine MAT for specific neighborhoods**: Zoom in [+]
    - **Check specifics**: Click any individual location marker to open its info-details window
    - **Find specifics**: Type text (*name, address, phone, etc.*) in Search bar

For further tips on how to navigate MATchmaker, see Appendix I.

Google Maps does not let users easily search and filter results for multiple features **in combination**. For our first attempt to address this limit, see **§7.2** (R Shiny demo).

§4.2. Layer titles identify the source and recency of mapped data

MATchmaker depicts three categories of information: (1) locations and volume of fatal **overdoses** (mapped as a proxy for need: §4.4); (2) locations and buprenorphine status of **programs** that offer MAT and/or qualify as FQHCs; (3) locations and waiver capacity for individual **practitioners** licensed to prescribe buprenorphine for OUD.



A custom Google Map can have up to ten layers. Depending on stakeholder priorities, 2020 updates could add an **all-sites** layer with updated information about types of MAT, layers marking prescribers by **speciality** (*family medicine, psychiatry, etc.*) and/or **affiliation** (*academic hospital system, private practice, OTP, etc.*), or other options.

Current program layers (*highlighted above*) depict data from the following sources:

Layer #2: SAMHSA, **OTPs in Pennsylvania** (24 Dec 2019)

Layer #3: HFP, **MAT at FQHCs in Philadelphia** (intern site report, 8 Jan–5 Feb 2020)

Layer #4: DBHIDS, **Buprenorphine & other MAT in Philadelphia** (TAD+map, 28 Feb 2020)

DBHIDS maintains an informative & user-friendly MAT directory for Philadelphia

The DBHIDS webpage for MAT explicitly notes that its data is neither comprehensive nor perfectly current and implies no endorsement:

> "Published availability is for informational purposes only, and is ***not inclusive of all providers, programs, or levels of care within the network***. Although this information is updated regularly, it is ***NOT real-time information***."

But its impressive usage statistics attest its helpfulness, and its updates are strikingly frequent. Introduced in January 2018, the DBHIDS Google Map for "Medication Assisted Treatment Facilities in Philadelphia" has now been viewed more than **22,000 times**, consistently averaging **over 24 views per day** throughout two-plus years. Since DBHIDS first started publishing its "Treatment Availability Database" (TAD) as a PDF in February 2019, the "Bed Availability" listings on page 5 have been updated *nearly every Monday, Wednesday, and Friday* for over a year (>10 updates per month, >160 times total so far).

MATchmaker maps **46 programs** in its DBHIDS layer:

- **37** listings from TAD pages 3–4 ("Winter 2020 Fact Sheet 2A")
- **6** "crisis response centers" from TAD page 2 ("Where to go for an assessment")
- **3** additional programs (two NET centers [19132; 19139] + Belmont Behavioral Hospital) that persist in the DBHIDS MAT map although they have disappeared from TAD

HFP's survey of FQHCs adds a substantial & complementary source for our city

In early 2020, HFP's intern compiled a report about MAT at FQHCs in Philadelphia by phoning each of **53 member centers** and/or checking their websites. According to her notes:

- **23** FQHCs offer MAT. For **13** of these locations, the report specified the number of buprenorphine providers (min 1, max 6), for a total of **37–39** individuals.
- **20** FQHCs do *not* offer MAT.
- **10** FQHCs yielded "no information" about whether MAT is available.

MATchmaker maps these sites with three different icons (as **Yes | No | Unclear** respectively).

SAMHSA's national databases offer phenomenal but dispersed reference options

In December 2019, SAMHSA's Opioid Treatment Program Directory listed **96 OTPs in Pennsylvania** as "Certified" or "Provisional", including **19 OTPs in Philadelphia** (all "Certified"). MATchmaker maps all 96. But this portal is only the tip of the iceberg among SAMHSA's dizzying array of reference tools for finding MAT and analyzing buprenorphine availability.

> Appendix II.1 identifies six distinct SAMHSA portals and explains their present or future relevance for MATchmaker.

Combining directories improves the range of information available per site

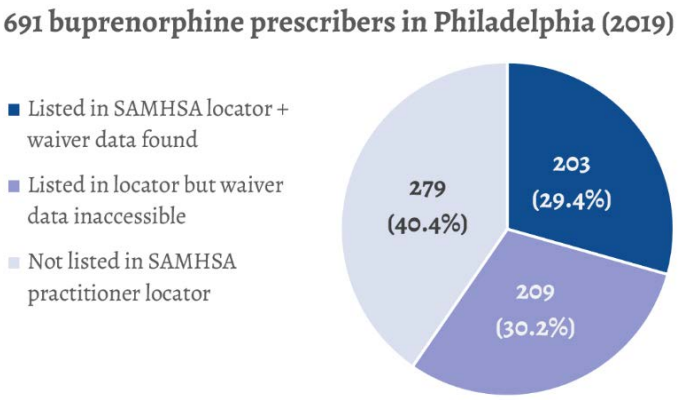
The DBHIDS map and HFP's directory list a ***webpage*** for each program. Very usefully, DBHIDS resources also specify the ***type(s) of MAT***, ***level(s) of care***, and ***complementary services*** (e.g. child-care, housing assistance, mental health treatment, etc.) offered at each location. Since early 2020, SAMHSA's OTP finder has added a field for each program's ***initial date of full certification***.

> The most important source to integrate further is SAMHSA's Behavioral Health Treatment Services Locator, which provides a wealth of useful details (including ***specific forms of buprenorphine prescribed***, levels of care, complementary services, payment options, and much more), encoded in both human- and machine-friendly forms. See Appendix II.3.

§4.3. Not all practitioner data is equally visible (nor current)

When using SAMHSA's data to analyze access, we need to recognize three major limits:

1. Only **about 60% of Philadelphia practitioners** are listed in public portals for finding buprenorphine prescribers.[6] (Since inclusion is voluntary, the other 40% presumably opted out.[7])
2. Waiver information in the Buprenorphine Pharmacy Lookup tool is publicly accessible for only **about half of all practitioners listed**. (Invisibility or visibility here is by coincidence rather than choice, based on shared vs. distinctive last names.)[8]



3. Approximately **25% of practitioner locations are inaccurate** due to typos, residential addresses, and outdated practice addresses. We have manually corrected 80–90 entries (*see* **§5.5** *below*) but well over 300 entries still need to be reviewed.

Accurate practitioner details affect all core project goals

Two target outcomes motivated the request for a clearer picture of buprenorphine access:

1. To "build on existing **referral pathways**" to "help sites that have a high volume of acute patients **find care**"
2. To identify "where **training efforts** should be concentrated in order to strengthen [service providers]' ability to respond to patients' needs"[9]

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[6] The estimate of "**about 60%**" compares SAMHSA listings with two key totals from city data, both reported in the article "As opioid crisis continues, Philly health systems expand access to buprenorphine" (*Inquirer*, 24 Feb 2020): In 2019 Philadelphia had **691 licensed practitioners**; in late 2019, SAMHSA listed approximately **412 practitioners**: 412/691 = **59.6%**. Within 2020, the city (in partnership with Einstein, Jefferson, Penn, and Temple) is licensing **400 more practitioners**; in 2020Q1, **62 new names** appeared in SAMHSA: 62/100 = **62%**.

[7] As SAMHSA's Practitioner Locator indicates: "this list only contains the contact information from practitioners who consent to release their practice information. Therefore, this list is not inclusive of all waivered practitioners." Its Treatment Locator appears to reflect the same preferences.

[8] Thanks to Marieke Jackson for explaining that a wildcard (any character plus asterisk) can be used to search the "DEA Registration Number" field. Unfortunately, without having the actual DEA number, over 50% of searches return a different provider than the one sought, based on last-name confusion.

[9] Catherine Abrams, HFP orientation for opioid hackathon, 7 February 2020.

To pursue these goals effectively, prescriber datasets must be cross-checked on three fronts:

A. WHO: **Delete** individuals who no longer practice in Philadelphia. **Add** individuals who recently moved here (to practice) and/or got licensed to prescribe buprenorphine.

B. WHERE: **Correct** address typos and entries that list residence rather than practice.[10]

C. CURRENT & POTENTIAL CAPACITY: Identify **patient limit** and **license anniversary** per prescriber, and (ideally) how many patients they have room to add.

These improvements are essential for:

- Mapping availability at ***actual*** locations (for finding care)
- Identifying practitioners' ***current*** affiliation (for offering support)
- Estimating capacity ***correctly*** (for comparing with need)

Steps A+B require time-intensive research, but once existing legacy entries are checked, incorporating new entries should be simpler since they will begin with current data.

Four checkpoints from SAMHSA's Buprenorphine Practitioner Locator (listings for "City: Philadelphia") illustrate the rate of change that motivates step A:

2019 Dec 24:	**407** individuals + **5** with data-entry variants ("Phila, Phildelphia," etc.)	
2020 Mar 14:	**+59, –10**	(less than 3 months later)—*mapped in Layers #6 and #8*
2020 Mar 30:	**+3, –3**	(just 2 weeks later)— *mapped in Layers #6 and #8*
2020 Apr 17:	**+6, –2**	(another 2½ weeks) —*not yet mapped*

Three of these minuses represent individuals who have moved elsewhere to practice. (Current SAMHSA and/or NPI data locates them in Florida, New Mexico, and South Carolina.) But the majority appear simply to have removed themselves from SAMHSA's public listings.

These minuses raise an important question for stakeholder input: How should we handle ***implied*** **privacy preferences** when updating MATchmaker?[11]

In early April we completed Step C to the extent possible with publicly accessible SAMHSA data.

MATchmaker now shows confirmed waiver data for about **30% of Philadelphia practitioners**.

Would DPH, DBHIDS, and/or HFP be able to share data on **waiver limits for the invisible 70%**? What about prescribers' **actual current usage** (occupied vs. open slots)?

[10] But retain record for HFP directory if practitioner listed residential address as first choice for *mailings*.

[11] These individuals are still findable via NPIs and, in some cases, SAMHSA's Buprenorphine Pharmacy Lookup, but no longer visible in SAMHSA's Buprenorphine Practitioner or Treatment Locators.

Cross-checked prescriber data produces better maps of where buprenorphine is available

Viewing prescriber locations (*dots*) on top of program layers (*white stars, black diamonds,* etc.) generates a richer picture. In future this combination may help answer questions such as:

- ☐ How many licensed prescribers [*of the 60% visible*] does each program have on staff?
- ☐ What is the total [*visible or minimum*] prescribing capacity per region?
- ☐ How many more sites offer buprenorphine than expected? Where are they?

Because SAMHSA directories contain practitioner typos and outdated locations, however, our current picture is actually **a confusing mix of useful vs. false information**.

The four prescriber layers in MATchmaker illustrate our progress in correcting these problems so far and offer samples of the payoffs that motivate us to complete the process.

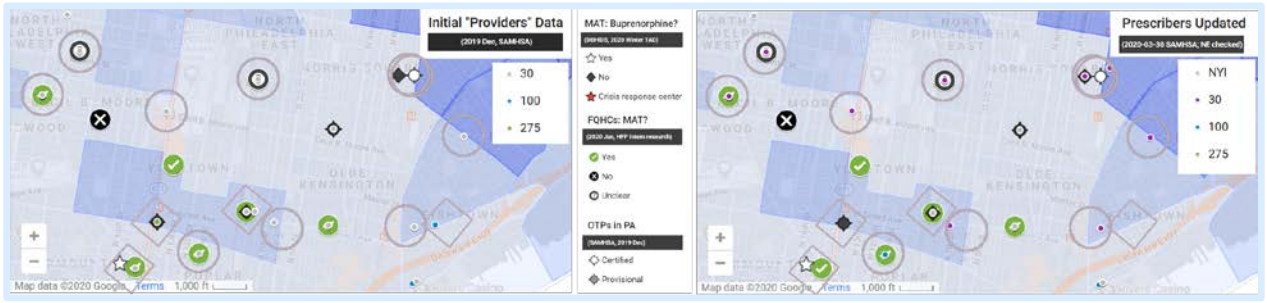
Layer #5: **Initial "providers"**—maps Dec 2019 SAMHSA dataset, supplied by hackathon leaders, which included waiver limits but used "30" as default for invisible entries too (*gray dots*)

Layer #6: **3-month changes**—depicts *plus & minus entries* from Dec 2019 to Mar 2020 SAMHSA

Layer #7: **Sample log for cross-checked changes**—tracks effects of applying Steps A+B to all practitioners listed for Northeast Philadelphia (*see* **§5.5** *for details*) plus 2020Q1 minuses and a few other addresses that initially failed to map due to data-entry problems

Layer #8: **Prescribers updated**—per Step C, confirms waiver limits of "30" for **145 practitioners** (*purple dots*) vs. "not yet identified" (NYI) for **251 others** (*gray dots*); incorporates updates from Layers #6–7 + retypes all addresses with consistent style (Appendix II.2)

In this **BEFORE | AFTER** comparison of **Layers #5 | #8** for a small area of North Philadelphia, *gray circles point out where updates* ***supply new data****, and gray diamonds show where they* ***correct false data***:

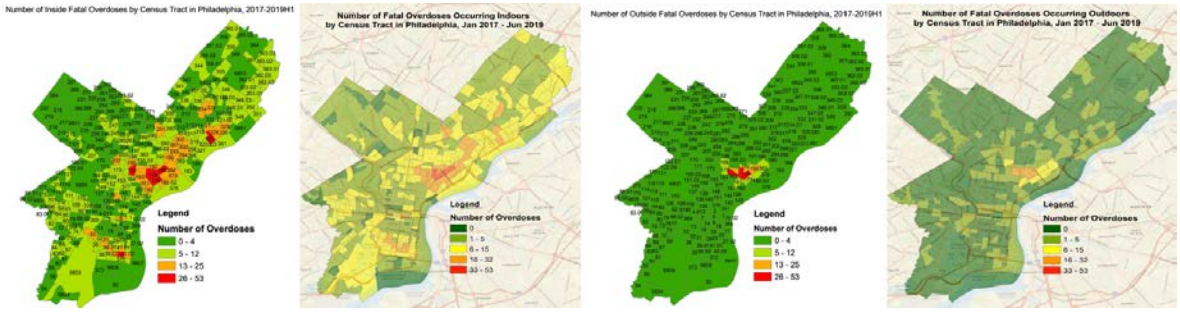


Within just 2 square miles, cross-checked data identifies prescribers at **2 locations** that previously showed none (including 1 site listed in TAD as offering no buprenorphine: Kensington Hospital) and confirms **9 instances** of 30-limit licenses plus **1 instance** of a 100-limit license. (These include prescribers at 4 FQHCs, 2 of which were previously "Unclear" about MAT.) Layer #8 also fixes **4 instances** of incorrect mapping from Layer #5 (each due to quirks in how practitioners listed their addresses in SAMHSA) for more accurate program matches (e.g. Westerhaus at HC #6).

§4.4. DPH provides an array of useful maps for assessing need

We have collected the four maps shown here, plus others discussed below (**§5.3**), in this reference PDF with page numbers and links to DPH sources.

In its February 2020 "Opioid Misuse and Overdose Report", DPH depicts **overdose fatalities** from 2017–2019H1 by **census tracts**. These paired maps distinguish whether fatal overdoses occurred **indoors** (*two on left*) or **outdoors** (*two on right*):

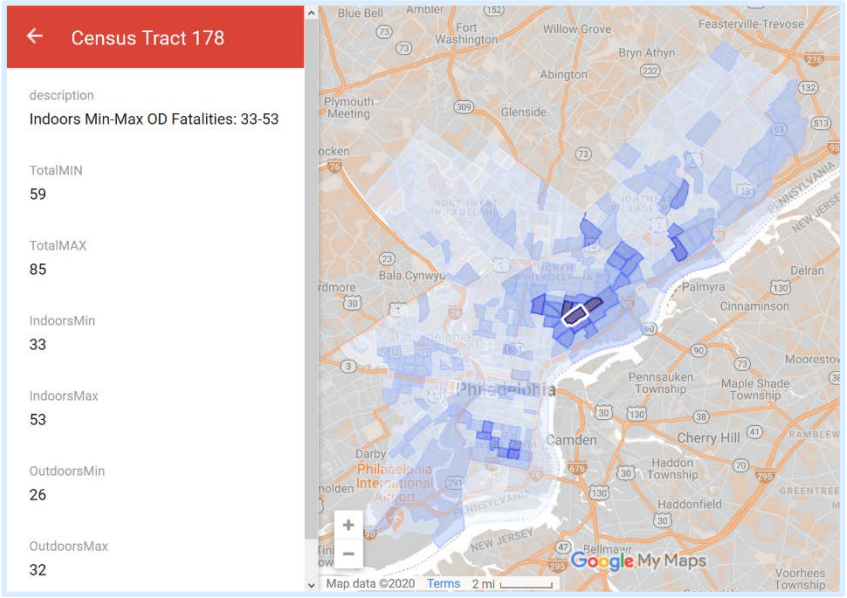


Two successive versions of this report **aggregated totals differently**:

Maps from February 13th and earlier (*white background*) used dark green for **0–4** deaths, then **5–12 | 13–25 | 26–53**.

Maps from February 26th (*beige background*) reserved dark green for **just 0 (zero)** deaths, then **1–5 | 6–15 | 16–32 | 33–53.**

Since these maps offer **better geographic specificity** than zip codes, MATchmaker merged their data to visualize indoor overdose fatalities in its blue base layer.[12] Combining two report versions narrowed some ranges. For example, the info-details window for census tract 178 (*right*) shows **33–53** indoor deaths plus **26–32** outdoor deaths for a total of **59–85** overdose fatalities.

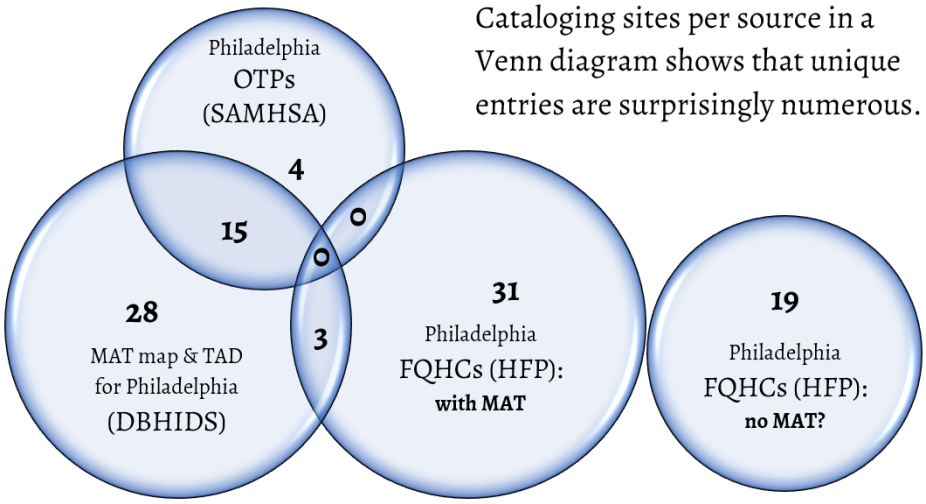


[12] We chose indoor fatalities as a proxy for **place of residence**, but outdoor fatalities are also listed in MATchmaker's data table, and we could readily recolor this layer to reflect total fatalities if stakeholders find that more helpful.

§5. Results

§5.1. Centralizing sources substantially improves MAT program counts

Bringing together three directories with fewer than 50 listings each produces a combined total of roughly **80 sites that offer MAT** in our city.



Cataloging sites per source in a Venn diagram shows that unique entries are surprisingly numerous.

Most overlaps (**15**) occur between the SAMHSA and DBHIDS datasets.

The DBHIDS TAD and HFP's list of FQHCs each include close to **30** MAT providers that do not appear in the other directories.

Preliminary location counts for buprenorphine & MAT in Philadelphia

Comparing program and prescriber layers in MATchmaker tentatively increases **buprenorphine site counts** from 37 to 55. The table below summarizes **BEFORE | AFTER** citywide totals.

In each pairing, the first number is based on explicit source notes about whether a program offers MAT in general and buprenorphine in particular. (NR = *"not reported" within the source cited*.)

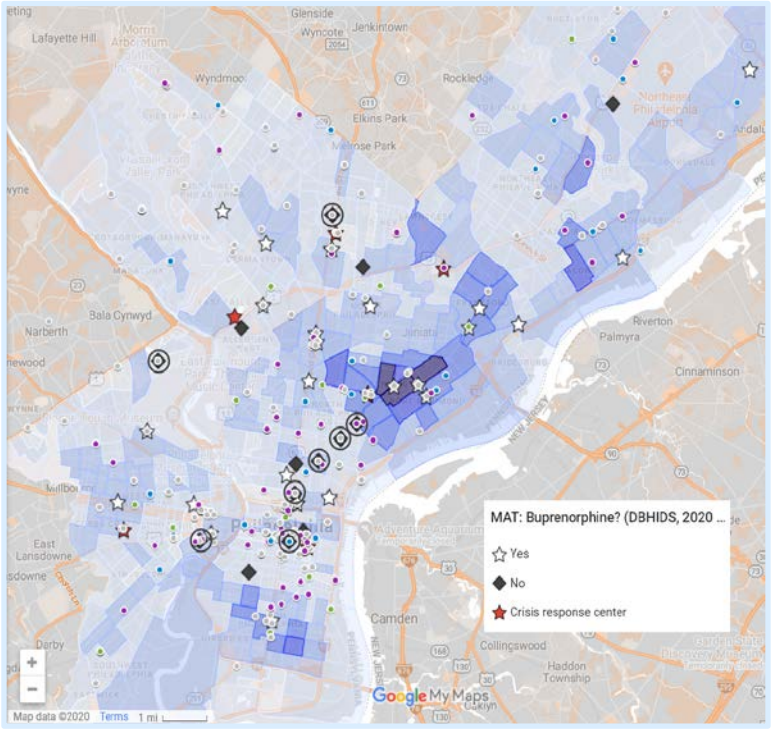
The second total ("##?") includes additional programs with one or more licensed **buprenorphine prescribers** listed at the same address (*see next page for map visuals*):

Source	Date (recency)	Listings with buprenorphine	Locations offering MAT
SAMHSA (OTPs)	**2019-12-24**	NR | 14?	19
DBHIDS (MAT map + TAD pp. 2–4)	**2020-02-28**	26 | 39?	46
HFP (intern research: FQHCs)	**2020-01-08 to 02-05**	13 | 26?	23 | 35
Combined: **MATchmaker**	**2020-03-17 to 03-31**	**37 | 55?**	**60 | 80**

§5.2. Mapping prescribers suggests updates for frequently used MAT finders

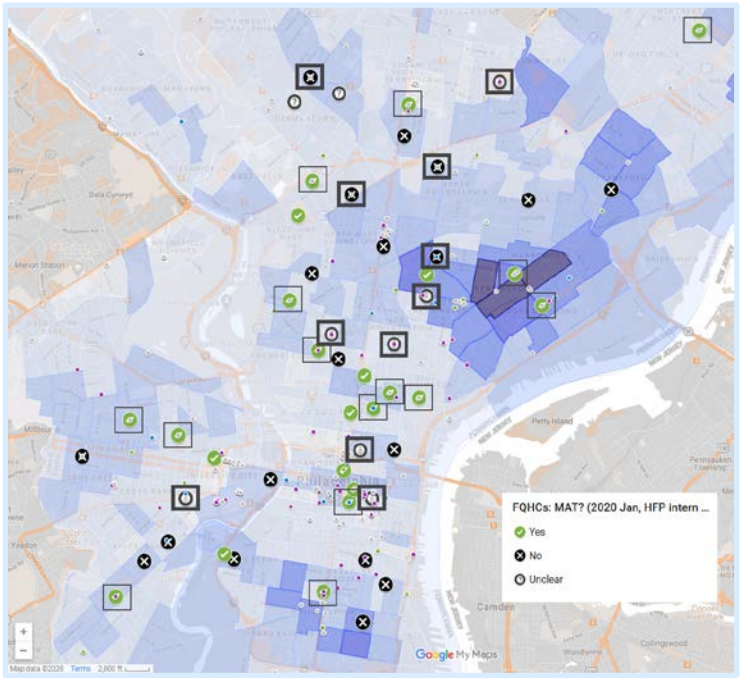
Buprenorphine in TAD

The online map and PDF directory (TAD) that DBHIDS provides for MAT in Philadelphia identifies **14 programs**—over one-third of all options listed—as offering ***only*** methadone and/or naltrexone (*black diamonds*). But according to SAMHSA's practitioner data, **at least 8 of these sites** have one or more licensed buprenorphine prescribers on staff (*diamonds overlaid with small dots, circled here*).



> If this information is verified as current, might it help to update details for TAD users?

MAT at FQHCs

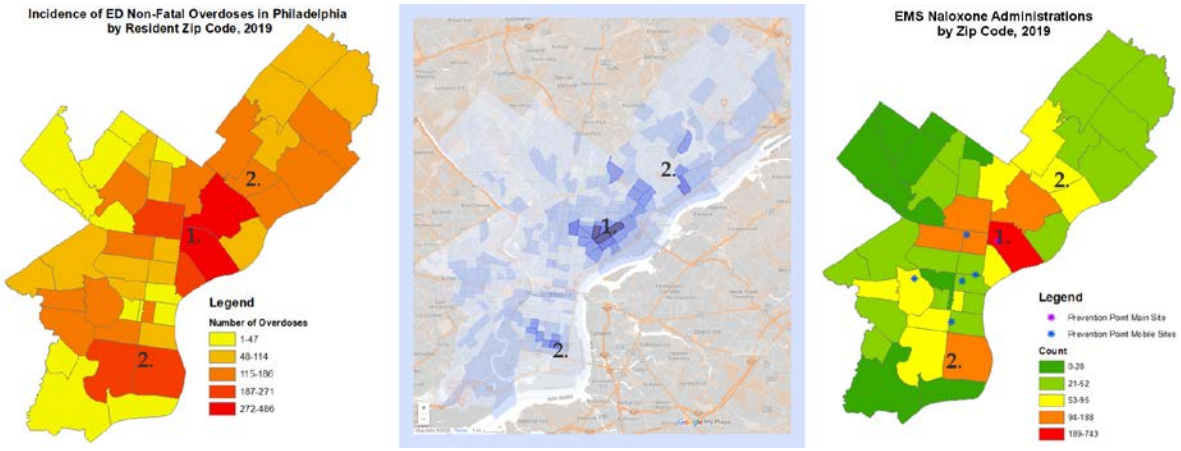


The same overlay of prescribers also advances the picture for MAT at **HFP member centers**. Building on January 2020 intern research, which identified 13 FQHCs as offering buprenorphine among 23 programs with some type of MAT (*green check-marks*), we now see **26 FQHCs with buprenorphine** (*sites boxed here*), raising the total to 34 programs offering some type of MAT.

> Once prescriber information is fully cross-checked, might an updated directory and/or revised map help with making referrals?

§5.3. Overdose incidents cluster in Kensington, South, and Northeast Philadelphia

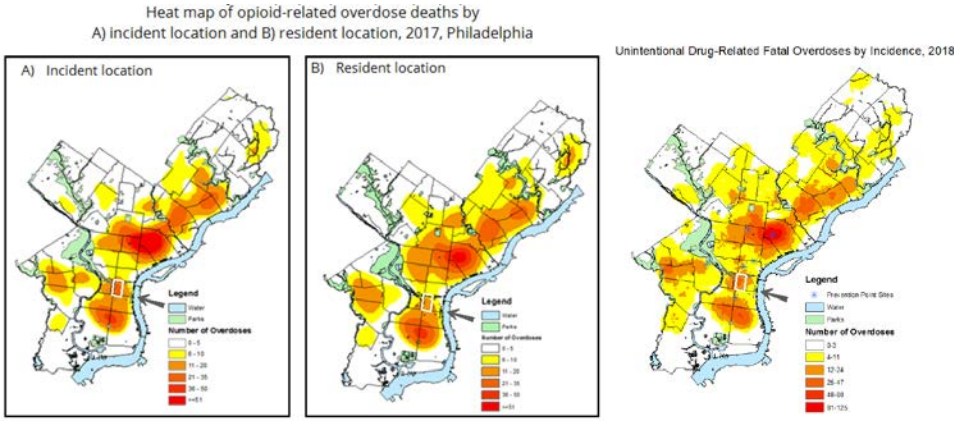
Viewed side-by-side with DPH maps for **non-fatal overdose emergency visits** and **EMS naloxone administrations** in 2019, our visualization agrees generally that areas of greatest need recur first around Kensington (**1**) and then in South and Near Northeast Philadelphia (**2**):



Census tracts offer a more localized view of where overdose events cluster within these regions:

- The areas of greatest need occur in **Kensington** and surrounding neighborhoods: **Port Richmond**, **Harrowgate**, **Fairhill**, and **West Kensington**.
- In Northeast Philadelphia, overdoses are especially numerous around **Tacony/Mayfair**, **Lawncrest**, **Lexington Park**, and **Frankford**.
- In South Philadelphia, opioid usage looks highest around **Lower Moyamensing**/ **Whitman**, **Point Breeze**, and **West Passyunk**.

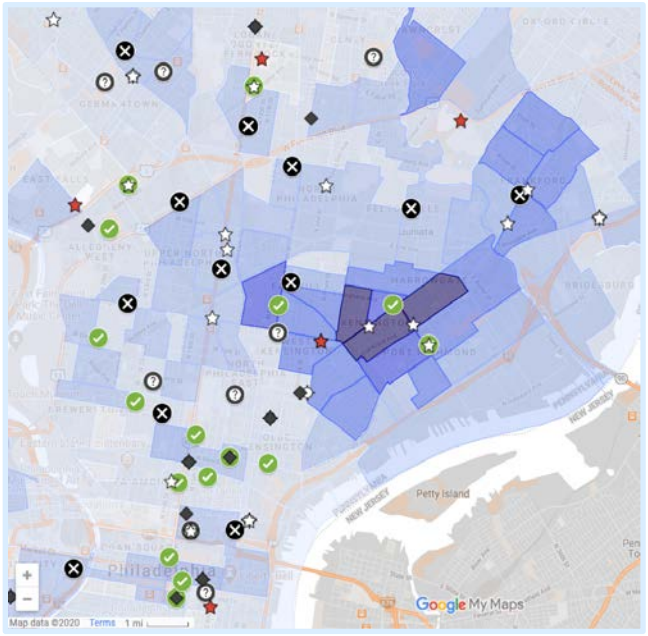
The small **Center City** zip code of **19102** near Love Park and City Hall (*tiny upright rectangle: yellow at right above, dark orange at left*) also has a high concentration of overdoses relative to land area. Although this region is harder to notice in our census-tracts visualization, DPH heat maps for 2017 and 2018 show that it was also a "hot spot" for overdose fatalities both years.[13]



[13] In our PDF of DPH selections, see pages 9 & 15 (of 16) for heat maps and pages 5 & 7 (of 16) for zip-code maps.

§5.4. Layering program directories offers a fuller picture of resources per region

Kensington and Center City have numerous sites for MAT and buprenorphine



Map visuals (*green checkmarks, white stars, black diamonds*) and preliminary distance analyses (Appendix III.2) both suggest that Philadelphia has done a good job of **strategically locating many MAT programs** in and near areas where the most overdoses occur (*darkest blue*).

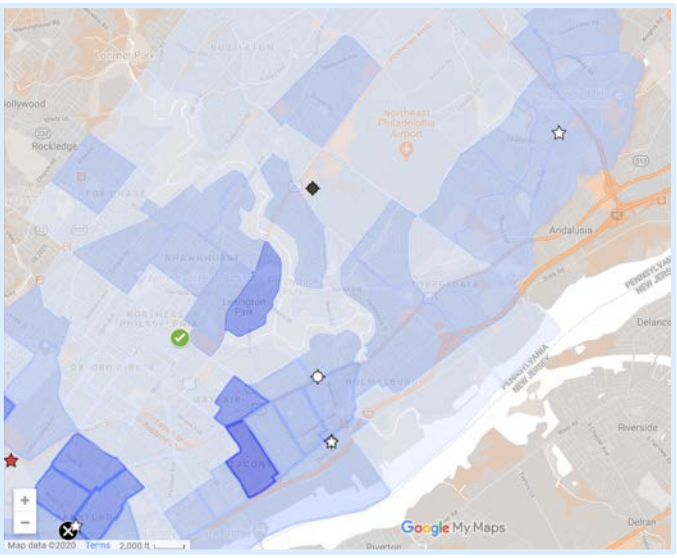
The presence of multiple sites does not, however, automatically guarantee adequate prescribing capacity.

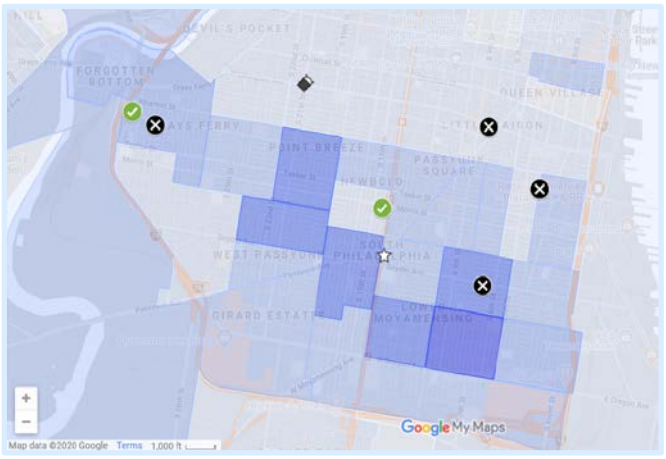
> Once practitioner data is fully checked, we may use the results to re-calculate distance and capacity estimates for this region and other areas of high need.

MAT options in other areas of need look far more limited

By contrast, several neighborhoods in Northeast and South Philadelphia (*darker blue areas*) are potentially underserved. Even when all program layers are viewed together, each has **very few nearby locations** that offer buprenorphine or other MAT relative to the amount of opioid use:

In Northeast Philadelphia near Tacony, the DBHIDS TAD lists only one location that offers buprenorphine (*white star*). HFP intern research identified HC #10 as an FQHC that offers MAT (*green checkmark*) but yielded no information about buprenorphine. Searching the health center address ("2230 Cottman") on our map identifies two licensed prescribers from the SAMHSA database at this location: *Daniel Chung, MD (Family Medicine)*, and *Sarah Messick, MD (Internal Medicine)*.





In South Philadelphia, the DBHIDS TAD again lists only one option for buprenorphine (*white star*). HFP research adds one FQHC: HC #2 (*green checkmark*). But there are three other FQHCs nearby that do not yet offer MAT (*black-&-white circled Xs*), plus one site that TAD lists as offering just methadone (*black diamond*). This program, Thomas Jefferson University's NARP, is also listed in SAMHSA; according to the Treatment Services Locator (search zip code 19146), this program *does* prescribe buprenorphine.

The preceding examples illustrate how combining SAMHSA, DBHIDS, and HFP directories can help with making the most of ***existing*** MAT resources.

Overdose data and preliminary distance analyses identify strategically located sites

But comparing the blue layer of overdose incidents with program maps also highlights strategically located sites that might benefit from support to ***add*** resources.

For example, in the regions just noted, we find:

- FQHCs that currently provide **no MAT**, such as Greater Philadelphia Health Action's several sites in South Philadelphia.
- MAT programs that offer methadone but **no buprenorphine**, such as Soar Corp and The Healing Way in Northeast Philadelphia.

In addition, preliminary distance calculations for TAD sites (Appendix III.2) highlight potentially isolated programs that *do* provide buprenorphine for especial attention:

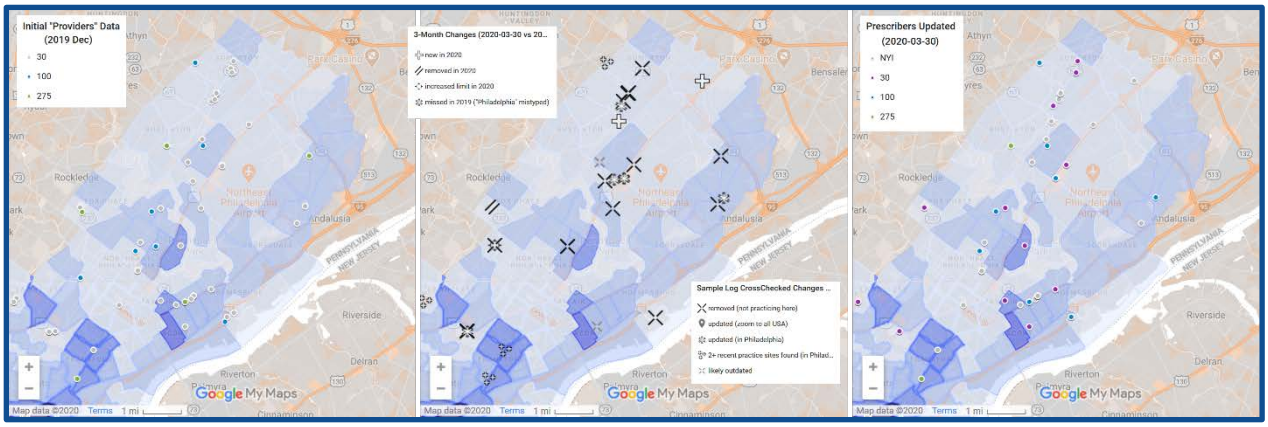
- **NET Centers 19136** in Northeast Philadelphia serves at least seven high-overdose tracts as their ***only*** nearby DBHIDS-listed option.
- **Wedge Medical Center 19148** in South Philadelphia serves at least six high-overdose tracts as their ***only*** nearby DBHIDS-listed option.

Key questions awaiting cross-checked practitioner data:

- ☐ Are there enough buprenorphine prescribers at these centers to meet nearby demand? What is their total prescribing capacity?
- ☐ Are there practitioners at these programs who would benefit from more support?
- ☐ Do these areas need more sites with licensed providers?

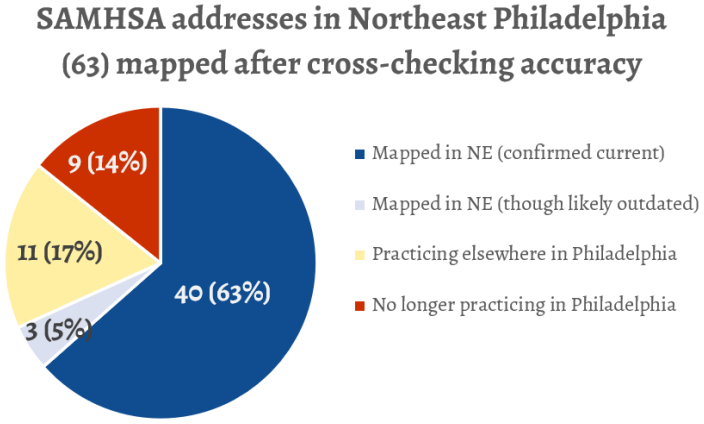
§5.5. Cross-checked data re-maps >25% of prescribers in Northeast Philadelphia

63 SAMHSA entries have zip codes in Northeast Philadelphia.[14] Updates from NPI records and (occasionally) other online data have shifted >**15%** of prescriber dots from their initial spots (*left*) to other locations in the city and removed **10%** from Philadelphia altogether (*center & right*):



Applying the process outlined in **§4.3** and Appendix II for cross-checking prescriber data to Northeast Philadelphia (NE) has:

- Confirmed **43 addresses** as the best available option to map (including 3 likely outdated entries[15]).
- Identified **11 individuals** as now practicing at a different location than their SAMHSA listing (though still in Philadelphia).[16]
- Clarified that another **9 individuals** no longer practice in Philadelphia (5 now work elsewhere in Pennsylvania, 3 in New Jersey, and 1 in New York).



This sampler shows why our preliminary estimates of prescriber capacity below are highly tentative until we have finished checking addresses for another >**300 practitioners**.

[14] 19111, 19114, 19115, 19116, 19120 (*shared with Northwest*), 19124 (*shared with Kensington*), 19135, 19136, 19149, 19152, 19154. See data_sources folder in project GitHub for zip codes reference visual and tables.

[15] Since neither NPI records nor other web resources revealed any viable option for relocating these practitioners, they are still mapped as listed.

[16] MATchmaker Layer #8 remaps 9 of these individuals accordingly (5 moved elsewhere within the Northeast); the other 2 were NE residents who already listed their actual practice address as a separate entry in SAMHSA.

§5.6. Tentative estimates and preliminary lists

What is Philadelphia's total buprenorphine-prescribing capacity?

Given current data limitations, the only estimate we can confidently advance is that the **62 prescribers** who obtained or updated licenses in 2020Q1 *and* agreed to list their information in SAMHSA's public locators increased city-wide capacity by at least **2,455** patients.[17]

The below summaries are highly speculative, not only because they only represent **about 60%** of licensed practitioners in the city,[18] but also because **10–20%** of these individuals may not actually practice in Philadelphia anymore:

Patient limit	Number of providers (SAMHSA, 2020-03-30)	% of confirmed | total listings	Prescribing capacity
30	138 (*purple dots*)	63% | 30%	4,140
100	52 (*blue dots*)	24% | 11%	5,200
275	29 (*green dots*)	13% | 7%	7,975
Confirmed:	**226**	**100% | 48%**	**17,315**
not yet identified (NYI)	**248** (*gray dots*)	**0 | 52%**	**7,260 – 19,130**

Low-end estimate: **24,575**.[19]

High-end estimate: **36,445**.[20]

In-between estimate: **31,940**.[21]

If we assume the same waiver proportions for the missing 40%, then these estimates translate to a city-wide capacity of roughly **41,000–60,000**, with an in-between figure around **53,000**.

This assumption might be flawed, however, if (for example) practitioners with limits of 30 are more likely to opt out of being listed in SAMHSA than practitioners with higher limits.

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[17] Multiplying [17, 5, 1, 39] individuals by prescribing limits of [30, 100, 275, NYI (default 30)].

[18] This table is a numerical representation of map Layer #8, with totals adjusted so that each prescriber with two location dots on the map is counted only once. For "only … about 60%", see §4.3 above.

[19] If *all* 239 providers whose patient limit is "*not yet identified*" in this project have prescribing limits of 30.

[20] If the invisible waivers match the visible ones in distribution: **63%** *30 | **24%** *100 | **13%** *275.

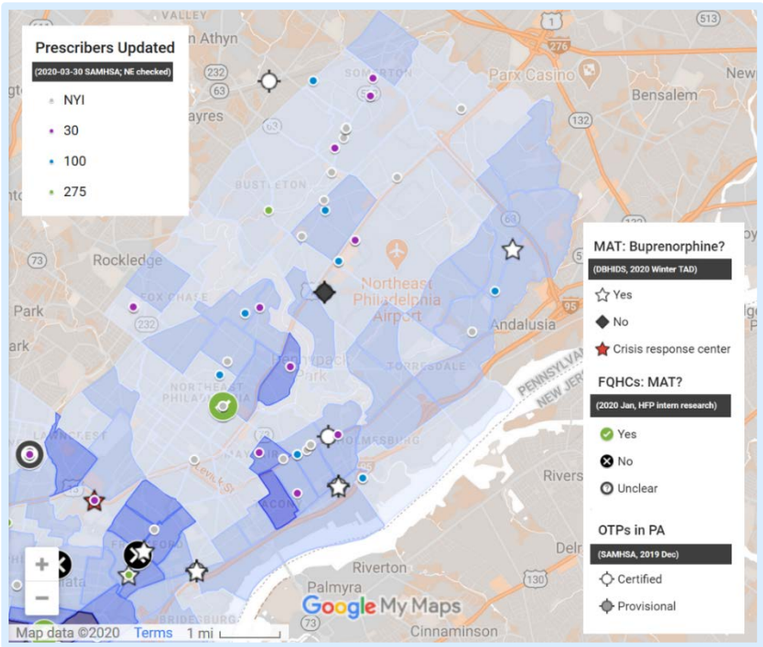
[21] If the invisible waivers match SAMHSA's nationwide statistics: **74%** *30 | **19%** *100 | **7%** *275.

MAT and buprenorphine in Northeast Philadelphia

There is a surprising amount of disagreement between programs and practitioners data for Northeast Philadelphia once the latter is cross-checked:

Although **5 listings in TAD** have **Yes** for buprenorphine (*white stars*), they collectively have only **1 prescriber** listed in SAMHSA's locators. By contrast, just **2 FQHC listings** (only one of which had confirmed any type of MAT) have **5 prescribers** listed.

Perhaps most concerning, **Friends Hospital** (identified in TAD as a crisis response center) appears to have lost most or all of its buprenorphine prescribers, with few or no visible replacements.



Site	Status in program layer(s)	Insights & questions raised by prescriber listings
Health Center #10	FQHC: **Yes** MAT (but no specifics)	**2 buprenorphine prescribers** (*gray dots on green checkmark*): **NYI, NYI**
PHMC: Rising Sun	FQHC: **Unclear** re: MAT	**3 buprenorphine prescribers** (*purple+ dots on b&w "?" circle*): **30, NYI, NYI**—at least 1 (Schofield) serves at all six PHMC sites
GPHA: Frankford Ave	FQHC: **No** MAT (*b&w X*)	**Candidate for adding service?** (*located close to next 3 sites, but they have few providers listed in area of high need*)
Wedge Medical Ctr, 19124 (*4243 Frankford Ave*)	TAD: **Yes** for buprenorphine, Temple TWO partner	1 prescriber listed (*green dot on white star*): **275**
NET Centers, 19124 (*4625 Frankford, 2nd Fl*)	TAD: **Yes** for buprenorphine	**Nothing visible** (*white star*): Are there prescribers from the 40% unlisted or is TAD information out of date?
NET Centers, 19137 (*2205 Bridge St*)	TAD: **Yes** for buprenorphine; SAMHSA: Certified OTP	**Nothing visible** (*white star*): Are there prescribers from the 40% unlisted or is TAD information out of date?
NET Centers, 19136 (*7250 State Rd*)	TAD: **Yes** for buprenorphine; SAMHSA: Certified OTP	**Nothing visible** (*white star*): Are there prescribers from the 40% unlisted or is TAD information out of date?
Merakey Behavioral Health, 19154	TAD: **Yes** for buprenorphine	**Nothing visible** (*white star*): Are there prescribers from the 40% unlisted or is TAD information out of date?
SOAR Corp	TAD: **No** for buprenorphine; SAMHSA: Certified OTP	**Nothing visible** (*black diamond*)
Friends Hospital	TAD: Crisis response center (*red star*)—no MAT specifics	**High attrition rate for buprenorphine prescribers**?—of 7 listed, at least 6 have left (according to other records)[22]
The Healing Way	SAMHSA: Certified OTP	**Nothing visible** (*spiky white circle*)

[22] **4 now practice elsewhere** according to NPI records (*Bolarinwa 2019 New Jersey, Esposito 2020 New York+, Garbely 2015 Wernersville, PA [vs. 2008 SAMHSA], Singh 2018 New York*), 2 names with outdated entries (last updated SAMHSA >10 years ago and NPI even earlier have **new locations in Google**: *Shack 2010* [100 East Lehigh Ave], *Melnick 2009* [New Jersey]), and **1 is unconfirmed** (*Lobach 2015*, no record on hospital website).

§6. Conclusions

Our project is named "MATchmaker" for several reasons

- It ***brings together data from four phenomenal and substantially independent sources*** to produce a fuller picture of where MAT, especially buprenorphine, may be available and to facilitate comparing where resources are located relative to need throughout Philadelphia.
- It analyzes these factors to help service providers such as HFP ***connect with individual buprenorphine prescribers to offer training and support***.
- Its ultimate aim is to help people grappling with OUD find (through referrers as well as directly) ***suitable matches with MAT programs and buprenorphine prescribers*** in our city.

Our pre-pilot map is both a robustly useful research tool and an intensive work in progress

The multi-layer Google Map introduced in our March 2020 presentation and analyzed in this report is a pre-pilot version. Section headings and green boxes throughout this report summarize key takeaways. Blue boxes explain project limits and upcoming potential.

Mapping availability can help with both finding and supporting services

- By combining site directories from **SAMHSA**, **DBHIDS**, and **HFP** in three distinct layers, MATchmaker depicts ***a more complete number and range of sites*** and centralizes access to ***relevant information about each*** program (Layers #2–#4).
- By mapping practitioner data on top of site data, MATchmaker greatly enriches the picture for availability by ***visualizing waiver capacity*** and ***tracking substantial increases*** in buprenorphine licensing from January–March 2020 (Layers #5–#8).

Mapping need enhances insights about where and how to offer support

- By superimposing this composite picture of MAT resources atop **DPH**'s maps for overdose fatalities from 2017–2019H1, MATchmaker makes it easier to identify both ***regions that may need more resources*** (**§5.3**) and ***strategically located sites*** to support or encourage in adding MAT capacity (**§5.4**).

Our pilot map will incorporate further improvements in both prescriber and program data

To refine this picture further and finalize a more widely shareable pilot map within May 2020, we plan to ***improve our datasets for MAT availability*** on two fronts:

1. Finish cross-checking buprenorphine practitioner details for current accuracy (per **§4.3** and Appendix II.2).
2. Ingest detailed program data from SAMHSA's Treatment Services Locator (see fields catalogued in Appendix II.3).

How to access publicly invisible data while protecting people's privacy?

If HFP, DBHIDS, DPH, and perhaps SAMHSA are able and willing to share publicly invisible details about key factors such as prescribing capacity for ~70% of Philadelphia practitioners, we would appreciate guidance on how to balance ***data completeness*** with ***practitioner privacy***. Similarly, we want to respect the privacy of individuals grappling with OUD while seeking fuller data about opioid and MAT usage.

Distinguishing accurate from outdated information will support target outcomes

Improving input data in these ways will allow us to ***run more systematic and reliable versions of analyses sampled in this report*** to help key stakeholders such as HFP and (hopefully) Prevention Point, DBHIDS, et al.:

- Update program listings in frequently used MAT finders.
- Identify sites with high turnover or attrition in buprenorphine practitioners on staff.
- Contact individual practitioners to offer training / support relevant to their prescribing limits and professional affiliations.
- Address gaps in practical access that involve a combination of factors.

We look forward to feedback and dialogue!

§7. Next Steps

Iterative engagement with the people this work aims to serve is essential for all of the below.

> Which options interest which potential partner(s): HFP? Prevention Point? DBHIDS? DPH? SAMHSA? Pennsylvania Pharmacists Association? Philadelphia's Project RIDE?

§7.1. Finish working out MATchmaker's ready potential

This section lists possibilities for analyzing existing project materials further and incorporating already collected data into current or new map layers.

Translate map layers into functional reference materials

- Produce a cross-checked **prescribers directory** for HFP to offer training and support. (For steps and resources, see **§4.3** and Appendix II.2.)
- Assemble a **combined sites directory**—and/or create a **resource finder** version of the current map—to help with MAT referrals in Philadelphia. Add data and features that help with referrals (like the *advanced search & filter demo* below); remove aspects that do not.

Examine need multidimensionally

- Analyze **location by season** for mobile sites (Appendix III.1).
- Provide updated **distance and capacity analyses** using the full set of sites and best updated prescriber data available (Appendix III.2).
- Engage **census data** on other relevant factors, such as health insurance and population density, for assessing need. Add map layers and/or collect figures from **DPH's zip-code maps** to compare need with capacity numerically (Appendix III.3).

§7.2. Stretch goals: Future Code for Philly projects?

Work with volunteers and stakeholders to update key information effectively

- Set up processes and templates to **update maps with relevant data** regularly and often.
    - As providers and programs need to be added or removed, we believe the map could be easily updated by a **trained person**. It would mostly involve learning how to edit the table used to generate the respective layer (Appendix I).
    - To simplify further, we could create a **Google Sheet** that could be exported to CSV.

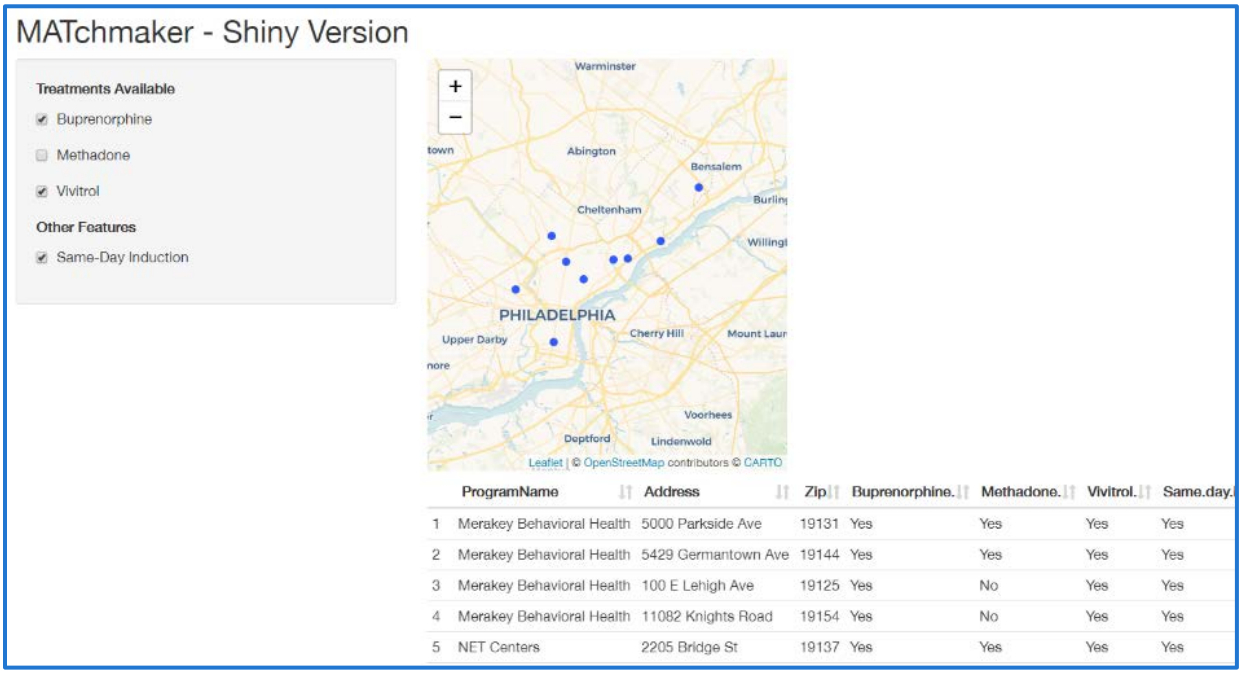
- Encourage and assist relevant stakeholders to **update their own information directly** (practice locations, waiver information, types of buprenorphine prescribed, open slots, etc.)
    - First choice: Given SAMHSA's oversight and DBHIDS's frequent local updates, would it be possible to coordinate with one or both in their **existing update channels** for practitioners and programs?
    - Second choice: What about creating a simple **Google Form** to support and extend existing coordination efforts in Philadelphia?[23]

Develop multi-attribute search & filter functions

A major advantage of Google Maps is the fact that it is **easy to use and update** (**§4.1**; Appendix I). However, its options for searching and filtering custom-mapped locations are limited.

Users can turn filters on and off for a **single** feature, for example to show only locations where buprenorphine is available. But there is no simple way to search for multiple attributes in **combination**, such as buprenorphine *and* same-day induction *and* Vivitrol.

If partner organizations would like fuller search-and-filter options, then developing a more advanced dashboard could be a good focus for a future Code for Philly project. We created this demo mockup using **R Shiny**, but a better hosting solution is needed for faster performance:



	ProgramName	Address	Zip	Buprenorphine.	Methadone.	Vivitrol.	Same.day.
1	Merakey Behavioral Health	5000 Parkside Ave	19131	Yes	Yes	Yes	Yes
2	Merakey Behavioral Health	5429 Germantown Ave	19144	Yes	Yes	Yes	Yes
3	Merakey Behavioral Health	100 E Lehigh Ave	19125	Yes	No	Yes	Yes
4	Merakey Behavioral Health	11082 Knights Road	19154	Yes	No	Yes	Yes
5	NET Centers	2205 Bridge St	19137	Yes	Yes	Yes	Yes

[23] Examples include Prevention Point's coordination with Pharmacy of America III near Kensington & Allegheny ("Getting on board Philly's buprenorphine bus") and Project RIDE in South Philadelphia (Twitter | Facebook).

Collect and map other relevant data?

- Research and map **pharmacies** in Philadelphia.[24]

  Where can someone go to fill a buprenorphine prescription? Most pharmacies do not carry every type of buprenorphine prescribed. Would it be helpful to collect and add details as another layer in this map, for easy comparison with locations of programs and prescribers?

  (*This idea was inspired by local journalism from 2019–2020 on bottlenecks to access.*[25])

- Map **bed availability** in Philadelphia.

  Further consultation with prospective users is needed, but the *tri-weekly updates by DBHIDS on page 5 of their TAD* offer a potential starting point both data- and process-wise.

  (*This idea was mentioned by Prevention Point in March 17th presentation Q&A via Zoom chat.*)

Share lessons with stakeholders elsewhere?

Could replicating this project, or applying some of its ideas beyond Philadelphia, improve **informational access to MAT resources** elsewhere? For example:

- In nearby areas of **New Jersey**?
  (per Prevention Point's experience of neighbors crossing the river for Philly services[26])
- In other parts of **Pennsylvania**?
  (per Governor Wolf's quarterly declarations of state emergency since early 2018)
- In other states where the opioids crisis is severe, such as **Delaware** or **West Virginia**?
  (per Team 6's analysis of CDC data on national overdose rates)

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[24] Recent poster topics for their 2020 conference show how the **Pennsylavania Pharmacists Association** is actively engaging the opioids crisis: (#9) "Exploring Pharmacists' Intention to Dispense Buprenorphine for Opioid Use Disorder" and (#3) "Creation of a Student Pharmacist Training Program to Reduce Opioid-Related Stigma" (Dec 2019/Jan 2020).

[25] See footnote 3 above, especially "Getting on board Philly's buprenorphine bus" (Mar 2019, WHYY).

[26] Prevention Point orientation for opioid hackathon, 7 February 2020.

Appendix I: How to work with Google Maps

Navigating MATchmaker: Two access modes offer distinct advantages

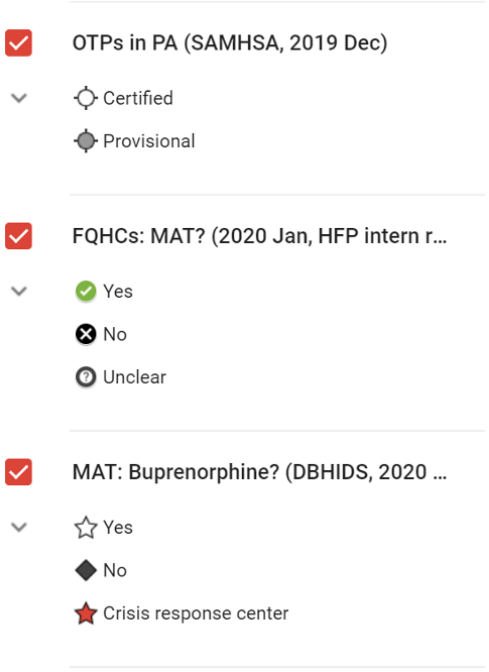
To **View** the map, anyone may use or share this link. This option is generally better for **checking individual location specifics**. The *info-details window* will appear next to the map (rather than on top of it). Also, Google automatically displays a *distance scale* for any zoom level.

To **display** a specific layer, click its checkbox (*red box in View = on*).
Click again to **hide** that layer (*blank box = off*). Click any map marker for site details.

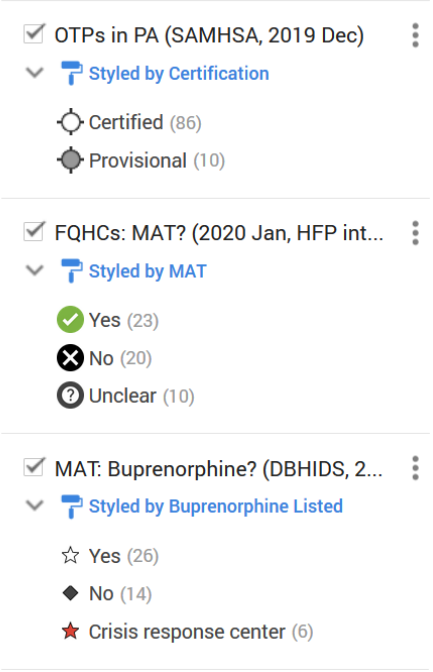
Edit access for the original map is limited to avoid accidentally deleting entire layers or other undesirable changes. But this mode offers some helpful functions for **exploring data patterns**, such as using the map legend to **count items by category**.

For example, in the "MAT: Buprenorphine? (DBHIDS…)" layer below, we can see that **26** sites (*white stars*) have "Yes" while **14** sites (*black diamonds*) have "No" for "Buprenorphine Listed":

Map legend in View mode



Map legend in Edit mode



To try **Edit** functions, create an independent **Copy** of the map in your own Google account:

To copy an existing map

1. Sign in to a Google account. Access the map you want to copy (e.g. MATchmaker).
2. In the red bar at upper left, click the **three vertical dots** next to the search icon:

In the dropdown menu that appears, choose **Copy map**. Name your copy whatever you wish and click **OK**.

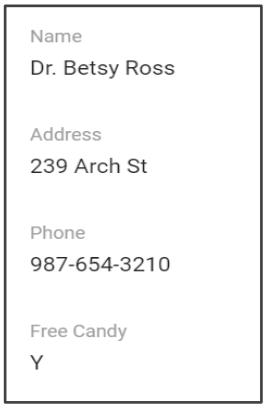
Any changes you make will be saved in your copy, but will not affect the original copy. You can also use Edit mode in your copy to explore data with map tools.

To prepare data for mapping

Organize and save your data as a spreadsheet in Google Sheets or Excel. It should look something like this:

Name	Address	Phone	Free Candy
Dr. Benjamin Franklin	520 Chestnut St	123-456-7890	Y
Dr. Betsy Ross	239 Arch St	987-654-3210	Y
The William Penn Clinic	1400 JFK Blvd	111-111-1111	N

(If using Excel, click File > Save As and make sure your filetype is either .xlsx or .csv. If you use an .xlsx workbook, Google will map only the first tab.)[27]



- Each **row** should contain one location that you wish to map = one marker on the map. You can have up to 2,000 rows.
- Each **column** should contain one attribute or data field = one field in your info window (*example at right*), and/or a category you want to use to filter your map legend (*next page*).
- The **first row** should contain the names of the data fields.

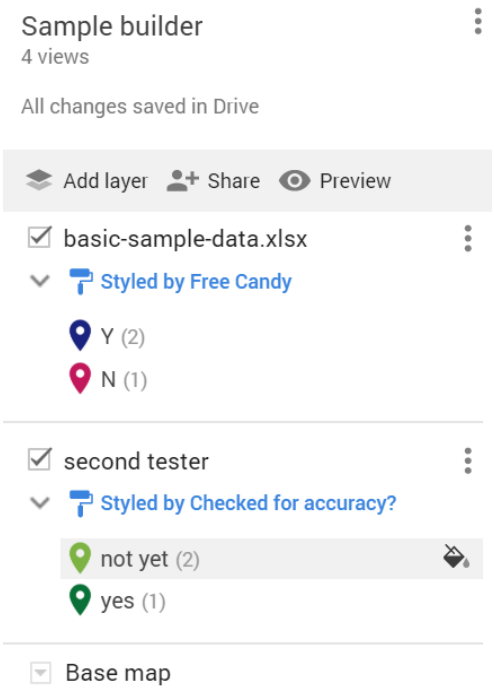
To make a new map—or modify or explore an existing one

1. Sign in to a Google Account. Navigate to https://www.google.com/maps/d/?hl=en.
2. Click the **red plus sign** at the bottom-right of the page (or the red button **+ Create A New Map**), or choose an existing map to edit it.
3. To add a data layer, click the blue **Import** button on the left under **Untitled layer**. Choose your desired data file.

[27] For more advanced options, see Google Support: "Import map features from a file"

4. To **position** each marker: Check the box corresponding to the column(s) that contain address or location information. This can either be a street address or latitude/longitude. This information can be contained in a single column, or spread across multiple columns.
5. To keep track of each marker: Choose a column to **title** each mapped location. (This label will appear in the legend's dropdown lists.)
6. If Google is able to correctly interpret the addresses in your file, the layer should now appear in the map. If not, you will be prompted to correct the addresses it was unable to match. To do so, click the settings button for the layer (**three vertical dots**), choose **Open data table** from the dropdown menu, and edit the incorrect address(es) in the table.

Customizing display (map markers, labels, etc.)



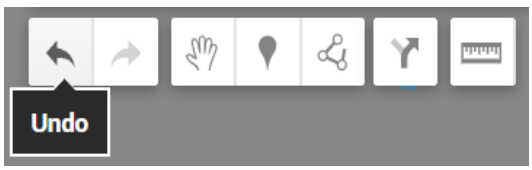
1. To give any map layer a custom title, click its three vertical dots and choose **Rename this layer**.
2. To customize the display of the map items, click the blue link under the name of your data file: **Individual styles** or **Styled by …**

   To mark different types of resources with different colors or icons, use the menu under **Group places by** and choose the data field you want to differentiate the map items (*example at right:* "Free Candy").

   You can then customize the color and symbol used to display the locations by hovering your mouse over the labels (*example at right:* "not yet") and clicking the **paint can** icon that appears.

   To label markers on the map directly, use the menu under **Set labels** to choose a data field (*example: zip code*).
3. To change background appearance, choose **Base map** at the bottom of your editing window. (Options include Satellite, Terrain, Light/Dark Political, Light/Dark Landmass, and more.) Experiment to find the visual/info combination that works best for your map.

If you make a mistake, the **Undo** icon is useful! Hover over each option to see what it does:



Exploring data with map tools

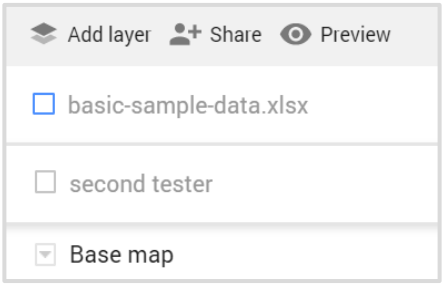
The following options only work in Edit mode:

- To **Measure distances and areas** directly on the map, click the **ruler** icon. (To start a new measurement, click the ruler again. To stop measuring, click the **hand**/"Select" icon.)
- To highlight all examples of a particular item on the map, hover over its styling line in the legend. (*See **Demo 2** below for practitioners highlighted by prescribing limits.*)

In lieu of highlighting all instances on the map, View mode offers **dropdown lists**.

Search works in both modes. (*See **Demo 1** below comparing results for a specific zip code.*)

Managing multiple layers

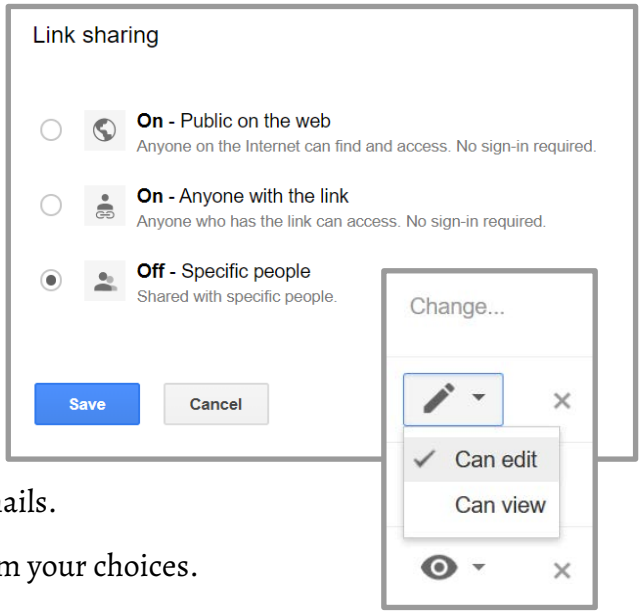


1. To add another layer, simply click **Add layer** and repeat the process (steps.

   > Note: Each new map layer will display on top of the previous one(s) listed in the legend.

   For example (*right*): map markers from "second tester" will appear on top of markers from "basic-sample-data" for identical locations.
2. To change layer order, click directly on a layer title and drag it to its new position. This is often easier if you first uncheck the layer you want to move, then click-and-hold to drag its gray title.

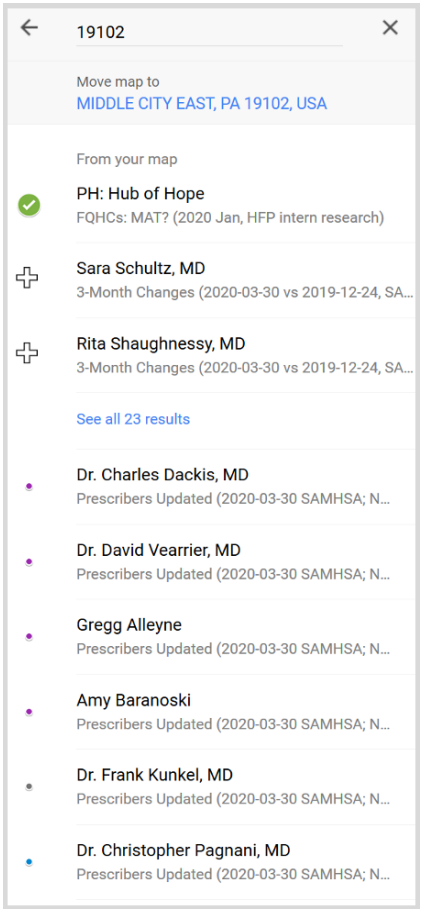
Sharing your map



1. In Edit mode, click **Share**. In the menu that opens, click **Change** to identify who can access your map (*Public* | *Anyone with the link* | or only *Specific people*).
2. For each option, you can choose whether to give View access only (*eye icon*), or permissions to Edit directly (*pencil icon*).
3. Then either copy your link to distribute it directly or invite people by entering their emails.
4. Click the blue **Save** or **Done** button to confirm your choices.

Demo 1: Using key location terms to explore areas of high need

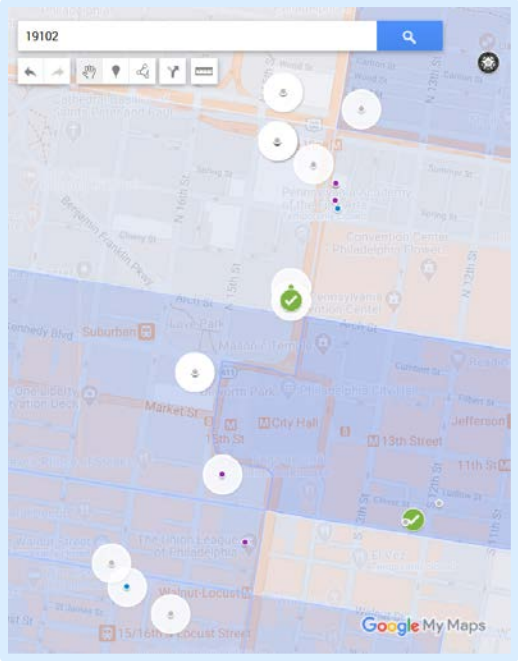
Searching for "**19102**" (identified in §5.3 above as an area with a high concentration of overdoses) pulls up all MAT records for this tiny zip code:



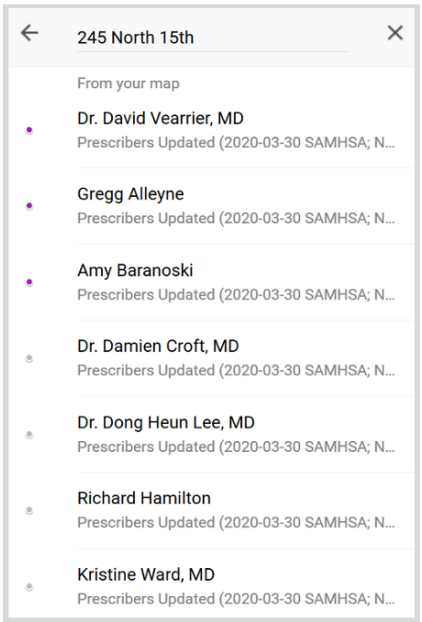
View mode lists names

Each listing depicts the corresponding map icon. These identify **20 licensed practitioners** (including 2 newly added in 2020 [*pluses*]: Schultz and Shaughnessy) plus **one FQHC** (Project Home's Hub of Hope) with addresses in this area:

Edit mode highlights results on map

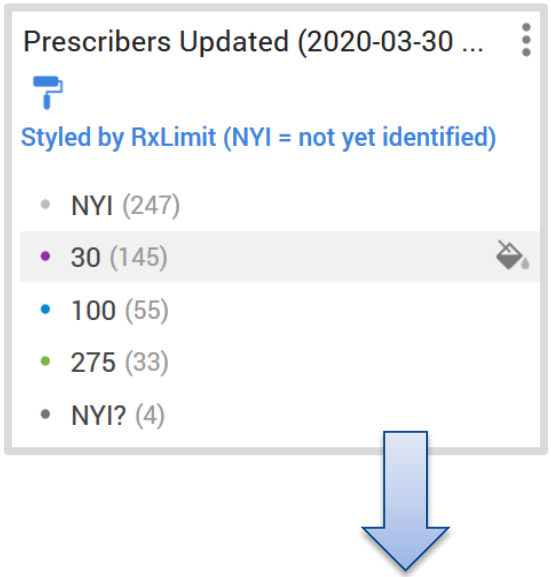


Clicking on one of the above results and searching for its address "**245 North 15th [St]**" produces a list of **7 licensed practitioners** at Drexel University College of Medicine:

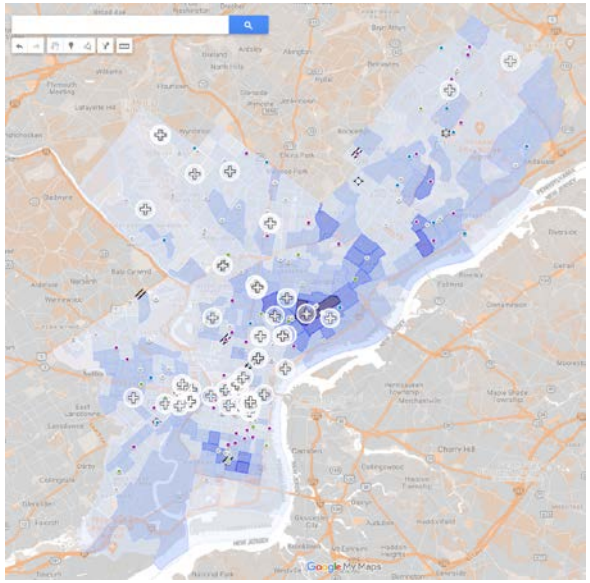


This example (*right*) shows at a glance that 3 of the 7 (Vearrier, Alleyne, and Baranoski) have prescribing limits of **30 patients** (*purple dots*), while the other 4 practitioners (Croft, Lee, Hamilton, and Ward) have limits that are **not yet identified** (*gray dots* = "NYI"), because their waiver records are inaccessible in SAMHSA's Pharmacy Lookup due to last-name confusion.

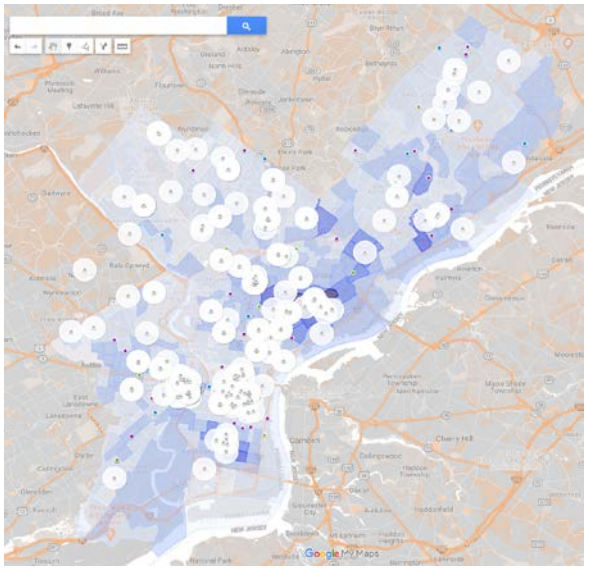
Demo 2: Hovering on the Edit legend to check out different prescriber categories on the map



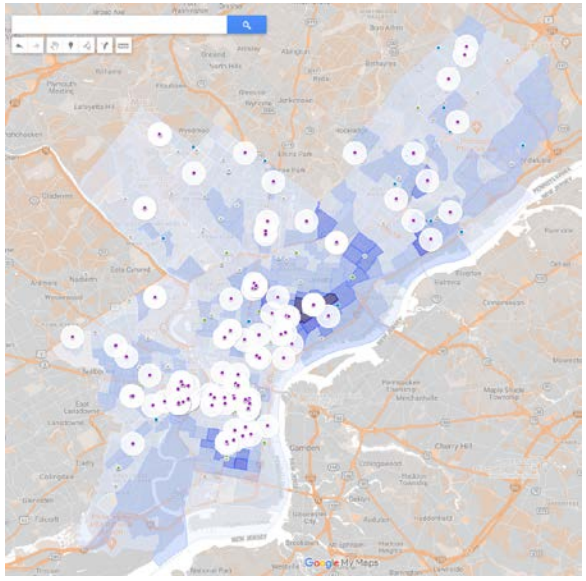
60 prescribers newly added in 2020Q1:



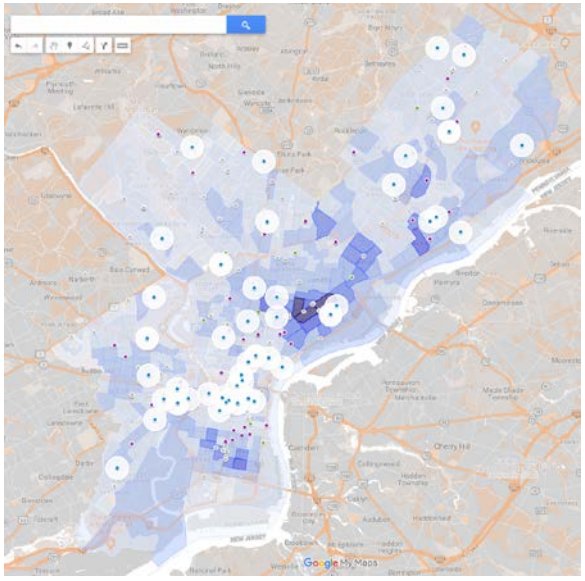
251 prescribers with unidentified Rx limits:



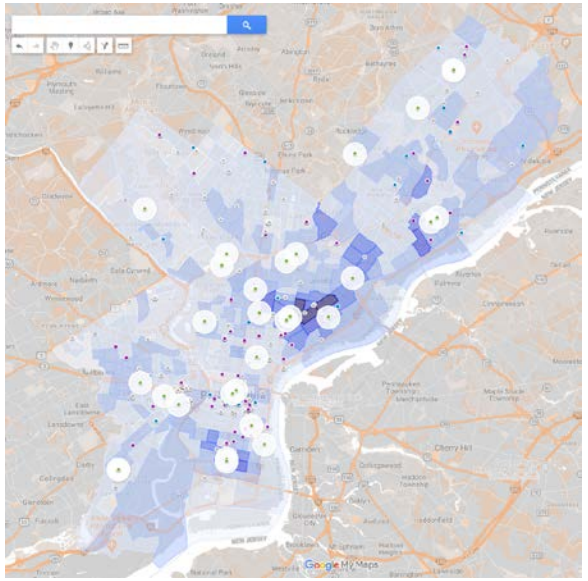
145 prescribers with Rx limits of 30:



55 prescribers with Rx limits of 100:



33 prescribers with Rx limits of 275:



Appendix II: Resources and tips for updating data

How to engage SAMHSA's phenomenal but dispersed resources

The hackathon provided datasets obtained in late December 2019 from three portals. Since our March 17th presentation, we have belatedly discovered three additional portals offering valuable complementary information.

- The Buprenorphine Practitioner Locator provides a downloadable table, based on searching state or city,[28] of individual practitioner names, addresses, phone, and fax. Individuals who list two addresses in SAMHSA get two rows in the table. This portal is the easiest to use for collecting periodic updates (search "City: Philadelphia" once or twice per month), but it organizes results less usefully than the Treatment Services Locator below. As explained in §4.3, about 60% of Philadelphia practitioners in 2019–2020Q1 opt to be findable here.
- The Buprenorphine Pharmacy Lookup enriches practitioner mapping with data about prescribing capacity and waiver anniversaries. As **§4.3** explained, these details are publicly findable for only about half the practitioners listed in SAMHSA's locators due to last-name confusion.
- The Opioid Treatment Program Directory lists certified programs by state.
- The Behavioral Health Treatment Services Locator is our most important late discovery. Tables available here include more sites than the OTP portal and add *a wealth of helpful details about every program*. (After clicking **Download**, choose yes for "**Include services information?**") The map interface groups individuals by practice site and lists websites for most programs. Its main drawback is that searches cannot filter by political region (such as "Philadelphia") but only by geography ("within 5 miles of zip code 19152").
- Practitioner & Program Data summarizes nationwide statistics for buprenorphine-prescribing DATA waivers. Since specific waiver data is publicly accessible for only about 30% of all prescribers in Philadelphia, we may use this information to extrapolate from visible capacity to estimate actual capacity. Daily updates identify how many new licenses for each limit have been added.
- Waiver Totals by State provides exactly what its title says.

[28] MATchmaker updates should note that this table will not include entries where "City" was not typed exactly as "Philadelphia". (The Services Locator catches 5 missing individuals with "Phila" | "Phildelphia" | "Phil;adelphia".) Prescribers "are responsible for updating their [own] contact information [using] the Update Practitioner Profile form" provided by SAMHSA.

How to update practitioner data for optimal mapping

★ Revisit SAMHSA regularly to incorporate new prescribers and note deletions: Buprenorphine Practitioner Locator / Behavioral Health Treatment Services Locator (*see previous page*)

★ To map locations precisely (and to facilitate keyword searches), fix address typos and standardize style (e.g. abbreviate or spell out "North/South/East/West" etc. consistently) before generating geocodes.

- Google Maps is accurate but imprecise about address variations—the location will still be mapped correctly but if the same address is not typed/spelled identically, then location markers may appear in slightly different positions, making it harder to match prescribers to programs accurately.
- Compare Layers #5 and #8 in the map—"initial providers" vs. "prescribers updated"—for numerous examples of how standardizing address style relative to the original SAMHSA entry improves precision.

★ Check whether addresses match current practice sites. Successively ask:

(1) Does SAMHSA entry already include a site name?

(2) Does practitioner address/phone match programs data?

(3) Do two or more practitioners share the same address?
(If so, it is less likely to be a residential site.)

Mark exceptions as "Unclear".

★ To find providers' current practice address(es), area(s) of speciality ("Primary Taxonomy"), Medicaid numbers, etc. look up their NPI using one or more of the sites listed on the next page. Where NPIs also fail (e.g. not recently updated):

★ Process "Unclear" entries for their practice status.

- Visiting ambiguous addresses in Google Maps Street View (photos) often clarifies whether a private or group practice site exists there. Google reviews for some addresses suggest that there are also residential practices.
- To look up whether address is Commerical or Residential: https://smartystreets.com/products/list

Links for looking up NPI data & PA medical licenses

NPI: National Provider Identifier | **NPPES**: National Plan & Provider Enumeration System Orchestrated by **CMS**: Centers for Medicare & Medicaid Services

- https://npiregistry.cms.hhs.gov/registry/ is the official NPPES portal; like SAMHSA's practitioner locator, contact information is updated directly by providers.
- https://www.npinumberlookup.org/ and https://npidb.org/npi-lookup/ were helpful substitutes when the above site temporarily crashed, though NPPES is generally preferable.
- https://npiprofile.com/search-advanced.php provides the most complete information; in addition to all the NPPES fields, it identifies "**Hospital Affiliations**" where "the clinician … provided services to at least three patients on three different dates ***in the last 12 months***" (this recency is helpful).
- The Pennsylvania Licensing System website shows up-to-date information on **medical license status**: https://www.pals.pa.gov/#/page/search

  We consulted this site to check minority instances like the two buprenorphine practitioners involved in this 2017–2019 DOJ case prosecuting pill mills. (M. Nikparvar's license is currently suspended. V. Thompson's license was suspended in 2008 but reinstated in 2012. Both are still listed in SAMHSA's practitioner database, Mar/Apr 2020.)

Additional notes on key sources

How to find archival copies of the DBHIDS TAD

The current version is always linked on the DBHIDS MAT page. The data mapped in our March/April pre-pilot version of MATchmaker came from the 28 February 2020 version:

> https://dbhids.org/wp-content/uploads/2020/02/TAD-2.28.2020.pdf

Older copies consistently follow this same URL pattern and simply change the date:[29]

> https://dbhids.org/wp-content/uploads/**[4-digit year]**/**[2-digit month]**/
> TAD-**[month#].[date#].[4-digit year]**.pdf

Question for DBHIDS: How did/do you automate these updates?
(Can we adapt your approach to solve one of the core challenges of this project?)

[29] Try the date for any Monday/Wednesday/Friday from 1 February 2019 onward. >80% of the time you'll find a TAD. For impressive usage statistics and update frequency, see **§4.2**.

Specific information tabulated in SAMHSA's Treatment Services Locator (a.k.a. why Next Steps should definitely engage this source!)

Tables downloaded from this database list one program per row and include **a binary column (1/0 = YES/NO) for each italicized line below**:

OUD TREATMENTS OFFERED

Opioid medications used in treatment

- *Buprenorphine*
- *Naltrexone*
- *Methadone*

Type of opioid treatment

- *SAMHSA-certified Opioid Treatment Program*
- *Prescribes buprenorphine*
- *Buprenorphine maintenance*
- *Buprenorphine maintenance for predetermined time*
- *Buprenorphine detoxification*
- *Administers naltrexone*
- *Relapse prevention from naltrexone*
- *Methadone maintenance*
- *Methadone maintenance for predetermined time*
- *Methadone detoxification*
- *Use methadone/buprenorphine for pain management or emergency dosing*
- *Lofexidine/clonidine detoxification*
- *Accepts clients on opioid medication but prescribed elsewhere*
- *Does not use medication for opioid addiction*
- *Does not treat opioid addiction*

Pharmacotherapies

- *Buprenorphine with naloxone (Ex. Suboxone®)*
- *Buprenorphine without naloxone*
- *Buprenorphine (extended-release, injectable, for example, Sublocade®)*
- *Buprenorphine sub-dermal implant (Probuphine®)*
- *Naltrexone (oral)*
- *Naltrexone (extended-release, injectable naltrexone (Vivitrol®))*
- *Methadone*
- *Lofexidine*
- *Clonidine*

External opioid medications source

- *In-network prescribing entity*
- *Other contracted prescribing entity*
- *Personal physician/health care provider*

PEOPLE SERVED

Age groups accepted | Gender accepted | Special programs/groups offered

- *Seniors or older adults*
- *Adolescents*
- *Pregnant/postpartum women*
- *Adult women*
- *Adult men*
- *Persons with co-occurring mental and substance use disorders*
- *Lesbian, gay, bisexual, or transgender (LGBT) clients*
- *Veterans*
- *Active duty military*
- *Military families*
- *Clients referred from the court/judicial system*
- *Persons with HIV or AIDS*
- *Persons who have experienced trauma*
- *Persons who have experienced sexual abuse*
- *Persons who have experienced intimate partner violence, domestic violence*
- *Transitional age young adults*
- *Persons with co-occurring pain and substance use*

Exclusive services

- *All Clients in Opioid Treatment Program*
- *Methadone and buprenorphine clients only*
- *Methadone clients only*
- *Specially designed program for DUI/DWI clients*
- *Serves only DUI/DWI clients*
- *Serves Veterans only*
- *Alcohol use disorder clients only*

Languages [over 20 listed]

PAYMENT OPTIONS

- *Payment assistance (check with facility for details)*
- *Sliding fee scale (fee is based on income and other factors)*
- *No payment accepted*
- *Cash or self-payment*
- *Medicaid*
- *Medicare*
- *State-financed health insurance plan other than Medicaid*
- *Private health insurance*
- *Military insurance (e.g., TRICARE)*
- *Federal, or any government funding for substance use programs*
- *IHS/Tribal/Urban (ITU) funds*

FACILITY / SETTING

Type of care

- *Substance use treatment*
- *Detoxification*
- *Transitional housing, halfway house, or sober home*
- *Treatment for co-occurring serious mental health illness/ serious emotional disturbance and substance use disorders*

Service settings

- *Hospital inpatient*
- *Residential*
- *Outpatient*
- *Short-term residential*
- *Long-term residential*
- *Residential detoxification*
- *Outpatient detoxification*
- *Outpatient methadone/buprenorphine or naltrexone treatment*
- *Outpatient day treatment or partial hospitalization*
- *Intensive outpatient treatment*
- *Regular outpatient treatment*
- *Hospital inpatient detoxification*
- *Hospital inpatient treatment*
- *General Hospital (including VA hospital)*
- *Psychiatric hospital*

License/certification/accreditation

- *State substance abuse agency*
- *State mental health department*
- *State department of health*
- *Commission on Accreditation of Rehabilitation Facilities*
- *Council on Accreditation*
- *Healthcare Facilities Accreditation Program*
- *Hospital licensing authority*
- *The Joint Commission*
- *National Committee for Quality Assurance*

Facility operation (e.g. private, public)

- *Local, county, or community government*
- *State government*
- *U.S. Department of Veterans Affairs*
- *Department of Defense*
- *Tribal government*
- *Indian Health Service*
- *Private non-profit organization*
- *Private for-profit organization*

OTHER SERVICES OFFERED

Assessment/Pre-treatment

- *Comprehensive mental health assessment*
- *Comprehensive substance use assessment*
- *Interim services for clients*
- *Outreach to persons in the community*

Treatment approaches

- *Cognitive behavioral therapy*
- *Dialectical behavior therapy*
- *Substance use counseling approach*
- *Trauma-related counseling*
- *Rational emotive behavioral therapy*
- *12-step facilitation*
- *Brief intervention*
- *Contingency management/motivational incentives*
- *Motivational interviewing*
- *Anger management*
- *Matrix Model*
- *Community reinforcement plus vouchers*
- *Relapse prevention*

Counseling services & education

- *Individual counseling*
- *Group counseling*
- *Family counseling*
- *Marital/couples counseling*
- *Employment counseling or training*
- *HIV or AIDS education, counseling, or support*
- *Health education services other than HIV/AIDS or hepatitis*
- *Substance use education*
- *Hepatitis education, counseling, or support*
- *Vocational training or educational support (for example, high school coursework, GED preparation, etc.)*

Medical services

- *Hepatitis A vaccination*
- *Hepatitis B vaccination*

Pharmacotherapies

- *Medications for psychiatric disorders*
- *Medications for HIV treatment*
- *Medications for Hepatitis C treatment*

Ancillary services

- *Residential beds for clients' children*
- *Child care for clients' children*
- *Domestic violence services-family or partner*
- *Early intervention for HIV*
- *Mental health services*
- *Self-help groups*
- *Social skills development*
- *Transportation assistance*
- *Case management*
- *Housing services*
- *Mentoring/peer support/consumer-run services*
- *Recovery coach*
- *Professional interventionist/educational consultant*
- *Acupuncture*

Screening & testing

- *Breathalyzer or blood alcohol testing*
- *Drug or alcohol urine screening*
- *HIV testing*
- *Screening for Hepatitis B*
- *Screening for Hepatitis C*
- *Screening for mental disorders*
- *Screening for substance use*
- *STD testing*
- *TB screening*
- *Drug and alcohol oral fluid testing*
- *Testing for metabolic syndrome*

Detoxification

- *Alcohol Detoxification*
- *Benzodiazepines Detoxification*
- *Cocaine Detoxification*
- *Methamphetamines detoxification*
- *Opioid Detoxification*
- *Routinely uses medication for detoxification*

Transitional services

- *Naloxone and overdose education*
- *Aftercare/continuing care*
- *Discharge Planning*
- *Outcome follow-up after discharge*

AUD TREATMENTS & OTHER ADDICTIONS

Type of Alcohol Use Disorder Treatment

- *This facility administers/prescribes medication for alcohol use disorder*
- *Accepts clients using medication assisted treatment for alcohol use disorder but prescribed elsewhere*
- *Does not use medication for alcohol use disorder*
- *Does not treat alcohol use disorder*

Pharmacotherapies

- *Acamprosate (Campral®)*
- *Disulfiram (Antabuse®)*

External Source of Medications Used for Alcohol Use Disorder Treatment

- *In-network prescribing entity*
- *Other contracted prescribing entity*
- *Personal physician/health care provider*

Facility Smoking Policy

- *Smoking not permitted*
- *Smoking permitted in designated area*
- *Smoking permitted without restriction*

Tobacco/Screening Services

- *Non-nicotine smoking/tobacco cessation medications*
- *Nicotine replacement therapy*
- *Screening for tobacco use*
- *Smoking/tobacco cessation counseling*

Other Addictions

- *Treatment for non-substance use addiction disorder*
- *Treatment for gambling disorder*
- *Treatment for internet use disorder*

Appendix III: Exploratory modules

Module #1: Should mobile sites change locations by seasons?

During the first month of the hackathon, we tried to identify **need for MAT** by mapping where Narcan/naloxone was administered. Hackathon organizers had provided data for EMS incidents from 2014–2018 by quarter. Our exploratory module for **mapping incidents by season** created a series of twenty maps—four per year—to ask:

> Are there differences *by season* (summer, winter, etc.) in where overdose events cluster? **Should *mobile sites* park in different locations for different times of year?**

These maps have yet to be analyzed. Followup will ideally address these limitations:

- Naloxone data distinguished **location** only for incidents involving EMS. Despite a staggering total of roughly 19,000 incidents from 2014–2018 (avg. *3,800 reversals per year*), EMS data accounts for **only about 40% of overdoses** involving heroin &/or fentanyl in 2018.[30]
- Even these locations are publicly available only down to the level of **zip codes**. We did not have time to integrate zip-code polygons into our Google Maps and are unsure whether this is specific enough to be helpful.

Is it possible to improve the completeness and/or geographic specificity of datasets for non-fatal overdoses? Could aggregate figures per quarter by zip code or even census tract be compiled or estimated for the **1,219 overdoses** reversed by police in 2016H2–2019 (avg. *348 reversals per year*), the **497 overdoses** reversed by SEPTA in 2017H2–2019H1 (avg. *249 reversals per year*), the **501 overdoses** that Prevention Point reversed in 2018 alone, and—most significantly—the overdoses reversed by individuals who used the **13,400 doses** of Narcan (distributed by Prevention Point in 2019) to save their neighbors' lives?[31]

[30] According to analysis of Prevention Point refill data by Team 6 (HEXCEL_DROP) in their "2020 Data Hackathon - Final Report" (page 14 of 37).

[31] These Prevention Point figures come from Team 2's analyses of "The provision of Narcan to the community" (click

Module #2: Preliminary distance analyses with TAD listings

Our exploratory module for **distance analysis** used DBHIDS resources as a baseline reference. This code compared Layer #1 and Layer #3 mathematically to identify how many **programs *listed* as offering buprenorphine** (*white stars*) appear within **1 mile** of each census tract.[32]

> Future applications of this code can adjust the cutoff figure to account for whether **walking**, **public transportation**, **driving**, or **other forms of travel** are in view.

When data from *all* census tracts is evaluated, the distance to the nearest white star varies widely, from **1.6 miles average** to **6.7 miles in the furthest case**.

But these figures are dramatically better for census tracts with higher overdose rates. For the ten tracts with the most overdose fatalities,[33] the distance to the nearest white star is just

0.6 miles average and **1.4 miles in the furthest case**.

Expanding the lens to consider a wider set of tracts with high overdose rates,[34] the distance to the nearest white star remains notably lower than the whole-city aggregates, though markedly higher than the ten :

0.8 miles average and **3.0 miles in the furthest case**.

These comparisons suggest that Philadelphia has done a good job of locating buprenorphine provision closer to areas of greater need—even before taking into account additional buprenorphine programs not listed in the DBHIDS TAD. At the same time, distance analyses have also highlighted two isolated sites in areas of high need for especial attention (*see* **§5.4**).

Future prospects: Analyzing distance in combination with other factors

Different program listings offer incomplete snapshots of buprenorphine and MAT availability per region. But the simple presence of a site is not enough to guarantee access.

> Once data about other key factors such as **walk-in or weekend hours** is compiled, this code might also be used for more sophisticated assessments of practical access.

> Would distance analyses be even more pertinent for MAT with **methadone**, since (unlike

"Play" to see slide). Totals for police and SEPTA reflect multiple DPH sources compiled and cited here.

[32] Calculations used Manhattan distance to account for Philadelphia's 9 degrees slant with respect to true north.

[33] >25 indoor and/or >40 est. total fatalities for 2017–2019H1

[34] I.e. all forty-three tracts with >12 indoor fatalities for 2017–2019H1

buprenorphine) it requires daily visits?

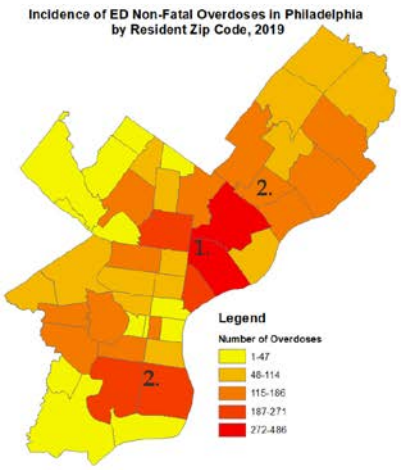
Module #3: Engaging census data & DPH maps to picture human factors better?

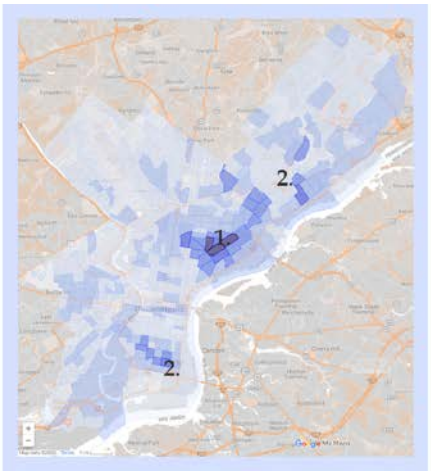
See GitHub for ACS 2018 data collected:

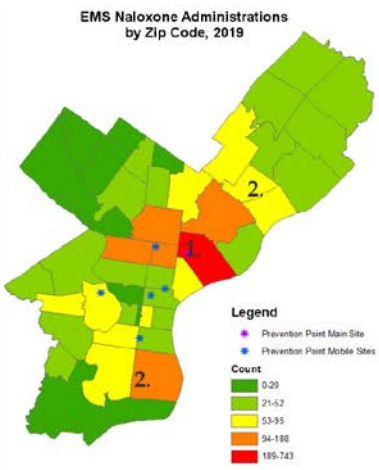
- Health insurance by census tract: % None | Public | Private
- Population density and land area per tract

In the DPH maps below:

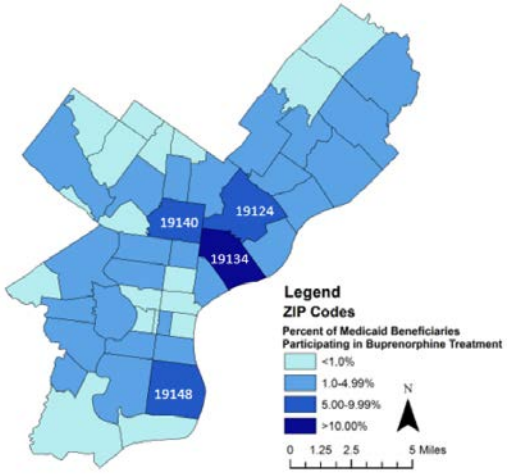
Do the ***relative*** matches between overdose statistics and access—where zip codes with ***higher totals of opioid overdoses*** mostly correspond to zip codes with ***higher percentages of buprenorphine recipients***—reflect actual *numbers of people* getting buprenorphine when they need it?







This map from December 2018 (*right*) shows where "**Medicaid Beneficiaries with a Primary Diagnosis of OUD Participating in Buprenorphine Treatment**" in **2015–2018H1** lived by zip code.



Its caption in the DPH report noted: "*While Medicaid beneficiaries in nearly every zip code received buprenorphine, the highest proportion lived in the* ***Kensington*** *ZIP codes of 19134 (**16%**) and 19124 (**8%**), the* ***Upper North Philadelphia*** *ZIP code of 19140 (**6%**) and the* ***South Philadelphia*** *ZIP code of 19148 (**5%**).*

[Given **10,973 recipients** for 2015–2018 (cf. ~9,770 excluding 2018H2):

1% ~ **100 people**, 5% ~**500 people**, 10% ~ **1000 people**]