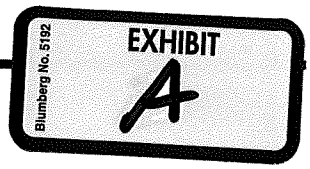
Schoening, Thomas E.



Subject: FW: FW: Article from Last Night's Meeting

From: Kevin L. Schofield <klschofield@windhammaine.us>
Sent: Thursday, September 30, 2021 3:31 PM
To: Jon G. Rioux <jgrioux@windhammaine.us>
Cc: Becky Humphrey <BeckyH@day-one.org>; Brent J. Libby <bjlibby@windhammaine.us>; Barry A. Tibbetts <batibbetts@windhammaine.us>
Subject: RE: Article from Last Night's Meeting

Hello Jon,

To follow up the this matter, Becky Humphrey of Day One (cc'd here) did contact me about two weeks ago to inform me that the ZBA had requested correspondence from me documenting any concerns I may have on the potential impact of adding 4-5 residential Juveniles to the existing Day One facility at 86 Tandberg trail. Becky had informed me they had a similar facility located in New Gloucester. I researched police calls for that facility since January 1, 2020. There were 18 calls and only 3 required a report to be taken. I was unable to locate any calls for our Windham Address.

In short, I am not concerned that adding this component to the existing day one facility in town would adversely impact The police Department. Also, Becky has provided her contact information, I am confident that if a matter did arise, we could work with her to mitigate the matter.

Please let me know if you need anything further.

Kevin

Kevin Schofield

Chief of Police

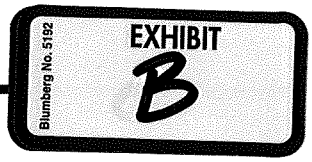
Windham Police Department

375 Gray Rd.

Windham, Maine. 04062

(207)892-1926

Schoening, Thomas E.



Subject: FW: 86 Tandberg Trail - Day-One

From: Brent J. Libby <bjlibby@windhammaine.us>
Sent: Thursday, September 30, 2021 3:15 PM
To: Becky Humphrey <BeckyH@day-one.org>
Cc: Kevin L. Schofield <klschofield@windhammaine.us>; Jon G. Rioux <jgrioux@windhammaine.us>
Subject: 86 Tandberg Trail - Day-One

Hi Becky,

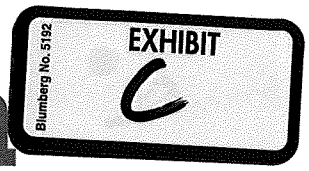
I wanted to follow up on our conversation the other day in reference to the expansion of residential care at the 86 Tandberg Trail location. Based on my preliminary research I do not anticipate that this use will have cause for an increased burden on Fire-EMS services. I am confident that in the event we do see an increase in the need for resources that we can come together to work towards a mutual arrangement.

The permitted process will trigger a life safety inspection.

Thanks you for reaching out.

Brent J. Libby, Chief
Windham Fire-Rescue
375 Gray Road
Windham, Maine 04062
207-892-1911 x2
bjlibby@windhammaine.us

Advanced
Leachfields



SEPTIC SYSTEM INSPECTION REPORT

Property Location: 86 Tandberg Trail, Windham

Inspection date: September 23, 2021

Inspected By: Ryan and Josh Fournelle

Prepared for:

Becky Humphrey / 207-329-5250 / BeckyH@day-one.org

Based on what we were able to observe and our experience with on-site wastewater technology, we submit the sewage treatment system inspection report based on the present condition of the on-site sewage treatment system. Advanced Leachfields LLC has not been obtained to warranty, guarantee or certify the proper functioning of the system for any period of time in the future. Because of numerous factors (usage, soil characteristics, previous failures, etc.) which may affect the proper operation of the septic system, as well as the inability of our company to supervise or monitor the use or maintenance of the system, this report shall not be construed as a warranty by our company that the system will function properly for any particular buyer. Advanced Leachfields LLC disclaims any warranty, either expressed or implied, arising from the inspection of the septic system or report. We are also not ascertaining the impact of the system is having on ground water, or the proximity of the system to property boundaries.

GENERAL PROPERTY INFORMATION

WAS THE HHE-200 SEPTIC DESIGN REVIEWED: Not available at the time of the inspection

DESIGNED FLOW/BEDROOMS: Unknown

BEDROOMS IN DWELLING: Unknown

OCCUPANCY OF THE DWELLING: Currently occupied

FUTURE OCCUPANCY: Unknown

INSTALLATION DATE OF CURRENT SYSTEM IN USE: Unknown (The septic system appears to have been professionally designed and installed within the last 10-15 years)

YEAR DWELLING WAS BUILT: Unknown

WEATHER AT TIME OF INSPECTION: Sunny

GROUND CONDITIONS: Dry

WERE ALL INTERIOR PLUMBING DRAINS CONNECTED TO THE SEPTIC: Yes

GARBAGE DISPOSAL: No disposal present. We recommend not installing a disposal in the future.

SETBACK FROM WELL TO TANK AND FIELD: N/A Public water

NOTES: The septic system is comprised of 2 – 1,000 gallon septic tanks draining to a common drain field area.

SEPTIC TANK

(Newer Structure)

At the time of our inspection the septic tank was located and opened. The septic tank was not pumped during the inspection, but the liquid level was observed for any indications of leaking or ground water infiltration. The tank was also checked for excessive deterioration and visible structural deficiencies above the water line, which is where most of the deterioration occurs. The septic tank should be pumped every 3-5 years and will vary with usage. When possible, the pipes entering and exiting the septic tank are scoped (due to many factors, tank depth, lack of access, etc., the pipes may not be reasonably accessed). Information below indicates conditions at the time of the inspection. Noted deficiencies don't necessarily require corrective action. See notes below.

TANK LOCATION: Pictured below

ESTIMATED SEPTIC TANK SIZE: 1000-gallons

TANK CONSTRUCTED OF: Concrete

DEPTH TO TOP OF TANK: 6"-12"

IF OVER 12" DEEP, WAS A RISER INSTALLED: N/A

OUTLET BAFFLE PRESENT: Yes

CONDITION OF OUTLET BAFFLE: Satisfactory condition

OUTLET FILTER (IF APPLICABLE): N/A

LIQUID LEVEL IN THE TANK: Proper operating level, bottom of the outlet invert

EVIDENCE OF PAST HIGH LIQUID LEVELS: No

DATE LAST PUMPED: Unknown

WAS THE TANK DUE FOR PUMPING: NO – we recommend pumping next in the spring of 2023.

CONDITION OF THE PIPE TO THE SEPTIC TANK: Satisfactory

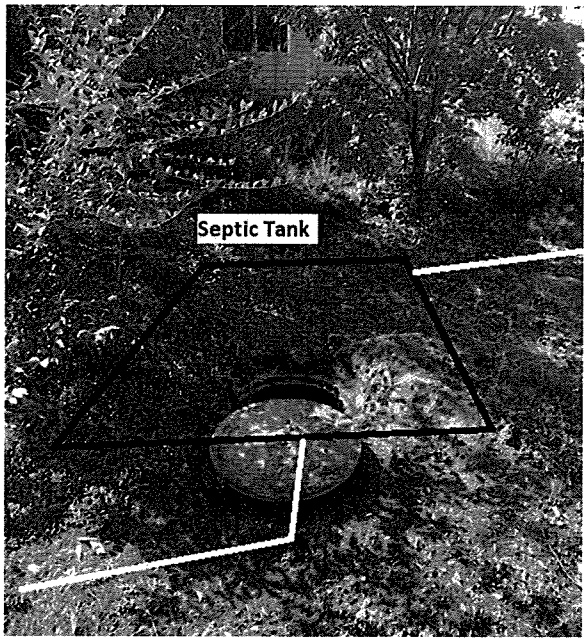
CONDITION OF THE PIPE EXITING THE TANK: Satisfactory

SEPTIC TANK NOTES/DEFICIENCIES:

- The septic tank is a newer tank (10-15 years old) that is in good condition. The septic tank is NOT due to be pumped. We recommend pumping in the spring of 2023 and then every 3 years.

REPAIRS OR REPLACEMENT RECOMMENDED:

- None needed now.



SEPTIC TANK
(Older Structure)

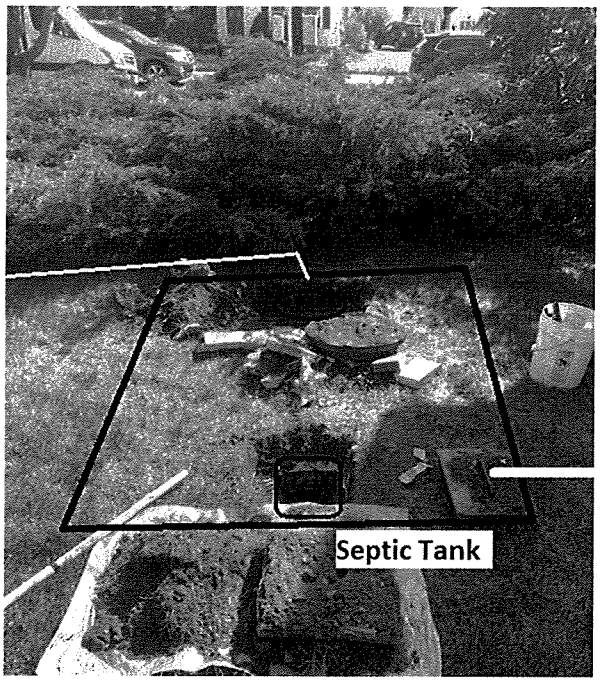
At the time of our inspection the septic tank was located and opened. The septic tank was not pumped during the inspection, but the liquid level was observed for any indications of leaking or ground water infiltration. The tank was also checked for excessive deterioration and visible structural deficiencies above the water line, which is where most of the deterioration occurs. The septic tank should be pumped every 3-5 years and will vary with usage. When possible, the pipes entering and exiting the septic tank are scoped (due to many factors, tank depth, lack of access, etc., the pipes may not be reasonably accessed). Information below indicates conditions at the time of the inspection. Noted deficiencies don't necessarily require corrective action. See notes below.

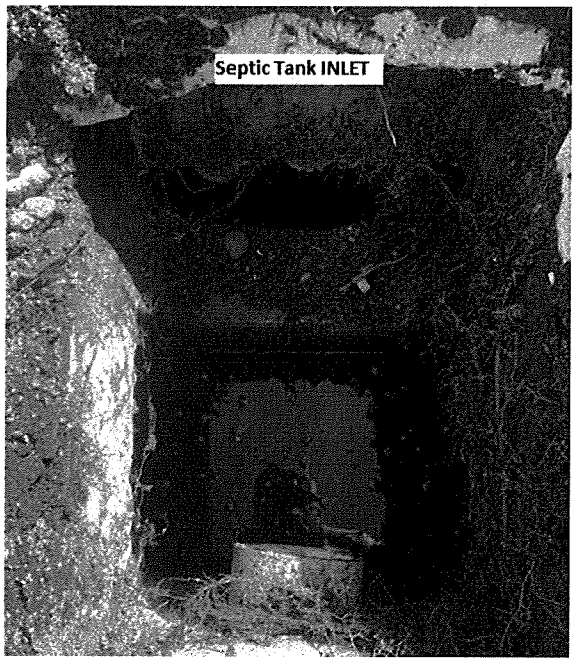
TANK LOCATION: Right side of the building
ESTIMATED SEPTIC TANK SIZE: 1000-gallons
TANK CONSTRUCTED OF: Concrete
DEPTH TO TOP OF TANK: 12"
IF OVER 12" DEEP, WAS A RISER INSTALLED: N/A
OUTLET BAFFLE PRESENT: Yes
CONDITION OF OUTLET BAFFLE: Satisfactory condition
OUTLET FILTER (IF APPLICABLE): N/A
LIQUID LEVEL IN THE TANK: Proper operating level, bottom of the outlet invert
EVIDENCE OF PAST HIGH LIQUID LEVELS: No
DATE LAST PUMPED: Unknown
WAS THE TANK DUE FOR PUMPING: NO
CONDITION OF THE PIPE TO THE SEPTIC TANK: Satisfactory
CONDITION OF THE PIPE EXITING THE TANK: Satisfactory
SEPTIC TANK NOTES/DEFICIENCIES:

- The septic tank is in satisfactory condition with no observed deficiencies. The septic tank is NOT due to be pumped. We recommend pumping the tank next in the spring.

REPAIRS OR REPLACEMENT RECOMMENDED:

- None needed.


Septic Tank


Septic Tank INLET

DRAIN FIELD

(Shared/common drain field)

At the time of our inspection the drain field was identified, located, and the area was checked for visible surfacing effluent. The distribution box was viewed (if applicable) and checked for any evidence of current or past high effluent levels. The soils in the drain field where checked for ponding, discoloration, and any evidence of past high effluent levels or malfunctions. Information below indicates conditions at the time of the inspection. Noted deficiencies don't necessarily require corrective action. See notes below.

FIELD/TRENCH LOCATION: Front right of the property

TYPE OF DRAIN FIELD: Pipe and stone bed

SIZE OF DRAIN FIELD/#OF ROWS: 20' x 45'

SURFACING EFFLUENT OR EXCESSIVE LUSH GROWTH FOUND: No

HIGH EFFLUENT IN THE DISTRIBUTION BOX: No

PONDING EFFLUENT OBSERVED: No

EVIDENCE OF PAST HIGH EFFLUENT LEVELS: No

EVIDENCE OF PAST MALFUNCTION: No

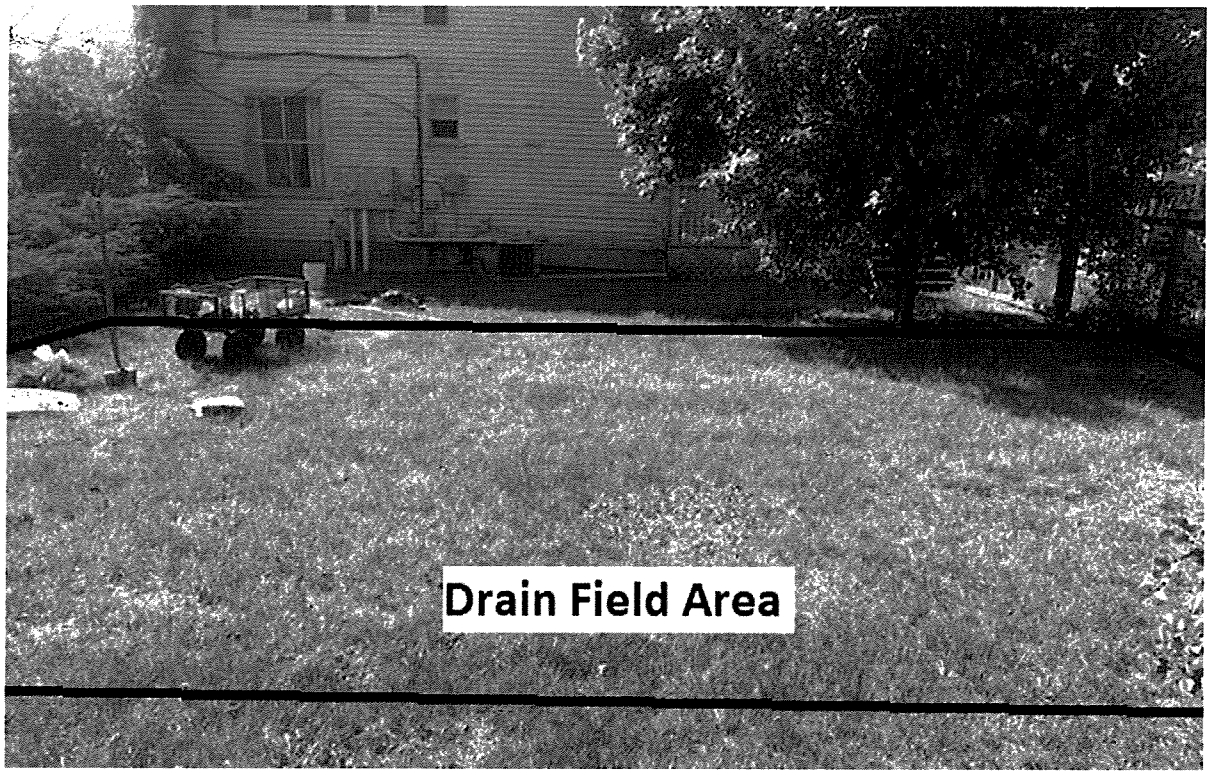
CONDITION OF FIELD AT TIME OF INSPECTION: **Functional, satisfactory (VERY GOOD/LIKE-NEW) condition**

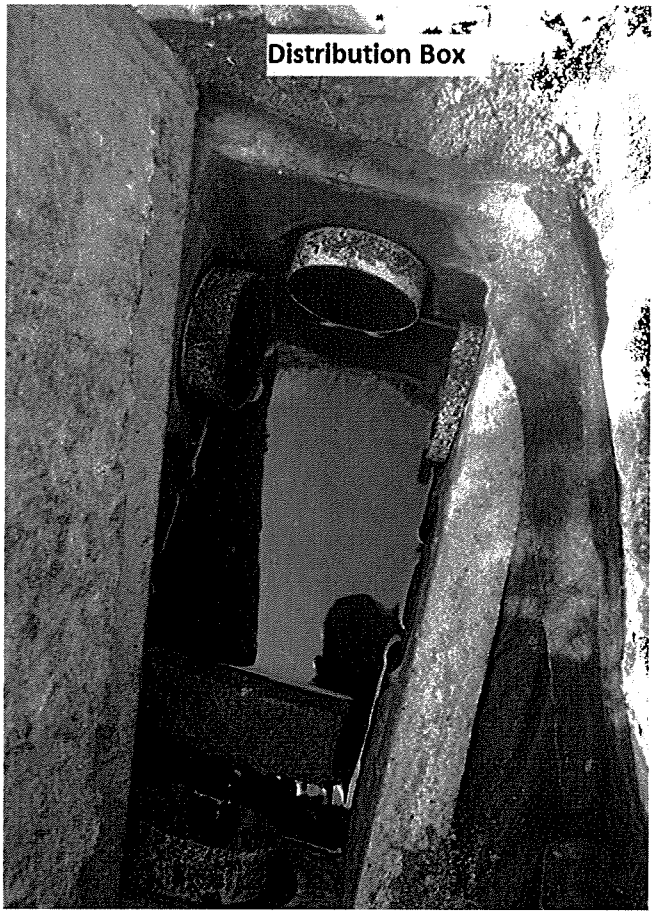
DRAIN FIELD NOTES/DEFICIENCIES:

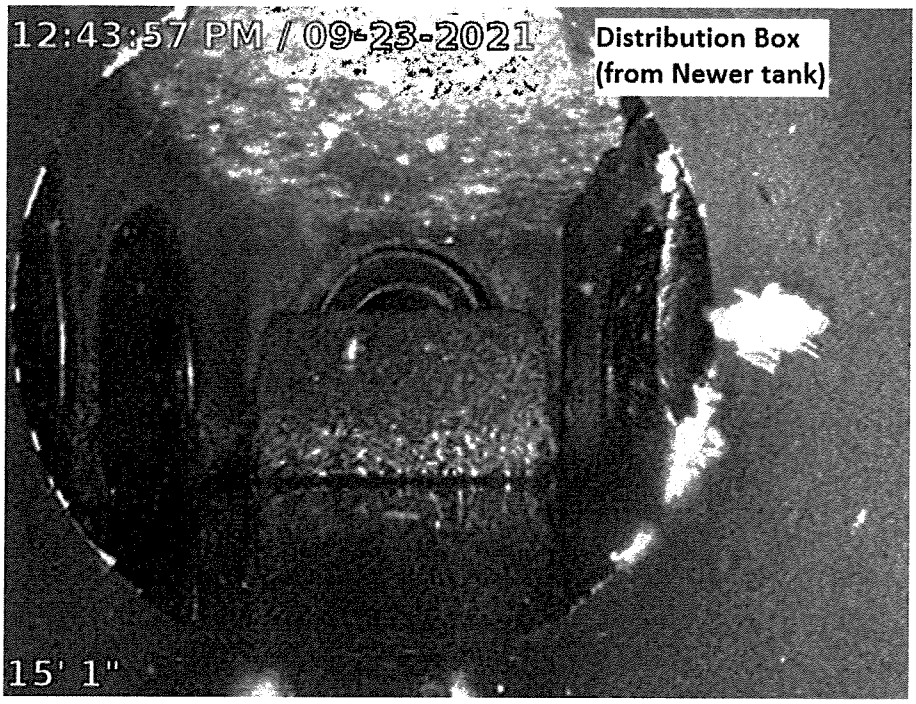
- The drain field is in very good condition. **The site is situated in an area with idea drainage soil. The drain field is likely intended for use for 6-8 full time residents.**

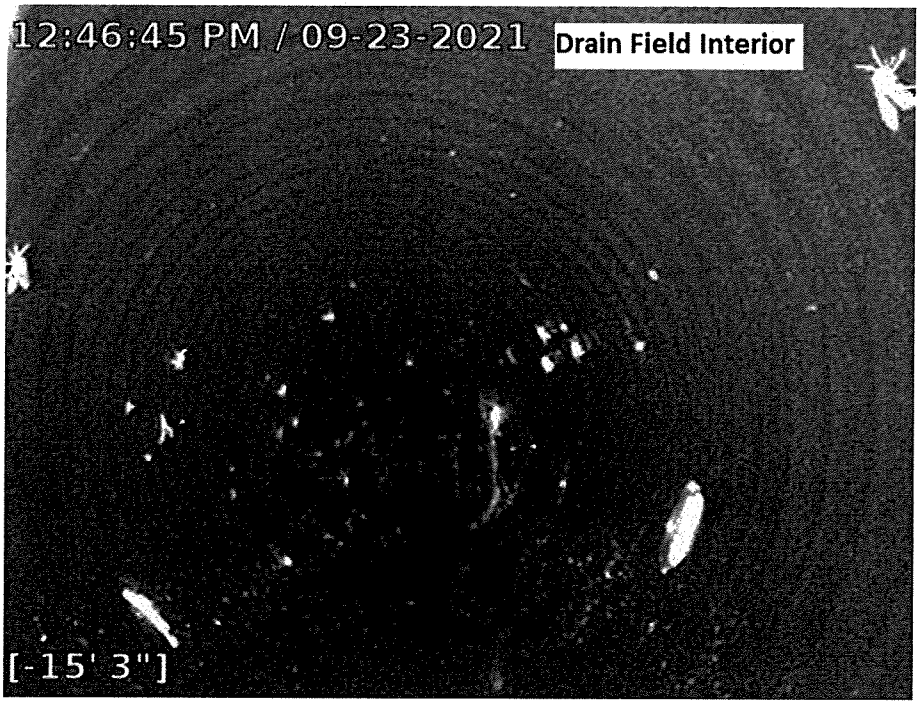
REPAIRS OR REPLACEMENT RECOMMENDED:

- None needed.


Drain Field Area


Distribution Box


12:43:57 PM / 09-23-2021
Distribution Box
(from Newer tank)
15' 1"


12:46:45 PM / 09-23-2021
Drain Field Interior
[-15' 3"]

Terms used are as defined below or within the State of Maine Subsurface Wastewater Disposal Rules, 10-144, Chapter 241. Copied from Maine Subsurface Wastewater Rules effective 8/3/2015

Disposal Area: The combination of the disposal field, shoulders and fill extensions.

Disposal Field: An individual subsurface wastewater disposal system component, consisting of a closed excavation made within soil, or fill material to contain disposal field stone and distribution pipes, or approved proprietary devices for the disposal of septic tank effluent. The excavation is typically in the form of trenches or beds with either stone or proprietary devices included in the design.

Disposal System Permit: Written authorization issued by the LPI to construct a specific subsurface wastewater disposal system. This authorization is attached to the application for disposal system permit.

Distribution Box: A device that receives septic tank effluent and distributes such effluent in equal portions to two or more disposal fields or distribution pipes within a disposal field.

Grey Wastewater: That portion of the wastewater generated within a residential, commercial, or institutional facility that does not include discharges from water closets and urinals

Holding Tank: A closed, watertight structure designed and used to receive and store wastewater or septic tank effluent. A holding tank does not discharge wastewater or septic tank effluent to surface or groundwater or onto the surface of the ground. Holding tanks are designed and constructed to facilitate ultimate disposal of wastewater at another site.

Parallel Distribution: A method of distributing wastewater from a treatment tank equally between multiple rows of distribution piping or media at the same time.

Proprietary Disposal Device: A device utilized in disposal fields as an alternative to a disposal field with a bedding of stone and one or more distribution pipes.

Pump/Dosing Tank: A watertight vessel receiving either untreated or treated domestic wastewater for transport to a disposal area by mechanical means.

Rules: Rules for the Inspection of Subsurface Wastewater Disposal Systems and the Certification of System Inspectors (CMR, Chapter [ ]).

Septic Tank: A watertight receptacle that receives the discharge of untreated wastewater. It is designed and installed so as to permit settling of settle-able solids from the liquid, retention of the scum, partial digestion of the organic matter, and discharge of the liquid portion into a disposal field.

Septic Tank Effluent: Primary treated wastewater discharged through the outlet of a septic tank and/or an approved sand, peat, or similar filter.

Septic Tank Outlet Filter: A device designed to keep solids and grease in a septic tank.

Serial Distribution: A method of distributing septic tank effluent between or within a series of disposal fields so that each successive disposal field receives septic tank effluent only after the preceding disposal fields have become full to the bottom of the invert.

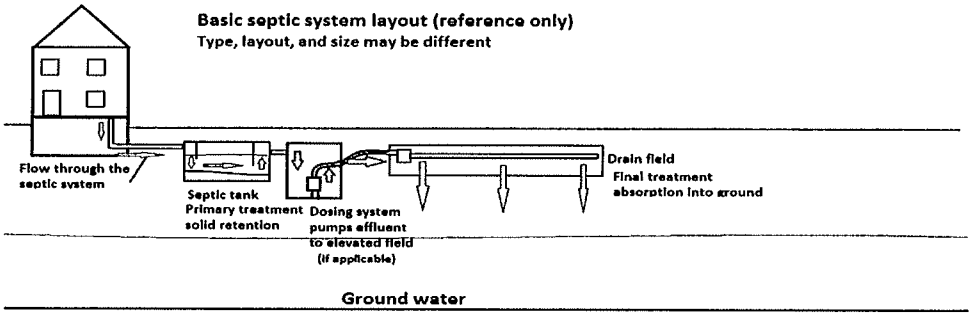
Subsurface Wastewater Disposal System: Any system designed to dispose of waste or wastewater on or beneath the surface of the earth; including, but not limited to: septic tanks; disposal fields; legally existing, nonconforming cesspools; holding tanks; pretreatment filter, piping, or any other fixture, mechanism, or apparatus used for those purposes; does not include any discharge system licensed under 38 M.R.S. §414, any surface wastewater disposal system, or any municipal or quasi-municipal sewer or wastewater treatment system.

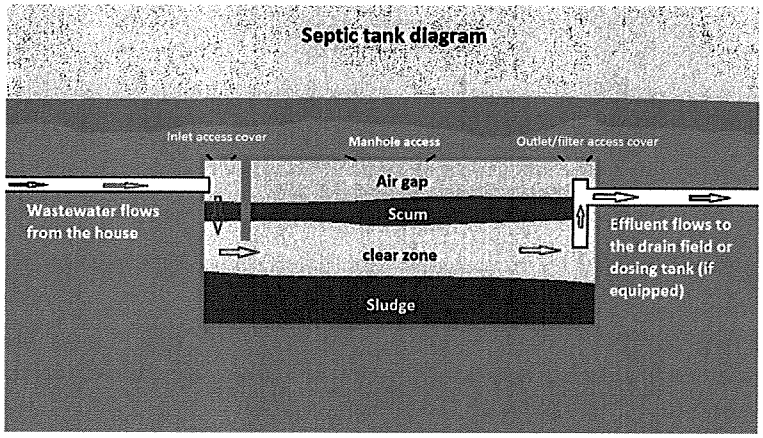
System, Malfunctioning: A system that is not operating or is not functioning properly, based on the following indicators: ponding or outbreak of wastewater or septic tank effluent onto the surface of the ground; seepage of wastewater or septic tank effluent into parts of buildings below ground; back-up of wastewater into the building being served that is not caused by a physical blockage of the internal plumbing; and contamination of nearby water wells and waterbodies/courses.

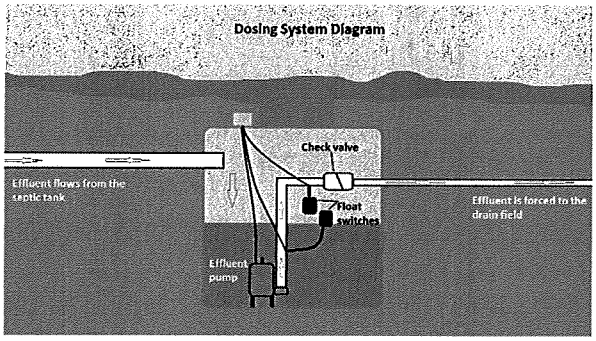
Variance: Written authorization that permits some act or condition not otherwise permitted by these Rules.

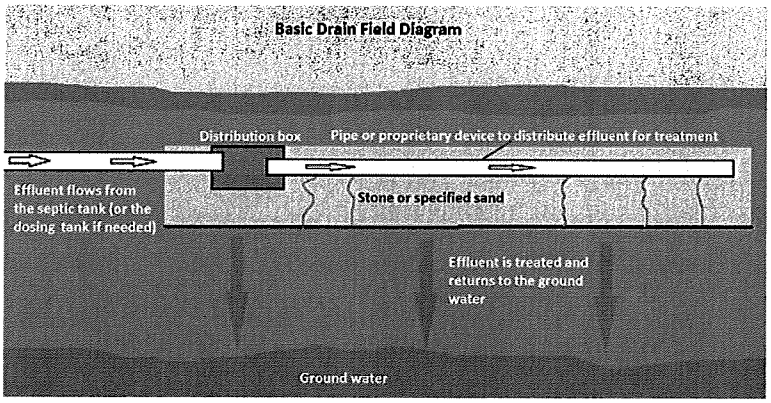
DESCRIPTION OF TYPICAL SEPTIC SYSTEM OPERATION

All plumbing fixtures in the building connect to a main pipe called a building sewer (pipe leading to the septic tank). The building sewer connects to the inlet end of the septic tank. The septic tank is an underground concrete or plastic tank and its purpose is to accept all wastewater from the house. With the help of baffles (at the inlet and the outlet of the tank) the tank will separate and retain solids, fats, greases, and oils. Having the septic tank pumped regularly will clear the tank of the collection of solids, fats, greases, and oils helping ensure a long life of the septic system. The liquid, called effluent, exits the septic tank outlet baffle. The flow thru the tank is done by displacement, the amount of effluent exiting the tank is equal to the amount of wastewater entering. Some septic tanks have an optional filter called an outlet or effluent filter. This is a plastic screen set in the outlet baffle and is designed to stop smaller solid waste from flowing out. If the tank is equipped with an effluent filter it needs to be kept clean. From the septic tank the effluent flows to either another septic tank, a dosing tank, or to the drain field. If the septic is designed with a dosing system (lift pump system used to pump effluent to an elevated or distant drain field) it will be a separate compartment in the septic tank or a standalone tank. Effluent will fill the compartment or tank lifting a float switch connected to a pump. When the switch floats to a vertical position the pump will activate and pump effluent to the drain field. The tank is also equipped with a high-water alarm switch that will sound an alarm panel in the house if the pump fails to operate. Effluent will enter the drain field either from the septic or dosing tank. The drain field may be constructed in many ways with many different types of devices used. Regardless of the layout, style, and device used the drain fields job is to slowly introduce effluent into the ground for treatment by naturally occurring bacteria and microbes. After being treated the effluent will enter the ground water safely.









Routine maintenance is necessary for the long life of a septic system.

Septic tanks require regular pumping. Every 3-5 years based on occupancy.

Clean the outlet filter annually or as necessary (if equipped).

Keep the area over the septic tank and drain field clear of overgrowth and structures.

Never drive a vehicle over a septic tank or drain field that is not designed for such use.

Your septic system is not a trash can

Use water efficiently and never flush anything besides human waste and toilet paper.

Never flush wipes, feminine products, or condoms into the septic system.

Avoid using chemical drain openers.

Do not use/install a garbage disposal.

Never pour cooking oil or grease down the drain.

Never pour paint, toxic chemicals, or pharmaceuticals down the drain.

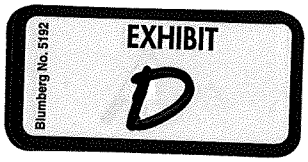
Use minimal amounts of anti-bacterial products for regular cleaning, and avoid pouring it down the drain.

Do not use septic additives.

For more information on septic systems and how to care for them visit https://www.epa.gov/septic

If we can be of any further assistance, please do not hesitate to email or call Advancedleachfieldsllc@gmail.com, 207-329-8495.

"Not in My Backyard": The Effect of Substance Abuse Treatment Centers on Property Values

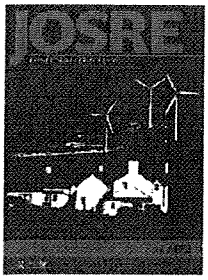


Authors Claire R. La Roche, Bennie D. Waller, and Scott A. Wentland

Abstract Residential treatment centers offer the most intense form of treatment for substance abuse and are often embedded in residential neighborhoods. As a result of the Patient Protection and Affordable Care Act, the number of treatment centers has been forecasted to burgeon. We examine the external effect of residential rehab centers on nearby real estate. As addiction treatment centers are planned, a common response of nearby property owners is "not in my backyard" (NIMBY). Using a large MLS dataset from central Virginia, we estimate the impact of substance abuse treatment centers on nearby home prices and liquidity (as measured by time on market). We find that a neighboring treatment center is associated with an 8% reduction in nearby home prices, and that this discount is magnified for treatment centers that specifically treat opiate addiction (as much as 17%).

The primary residence is perhaps the greatest single investment made by an individual and the mantra "location, location, location" is an ever-present concern of a prospective buyer. Before purchasing a home, a savvy buyer will frequently research the community and the school system, as well as the crime statistics. When homeowners are made aware of an application for a special use permit for the possibility of an addiction treatment center being located in their neighborhood, initial concern for personal and household safety, followed by the stark realization that home values in their neighborhood may be adversely affected, almost always lead homeowners to the universal response of "not in my backyard" (NIMBY). The typical opposition to a proposed substance abuse treatment facility is based on two visceral concerns: an increase in crime risk and a related decrease in property values. The primary purpose of this paper is to examine the latter claim empirically, determining whether there is significant evidence that treatment centers have a negative impact on nearby real estate.

Ex ante, it is not clear that substance abuse treatment centers will adversely impact neighboring real estate, which motivates our empirical examination of this externality. On one hand, there may be a priori reasons to suspect that treatment facilities will not have much of an impact on neighboring real estate. Locating addiction treatment centers in residential areas has become commonplace.



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"Not in My Backyard": The Effect of Substance Abuse Treatment Centers on Property Values

Claire La Roche, Bennie Waller & Scott Wentland

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To link to this article: https://doi.org/10.1080/10835547.2014.12091865

"Not in My Backyard": The Effect of Substance Abuse Treatment Centers on Property Values

Authors Claire R. La Roche, Bennie D. Waller, and Scott A. Wentland

Abstract Residential treatment centers offer the most intense form of treatment for substance abuse and are often embedded in residential neighborhoods. As a result of the Patient Protection and Affordable Care Act, the number of treatment centers has been forecasted to burgeon. We examine the external effect of residential rehab centers on nearby real estate. As addiction treatment centers are planned, a common response of nearby property owners is "not in my backyard" (NIMBY). Using a large MLS dataset from central Virginia, we estimate the impact of substance abuse treatment centers on nearby home prices and liquidity (as measured by time on market). We find that a neighboring treatment center is associated with an 8% reduction in nearby home prices, and that this discount is magnified for treatment centers that specifically treat opiate addiction (as much as 17%).

The primary residence is perhaps the greatest single investment made by an individual and the mantra "location, location, location" is an ever-present concern of a prospective buyer. Before purchasing a home, a savvy buyer will frequently research the community and the school system, as well as the crime statistics. When homeowners are made aware of an application for a special use permit for the possibility of an addiction treatment center being located in their neighborhood, initial concern for personal and household safety, followed by the stark realization that home values in their neighborhood may be adversely affected, almost always lead homeowners to the universal response of "not in my backyard" (NIMBY). The typical opposition to a proposed substance abuse treatment facility is based on two visceral concerns: an increase in crime risk and a related decrease in property values. The primary purpose of this paper is to examine the latter claim empirically, determining whether there is significant evidence that treatment centers have a negative impact on nearby real estate.

Ex ante, it is not clear that substance abuse treatment centers will adversely impact neighboring real estate, which motivates our empirical examination of this externality. On one hand, there may be a priori reasons to suspect that treatment facilities will not have much of an impact on neighboring real estate. Locating addiction treatment centers in residential areas has become commonplace.

Treatment centers tend to be inconspicuous and may have blackout curtains and minimal signage (or no sign). The housing is often gated and locked at a certain time of the day. Generally, clients enrolled in residential treatment programs are not allowed to interact with the "locals" of the neighborhood or leave the premises. Under current law (discussed in the next section), despite their challenges, residential treatment centers have relatively few limitations on where they are sited.

On the other hand, like many negative externalities or NIMBY issues, there are reasons to suspect that rehab facilities may adversely impact neighboring real estate. Substance abuse is a multifaceted health issue and many patients in residential treatment have a dual diagnosis: a mental health issue and an addiction (Connery, 2011). The Substance Abuse Mental Health Services Administration (SAMHSA, 2008) surveyed 14,423 facilities in 2008 and had a response rate of 94.1%. The SAMHSA survey indicated that 39% of the clients in treatment centers had a dual diagnosis. In addition, concurrent alcohol and drug addiction accounted for approximately 45%, while clients in treatment solely for drug abuse accounted for 34%–36% and 18%–20% of the patients only abused alcohol (SAMHSA, 2008).

One consequence of locating drug and alcohol rehabilitation centers in residential areas is that patients in substance abuse treatment programs frequently leave or are administratively discharged before successful completion. At some point, experts say that, "relapse is an almost unavoidable—and potentially useful—step in recovery" (Shaffer, 2012). For many, intensive residential treatment is a "last resort." A healthy family of an addict will decline to "enable" negative behavior and, instead, will insist that the alcoholic/addict experience the "consequence" of the decision to use again and refuse treatment. In other words, the family will often not offer any form of financial support and the addict will have to fend for himself or herself. In addition to having a substance abuse disorder and possibly a dual diagnosis, those who relapse and leave treatment prior to completion often have limited job skills and perhaps even a criminal record—factors that make employment a challenge. Thus, as a practical matter, nearby neighbors may have valid concerns that the presence of a treatment center will be accompanied by additional unemployed or even homeless addicts on the street near the area in which the treatment center is located. This perception of elevated risk in these areas may then be reflected in the market prices of nearby real estate.

The likely occurrence of relapse combined with the probability of criminal charges and/or convictions associated with substance abuse corroborates the argument that the presence of a treatment center may bring objectionable consequences into a community. The purpose of this paper is to use market data to assess whether there is substantial evidence of nearby real estate being adversely impacted by the presence of treatment centers, consistent with the potential risks that proximity to these facilities may bring. As a clear-cut NIMBY issue, this paper contributes to the broader literature of examining the market effects of specific externalities or environmental factors in real estate. Our study contributes to the literature by being the first to examine the effect of substance abuse treatment centers on the

surrounding real estate market and, more generally, adding to our understanding of external factors that impact home prices.

Substance Abuse Treatment: Salient Issues, Recent Trends, and Related Literature

It is anticipated that the impact of the July 1, 2014 changes to insurance coverage under the Affordable Care Act (ACA) will cause the number of treatment centers to burgeon and thus, a study of the effect of nearby addiction treatment centers on real estate is timely. Prior to investigating treatment centers' effects on nearby real estate, it is crucial to understand the background of substance abuse treatment and why the current issues motivate the examination of potential real estate externalities.

Although accurate statistics of drug or alcohol disorders are difficult to obtain, according to a Harvard Medical School Special Health Report, between 15% and 28% of Americans will have a substance use disorder sometime during their lifetime and this estimate does not include addiction to nicotine (Shaffer, 2012). Residential treatment has become a more common way to treat addiction and, like many areas in healthcare services, residential rehabilitation has become a growth industry.

Broadly speaking, there are three types of treatment centers: intensive outpatient program (IOP), inpatient treatment, and partial hospitalization program (PHP). Typically, IOP treatment centers offer each client nine hours of group therapy, one hour of individual therapy, and one hour of case management (managing auxiliary services) per week. IOP clients either live in a halfway house or at home with strict guidelines established by their primary therapist. Although halfway houses can vary greatly, they generally have full-time house managers and mandatory, random urinalysis. Inpatient programs require clients to live at the facility in which all treatment takes place and may either be freestanding or hospital-based. PHP, also known as the "Florida model," is a hybrid version of inpatient treatment and intensive outpatient treatment: individuals go to a counseling center during the day, and after a full day of therapy sessions return to off-site housing located in a neighborhood. Behavioral health technicians work at the off-site facilities around the clock.

Mandatory addiction treatment (commitment) does not exist under the law. An addict must choose to be in a recovery program. It is interesting to note that all three of the substance abuse treatment models include the possibility of group housing in neighborhood settings.

Projected Increase in SUD Treatment Facilities: MHPAEA and the ACA

The Patient Protection and Affordable Care Act (PPACA), also known as Obama Care, made sweeping changes to Mental Health/Substance Use Disorder

(MH/SUD) insurance coverage that went into effect on July 1, 2014. To understand the ramifications for residential treatment centers, it is necessary to briefly examine the legislative history of MH/SUD insurance coverage. Prior to July 1, 2014, the high cost of MH/SUD treatment meant that it was only available to patients with (or whose families have) considerable means, or those whose health insurance provided coverage. The Mental Health Parity and Addiction Equity Act of 2008 (MHPAEA) attempted to address the unequal treatment of MH/SUD health insurance coverage and legislated equal treatment between MH /SUD benefits and medical/surgical benefits. If a plan had MH/SUD coverage, then it must be on par with the medical/surgical benefits offered under that policy. The MHPAEA did not mandate that an insurance policy must cover MH/SUD and only applied to group health plans sponsored by employers with 50 or more employees. Both individual and small employer group policies were specifically exempted from coverage (MHPAEA Fact Sheet).

The PPACA mandates that MH/SUD coverage be included in marketplace health insurance policies as an "essential health benefit" as of July 1, 2014 (MHPAEA Fact Sheet). The effect of inclusion of MH/SUD coverage as an essential health benefit is that the MH/SUD parity rules now apply to non-grandfathered individual and small group plans (Beronio, Po, Skopec, and Glied, 2013). With expansion of the "parity rules" and inclusion of MH/SUD coverage as an essential health benefit under the ACA, it is anticipated that the number of patients having access to expensive addiction treatment options will grow exponentially, as will the number of treatment centers.

Antidiscrimination Housing Laws

When a proposed treatment center is sited, concerned members of the community frequently pressure lawmakers or hire attorneys, causing treatment centers to fight protracted legal battles that attempt to prevent the opening of the center. However, numerous laws hinder such NIMBY efforts, providing legal basis for treatment centers to be located just about anywhere. There are several federal laws that prohibit discrimination in housing based on a "disability" and define disability as: "Any person who has a physical or mental impairment that substantially limits one or more major life activities; has a record of such impairment; or is regarded as having such impairment" (HUD).

Substance abuse disorders are clearly recognized disabilities and thus are covered under fair housing laws. Federal housing laws that prohibit disability-based discrimination and ensure equal housing opportunities are briefly discussed below.

Fair Housing Act. The Fair Housing Act (FHA) was designed to prohibit discrimination in housing. In 1988, the FHA was amended to include persons with handicaps to the protected classes under the FHA, 42 U.S.C. §3604(f)(3)(B). The definition of "handicap" under the FHA is very broad, and drug addiction and alcoholism are considered to be disabilities that are covered. The FHA also has a provision (42 U.S.C. §3604(f)(9)) that permits the exclusion of those "whose tenancy would constitute a direct threat to the health or safety of other individuals or ... would result in substantial physical damage to the property of others." Thus,

the FHA does not protect an individual currently using illegal drugs or a person with a conviction of distributing or illegally manufacturing a controlled substance.

The FHA covers almost every aspect of a real estate transaction. According to the Act, it is illegal to discriminate in the sale or rental of a dwelling against a person with a disability. Thus, an alcoholic/addict cannot be denied housing based solely on his or her addiction. The Act does permit "reasonable local, State or Federal restriction regarding the maximum number of occupants permitted to occupy a dwelling" 42 U.S.C. §3607(b)(1). This exemption is for living space per occupant and is intended to promote health and safety, not exclude group homes from residential areas.

Although a person with a conviction for dealing or illegally manufacturing a controlled substance is not protected under the FHA, a drug distribution conviction does not automatically exclude a person from invoking the Rehabilitation Act or the Americans with Disabilities Act.

Rehabilitation Act. §504 (45 CFR Part 84) of the Rehabilitation Act of 1973 prohibits any entity from receiving federal funds from discriminating on the basis of a disability. Drug addiction and alcoholism are covered under this act as well. Communities have attempted to use zoning laws to exclude treatment centers. Under §504, if a community's zoning regulation excludes substance abuse treatment centers, that community risks losing its federal funds.

Americans with Disabilities Act. Among other things, the purpose of Title II of the Americans with Disabilities Act (ADA) is to eliminate discrimination in housing against people with disabilities. This Act has further reach than §504 of the Rehabilitation Act because the receipt of federal funds is not required for Title II of the ADA to apply.

Zoning and Case Law. Zoning regulations create perhaps the biggest barrier to entry for a substance abuse center. As a practical matter, when considering a proposed site for a treatment center, the owners prefer to avoid spending a lot of time and money fighting a protracted court battle associated with a zoning ordinance. This mindset, however, did not stop a significant case from being appealed to the United States Supreme Court by Oxford House, a self-supporting, resident-run, residential treatment program. In the landmark case of *City of Edmonds v. Oxford House, Inc.*, et al., 514 U.S. 725 (1995), the City of Edmonds attempted to use an occupancy restriction in a zoning ordinance to exclude treatment centers from residential areas. The zoning ordinance in question allowed an unlimited number of related persons to live in a home and attempted to restrict the number of unrelated persons living in a single-family dwelling to five. The City of Edmonds claimed that the §3607(b)(1) exemption to the FHA applied to the city's zoning ordinance. In a 5–4 decision, the Supreme Court held that a zoning ordinance that defined a family in such a way as to exclude treatment centers was unlawful. The ordinance was not a maximum occupancy provision but a provision describing who may compose a "family" and, thus, it violated the FHA. This case was a critical victory for the "Oxford House Model" because this community-based treatment program leases houses located in upscale neighborhoods across the U.S.

The bottom line is that there must be a "rational basis" for zoning regulation to be valid and localities have consistently been prohibited from discriminating against substance abuse treatment centers. Absent drastic changes to the laws outlined above, it is clear that residential centers are here to stay, and that if challenged in court, NIMBY proponents will have an uphill battle. Thus, given the growth trends in this industry, the potential risks posed to neighbors, and the laws that protect the treatment centers' rights to locate almost anywhere, what is the consequence for real estate when a treatment center is located in one's "backyard," so to speak?

Related Literature in Real Estate

Researchers have long recognized that numerous externalities impact the marketing outcomes of residential real estate. These externalities may include, for example, neighboring pollution,[1] or even the condition of adjoining or nearby properties and/or the tenant's behavior living in such properties. Real property has intangible benefits or disamenities, which are determined largely by public perception and capitalized into the pricing and marketing duration of residential properties. Furthermore, negative externalities are likely to significantly impact the marketing outcomes of properties in close proximity to the properties being marketed for sale, as well as impact the desirability of the overall neighborhood. Such "stigma" events are likely to be correlated with an exodus of higher income residents causing a "snowball" effect in declining property values (McCluskey and Rausser, 2003).

There are a number of researchers who analyze the degree to which external or neighborhood factors, both positive and negative, are capitalized in residential real estate marketing outcomes. For example, Thaler (1978) finds a negative relationship between neighborhood crime rates and property values. Gibbons (2004) finds an inverse relationship between vandalism and property values in London. As one would expect, robbery and aggravated assault rates have a significant and negative impact on property values (Ihanfeldt and Mayock, 2010). Pope (2012) found that decrease in crime rates had a positive effect on property values, particularly in those cities with substantial decreases in crime rates. Using a microspatial approach, Rosiers (2002) examined the impact of the visual encumbrance of power lines on property value and finds that on average it negatively impacts value by approximately 10%, but increases to 14% in areas where setback in property lines are less.

As a result of the recent economic and housing collapse, there are several studies that have examined the impact of foreclosed properties. Foreclosed properties may present a variety of negative effects on neighboring properties, including (but not limited to) the "eyesore effect" where neighboring foreclosures that have long been vacant adversely impact the aesthetic appeal of the neighborhood. Such studies include Harding, Rosenblatt, and Yao (2009), Lin, Rosenblatt, and Yao (2009), Daneshvary, Clauretie, and Kader (2011), Daneshvary and Clauretie (2012), and Agarwal, Ambrose, Chomsisengphet, and Sanders (2013). Generally, these studies find negative neighborhood spillovers from foreclosed or distressed properties.

A review of the literature does not reveal any specific examples of residential drug rehabilitation centers and their impact on neighboring property values. However, there is analogous literature of undesirable neighbors impacting property values. For example, Congdon-Hohman (2013) finds a significant and negative effect on home values located within one-eighth of a mile of a methamphetamine lab. The effect dissipates both as time passes after the discovery of and distance from a meth lab. Reichert, Small, and Mohanty (1992) estimate the impact of landfills on nearby real estate, finding a negative impact when located within several blocks of an expensive housing area. They find an effect that ranges from 5.5% to 7.3%, depending on the distance from the landfill. Indeed, the authors find that the percentage impact on older, less expensive properties to be significantly less (3%–4%) relative to the more expensive properties. Similarly, Hite, Chern, Hitzusen, and Randall (2001) find significant differences in property values located within 3.25 miles of a landfill.

Other studies have shown that a variety of other external factors affect real estate market outcomes. Coulson and Leichenko (2001) find that designated properties, as well as neighboring properties, are significantly impacted by historical designations. Other examples include the impact of registered sex offenders on the marketing outcomes of neighboring properties. Three recent studies have examined the impact as to the proximity of registered sex offenders. Most recently, Wentland, Waller, and Brastow (2014) found that close proximity to sex offenders rendered large price and liquidity effects, declining but significant out to one mile. The authors also found amplified effects for homes with more bedrooms, a proxy for children, and whether the nearby offender was convicted of a violent sex offense. Linden and Rockoff (2008) found significant reductions in home prices across radii of less than 0.1 miles and 0.1 to 0.3 miles when an offender moves in. Pope (2008) found properties located within 0.1 miles of a sex offender significantly reduced home values.

Data

We use residential real estate data from a multiple listing service (MLS) located in central Virginia, including Richmond and other surrounding areas. MLS data are critical for any externality study, particularly those that analyze both time on market and price, because it contains both the list date and sell date (or withdraw date) of residential properties, while tax data and other publically available data usually only include the property's date of sale. This is critical because nearby amenities or disamenities may be capitalized into a home's price, liquidity, or some combination of the two. In this study, we examine both. While the expected sign of living near a potential disamenity is likely negative for the price estimates, the estimated impact on liquidity is theoretically ambiguous. While the disamenity may lower the arrival rate of potential buyers, lengthening the time on market, the seller may be willing to discount the home in part to counteract this effect.

The sample is composed of listings in the residential real estate market over approximately a decade, between 2001 and 2011. The initial housing data contains 207,793 observations (including both sold and unsold properties). Among others,

Levitt and Syverson (2008) point out that MLS data are entered by real estate agents and can be incorrect or incomplete. The data were carefully examined in light of common issues prevalent in the data. After culling for incomplete, missing or illogical data that suggest data entry errors or extravagant outliers, the final data set consists of approximately 194,983 homes on the market, with approximately 111,580 that eventually sold.[2] The MLS data include numerous property characteristics (square footage, bedrooms, baths, age, acreage, etc.) and, of course, each property's location.

Our MLS data are a fairly representative housing market in the U.S., which includes urban, suburban, and rural sales. Richmond is a medium-sized city located in the eastern part of central Virginia and the MLS covers much of the "Greater Richmond" area (or Richmond MSA). The average property in this MLS has a listing and selling price of $263,641 and $242,116, respectively. The average listed property was 25 years of age, with 2,143 square feet, 3.6 bedrooms, and 2.4 bathrooms with an average time on market of 85 days. During this time period, there were 36 substance abuse treatment centers located within the broader region encompassing the listings in our data, and nine were located within the city limits of Richmond specifically.[3] See Exhibit 1 for additional descriptive statistics.

The primary source of the treatment center externality is its proximity to a given home on the market. Intuitively, there is likely an increasing NIMBY sentiment as the proximity to the center is closer in distance. Thus, we compute the distance from a given home in the MLS and each treatment center, using address data to code the longitude and latitude from which the straight-line distance is calculated using the great-circle formula. While NIMBY does not literally refer to one's "backyard," it is usually taken to mean very close proximity, but the definition of what qualifies as "very close proximity" may be different depending on the person and the issue. Below we examine the effect of nearby substance abuse treatment centers on nearby real estate, using different spatial proximities (e.g., 0.175 miles, 0.15 miles, and 0.125 miles) as a robustness check.[4]

Empirical Methodology

Our primary goal is to isolate the effect of a treatment center on neighborhood real estate outcomes. Numerous studies have examined other neighborhood externalities, using a variety of empirical approaches.[5] Initially, we focus on a treatment center's effect on the sale price and liquidity of a home, utilizing a cross-sectional OLS hedonic pricing model as the baseline. While hedonic pricing models are commonly used to determine the value of specific property attributes and surrounding (dis)amenities by estimating marginal effects on the sale price of the property,[6] we also explore a simultaneous equation model to account for the joint determination of both price and liquidity. The purpose of exploring multiple approaches is to demonstrate that the results are not particularly sensitive to the choice of modeling technique.

Baseline OLS Hedonic Models

Beginning with a simple cross-sectional approach, we provide a baseline estimate of the effect of a nearby substance abuse treatment center, employing a traditional

Exhibit 1 | Summary Statistics

Variable	Mean	Std. Dev.
List Price ($)	263,641	142,300
Sale Price ($)	242,116	127,608
Time on Market (in Days)	85.45	79.99
Rehab Center (Dummy Var. = 1 if the home is near a rehab center (distance specified in each table), 0 otherwise)	0.0003	0.02
Age (in Years)	24.99	26.16
Acreage	0.79	1.91
Square Feet	2,143.29	888.25
Bedrooms	3.60	0.77
Bathrooms	2.38	0.82
Foreclosure (Dummy Var. = 1 if foreclosure, 0 otherwise)	0.02	0.12
Number of levels	1.83	0.65
Pool (Dummy Var. = 1 if the home has a pool, 0 otherwise)	0.05	0.23
Basement (Dummy Var. = 1 if they have a basement, 0 otherwise)	0.17	0.38
Short Sale (Dummy Var. = 1 if short sale, 0 otherwise)	0.02	0.13
Tenant (Dummy Var. = 1 if it has a tenant at listing, 0 otherwise)	0.03	0.16
Vacant (Dummy Var. = 1 if the home is vacant, 0 otherwise)	0.36	0.48
Taxes	1,779.95	1,311.74
HOA Fees (Dummy Var. = 1 if it has HOA fees, 0 otherwise)	0.32	0.47
Listing Density	64.41	577.40
Competition	582.22	1,062.08

Note: Location and year fixed effects summary stats omitted.

hedonic model that accounts for heterogeneous characteristics of both homes and their locations. We estimate the following functional forms:

$$SP_i = \varphi_i(X_i, LOC_i, T_i, TOM_i) + \varepsilon \quad (1)$$

and

$$TOM_i = \varphi_i(X_i, LOC_i, T_i, LP_i) + \varepsilon, \quad (2)$$

where SP_i is a vector for property selling price,[7] LP_i is a vector for property listing price X_i is a vector of property specific characteristics,[8] LOC_i is a vector for location control using ZIP Codes (see below), T_i, the variable of interest, equals

1 if a treatment center is located nearby of a given home, and is 0 otherwise, TOM_i is the time on market (in days), which the literature also calls marketing duration or a measure of liquidity, and ε is an error term that is heteroskedastic-consistent and clustered by ZIP Code.[9]

Hedonic analysis of the housing market requires some control for spatial heterogeneity because location itself is a key source of differences in housing prices. The goal is to disentangle specific proximity to a treatment center from broader location differences that explain real estate prices. Following numerous studies in the real estate and urban economics literature, we chose ZIP Code fixed effects to control for unobserved heterogeneity *across* these areas so that the explanatory variables' effects are identified from variation *within* a given area (or even in a given year, as is the case for time fixed effects). In effect, our results may then be interpreted as the treatment center's effect on home prices given comparable homes within the same ZIP Code, but located further away. In this sense, we are attempting to disentangle the broader location effect from the proximity to a treatment center by essentially comparing homes within a certain ZIP Code. Further, we explore alternative location controls (census tracts, block groups, and blocks) in a similar vein, as well as altering the control group itself by confining it to narrow bands around a rehab facility. Appropriate location controls can disentangle the negative externality effect from simply a "bad neighborhood" or "bad part of town" effect.

Simultaneous Equations Approach: System Identification

Numerous studies in real estate and urban economics model price and time on market in a simultaneous system (like 2SLS or 3SLS) given likely joint determination of these factors. A seller can always lower price to increase liquidity, and vice versa. Yet, a home's sale price and time on market are determined by virtually identical factors. Econometrically, this creates an identification problem because if one wants to model this simultaneity with a system of equations, then, by definition, such a system could not be identified using identical exogenous variables. While a number of empirical studies acknowledge this simultaneity,[10] Turnbull and Dombrow (2006) and Zahirovic-Herbert and Turnbull (2008) have identified a novel way of overcoming this identification problem through their incorporation of variables that represent market conditions from other listings on the market. Below we summarize a solution to this identification issue, as we utilize an adapted form of this approach to model price and liquidity in a simultaneous system.

Following Krainer's (2001) search market model, one can model a home's expected liquidity, $E[TOM]$, (measured as a home's marketing duration or time on market) and expected house sale price, $E[SP]$, as simultaneously determined and implicitly defined as:

$$F(E[SP], E[TOM], T, X, LOC, C) = 0, \quad (3)$$

where T is an indicator of whether a home is near a rehab treatment center, X is a vector of house (and market) characteristics, LOC is location controls, and C are neighborhood market conditions. The latter variable, C, represents neighborhood market conditions that have an ambiguous external effect on local properties. On one hand, when the number of nearby homes that go on the market increases, the supply of additional homes on the market ought to negatively impact the price and liquidity of a nearby home (i.e., "a competition effect"). On the other hand, the increased traffic generated from additional nearby homes on the market could actually positively impact a home's price and liquidity, which is termed "a shopping externality effect." Empirically, the sales price and time on market can be represented as separate functions with jointly distributed stochastic errors ε_p and ε_T:

$$SP = \varphi_p(TOM, T, LOC, X, C) + \varepsilon_p \quad (4)$$

and

$$TOM = \varphi_T(SP, T, LOC, X, C) + \varepsilon_T. \quad (5)$$

The vector C (i.e., market conditions or neighborhood competition) and another vector, L (i.e., listing density), are the keys to Turnbull and Dombrow's (2006) solution to over-identifying this system of equations (since equations 3 and 4 are not yet identified). Neighborhood competition, C, is a measure that accounts for "nearby houses for sale as long as each competing listed house overlaps with the period that this house is on the market, inversely weighted by the distance between the houses to reflect the assumption that nearby houses will have stronger effects on the sale of this house than houses that are farther away" (Zahirovic-Herbert and Turnbull, 2008).[11] Listing density, L, is similarly defined as "the measure of competing overlapping listings per day on the market" (Zahirovic-Herbert and Turnbull, 2008), where: $L(i) = \Sigma_j(1 - D(i, j))^2\{\min[s(i), s(j)] - \max[l(i), l(j)]\}/s(i) - l(i) + 1$. Essentially, both measures capture neighborhood market conditions by quantifying the marketing overlap of nearby homes on the market simultaneously, however, listing density is weighted by time on market. Turnbull and Dombrow (2006) point out that a change in competition while holding selling time constant is also the partial derivative with respect to listing density (and it is easy to see that $\partial\varphi_p/\partial C \equiv \partial\varphi_p/\partial L$). Therefore, we can rewrite our system of equations to reflect:

$$SP = \varphi_p(TOM, T, LOC, X, L) + \varepsilon_p \quad (6)$$

and

$$TOM = \varphi_T(SP, T, LOC, X, C) + \varepsilon_T. \quad (7)$$

Both L and C vectors uniquely identify the simultaneous system. Further, we supplement this approach by using different location controls across equations.[12] We estimate the system of equations (5) and (6) using three-stage least squares (3SLS) in the next section to generate a coefficient estimate of the effect of a nearby treatment center on price and time on market. We model simultaneity using a 3SLS approach because it incorporates an additional step with seemingly unrelated regression (SUR) estimation to control for correlations between error terms.[13]

Alternative Specifications and Robustness

While the baseline results include location controls, an additional way to isolate the treatment effect of a rehab facility is by limiting the control group to homes closer to rehab facilities more generally (i.e., omitting observations sufficiently far from any rehab facility). Methodologically, the comparison is then between homes that are near a rehab treatment facility and homes just outside a given range. Specifically, we explore the effect of a rehab center (within 1/8 mile) on nearby real estate as compared to similar homes further out (i.e., within 1.5 miles, 1 mile, and 2/3 mile, respectively). This approach allows us to further homogenize location as a robustness check, and to provide additional evidence that the external effect is specific to the rehab facility, and not simply the part of town in which it is located.

We also examine whether facilities that only treat opiate addicts (commonly known as methadone clinics) have a larger impact on nearby real estate. Clinics that treat heroin or prescription addicts, for example, often use buprenorphine or methadone as part of the rehabilitation process. Nearby residents may perceive patients who are still intoxicated, albeit at a lower dose, as an elevated crime risk. Approximately half of the 36 treatment centers in our sample only treat opiate addiction (hereinafter referred to as methadone clinics). We examine whether nearby real estate is more affected by methadone clinics specifically.

Results

Baseline OLS Results

The baseline OLS results provide evidence that nearby treatment centers adversely impact surrounding home values, but have little if any impact on property liquidity. Estimating equations (1) and (2), Exhibit 2 shows that this adverse effect is not qualitatively sensitive to the choice of the definition of "nearby." Column 1 shows that the presence of a rehab center within 0.125 (1/8) miles is associated with

Exhibit 2 | Effect of a Nearby Rehab Center on a Home's Price and Liquidity: Baseline OLS Results

	Dependent Variable: *ln(Sale Price)*			Dependent Variable: *ln(Days on Market)*		
	(1)	(2)	(3)	(4)	(5)	(6)
Rehab Center ≤ 0.125 Mile	−0.0796**			−0.0513		
	(−1.97)			(−0.28)		
Rehab Center ≤ 0.15 Mile		−0.0623**			0.1101	
		(−2.20)			(0.76)	
Rehab Center ≤ 0.175 Mile			−0.0517**			0.1190
			(−2.49)			(1.10)
ln(Age of Home)	−0.0649***	−0.0649***	−0.0649***	0.0213***	0.0213***	0.0213***
	(−19.07)	(−19.07)	(−19.08)	(2.71)	(2.71)	(2.71)
Acreage	0.0206***	0.0206***	0.0206***	0.0203***	0.0203***	0.0203***
	(13.39)	(13.39)	(13.39)	(4.47)	(4.46)	(4.46)
Sq. Ft.	0.0003***	0.0003***	0.0003***	−0.0000	−0.0000	−0.0000
	(15.38)	(15.38)	(15.38)	(−0.50)	(−0.50)	(−0.50)
Bedrooms	−0.0075	−0.0075	−0.0075	0.0441***	0.0441***	0.0441***
	(−0.99)	(−0.99)	(−0.99)	(5.06)	(5.07)	(5.06)
Bathrooms	0.0390***	0.0390***	0.0390***	−0.0517***	−0.0517***	−0.0517***
	(6.30)	(6.30)	(6.30)	(−5.34)	(−5.34)	(−5.33)
Foreclosure	−0.1691***	−0.1691***	−0.1691***	−0.3936***	−0.3938***	−0.3939***
	(−20.60)	(−20.60)	(−20.60)	(−15.90)	(−15.91)	(−15.93)
Number of Levels	−0.0055	−0.0055	−0.0055	0.0419***	0.0418***	0.0418***
	(−1.17)	(−1.17)	(−1.17)	(4.93)	(4.93)	(4.93)
Pool	0.0334***	0.0334***	0.0334***	0.0060	0.0060	0.0060
	(3.61)	(3.61)	(3.60)	(0.18)	(0.18)	(0.18)
Basement	0.0418***	0.0418***	0.0418***	0.0045	0.0046	0.0046
	(3.15)	(3.15)	(3.15)	(0.23)	(0.23)	(0.23)

approximately an 8% reduction in home values. The corresponding impact on time on market is not statistically significant at any conventional level, providing initial evidence that the externality is primarily capitalized into home prices, rather than liquidity. Indeed, columns 2 and 3 show that homes sold for approximately 6% or 5% less if they were located within 0.15 miles or 0.175 miles of a rehab center, respectively. While qualitatively similar, these coefficient estimates also provide some evidence that the externality may be diminishing in distance, as additional, further properties are included in the latter estimates. The regressions tabulated in columns 5 and 6 tell approximately the same story as column 4, in that there is little evidence that rehab centers have a statistically significant impact on a home's liquidity.

The real estate literature has not adopted a single way to control for spatial heterogeneity. In Exhibit 3 we examine a few common alternatives to controlling for location. The initial estimates in Exhibit 2 use ZIP Codes to control for spatial heterogeneity. In Exhibit 3, we use census tract fixed effects (columns 1 and 4), block group fixed effect (columns 2 and 5), and block fixed effects (columns 3 and 6). Census tracts, according to the U.S. Census, are "small, relatively permanent statistical subdivisions of a county ... designed to be homogenous with respect to population characteristics, economic status, and living conditions."[14] Census block groups are subsets of census tracts; and, blocks are further subsets of block groups. One can think of these as different measures of "neighborhoods," broadly to more narrowly defined. The results from the price regressions in Exhibit 3 are consistent with Exhibit 2, falling within a fraction of a percentage point of one another, with an effect of approximately 7.2% to 7.9%. Columns 4–6 in Exhibit 3 also show that substance abuse treatment centers are not associated with a statistically significant impact on nearby property liquidity. Overall, it is clear that the estimates of the effect of a substance abuse treatment center on nearby real estate is not particularly sensitive to the choice of location controls, providing evidence that the external effect of substance abuse treatment centers is robust.

Simultaneous Equation Results

When price and time on market are modeled within a simultaneous 3SLS system of equations, the estimated effect of a nearby substance abuse treatment center on home price and liquidity are similar to the OLS results, finding that nearby substance abuse treatment centers are associated with an approximately 8% drop in home values (within 1/8 mile). Column 1 in Exhibit 4 displays this result. Like the initial OLS results, the 3SLS estimations also show that substance abuse treatment centers have little impact on nearby property liquidity, as the externality appears to be capitalized into price exclusively. Exhibit 4 provides additional evidence that the external impact of substance abuse treatment centers is robust to multiple modeling approaches that are common in empirical real estate studies.

Exhibit 4 also provides evidence that not all substance abuse treatment centers may be perceived by nearby residents as presenting equal risk. It is possible that methadone clinics have a greater NIMBY sentiment from the broader community. We test this proposition empirically by exclusively examining the effect of

Exhibit 2 | (continued)

Effect of a Nearby Rehab Center on a Home's Price and Liquidity: Baseline OLS Results

	Dependent Variable: *ln(Sale Price)*			Dependent Variable: *ln(Days on Market)*		
	(1)	(2)	(3)	(4)	(5)	(6)
Short Sale	−0.0935***	−0.0935***	−0.0935***	0.3775***	0.3775***	0.3775***
	(−12.68)	(−12.68)	(−12.67)	(18.07)	(18.08)	(18.07)
Tenant	−0.0815***	−0.0815***	−0.0815***	0.2479***	0.2479***	0.2479***
	(−10.10)	(−10.10)	(−10.10)	(11.82)	(11.81)	(11.81)
Vacant	−0.0279***	−0.0279***	−0.0279***	0.1207***	0.1207***	0.1207***
	(−6.56)	(−6.56)	(−6.57)	(7.44)	(7.43)	(7.43)
Taxes ($)	0.0001***	0.0001***	0.0001***	−0.0000	−0.0000	−0.0000
	(6.81)	(6.81)	(6.81)	(−1.23)	(−1.23)	(−1.23)
HOA Fee	0.0715***	0.0715***	0.0715***	−0.0690***	−0.0691***	−0.0690***
	(7.11)	(7.11)	(7.11)	(−3.26)	(−3.26)	(−3.26)
ln(Days on Market)	0.0003	0.0003	0.0003			
	(0.21)	(0.21)	(0.21)			
ln(List Price)				0.6486***	0.6487***	0.6487***
				(9.34)	(9.34)	(9.34)
Constant	11.4723***	11.4723***	11.6581	−5.6213***	−5.6222***	−5.6225***
	(171.71)	(171.70)	(0.07)	(−6.69)	(−6.69)	(−6.69)
Location Controls (ZIP Code)	✓	✓	✓	✓	✓	
Year Fixed Effects	✓	✓	✓	✓	✓	

Notes: This table presents results of hedonic OLS models showing the effect of a nearby (i.e., within 0.125 mile, 0.15 mile, and 0.175 mile) rehab facility on a property's sale price and time on market (errors clustered by ZIP Code). *T*-statistics are in parentheses. The number of observation in columns 1–3 is 117,187; the number of observation in columns 4–6 is 206,420.

*Significant at the 10% level.

**Significant at the 5% level.

***Significant at the 1% level.

Exhibit 3 | Effect of a Nearby Rehab Center on a Home's Price and Liquidity with Different Location Controls

	Dependent Variable: *ln(Sale Price)*			Dependent Variable: *ln(Days on Market)*		
	(1)	(2)	(3)	(4)	(5)	(6)
Rehab Center ≤ 1/8 Mile	−0.0720**	−0.0787**	−0.0744**	−0.0695	−0.0919	−0.0520
	(−2.01)	(−2.16)	(−2.25)	(−0.41)	(−0.55)	(−0.32)
ln(Age of Home)	−0.0683***	−0.0668***	−0.0650***	0.0066	−0.0111	−0.0110**
	(−36.51)	(−39.52)	(−48.49)	(0.87)	(−1.50)	(−2.39)
Acreage	0.0200***	0.0209***	0.0201***	0.0372***	0.0589***	0.0552***
	(17.12)	(20.28)	(24.52)	(9.82)	(12.25)	(23.18)
Sq. Ft.	0.0002***	0.0002***	0.0002***	0.0000**	0.0001***	0.0001***
	(14.20)	(13.45)	(14.30)	(1.96)	(4.91)	(7.83)
Bedrooms	0.0004	0.0038	0.0046	0.0356***	0.0148	0.0202***
	(0.08)	(0.71)	(1.12)	(3.56)	(1.34)	(2.81)
Bathrooms	0.0404***	0.0394***	0.0383***	−0.0495***	−0.0441***	−0.0463***
	(7.09)	(7.06)	(7.96)	(−5.08)	(−4.00)	(−5.91)
Foreclosure	−0.1546***	−0.1482***	−0.1401***	−0.4062***	−0.4258***	−0.4239***
	(−24.91)	(−27.52)	(−32.23)	(−19.06)	(−18.46)	(−21.16)
Number of Levels	−0.0032	−0.0012	0.0022	0.0202***	−0.0078	0.0010
	(−1.08)	(−0.46)	(0.96)	(2.65)	(−0.78)	(0.16)
Pool	0.0355***	0.0333***	0.0289***	0.0126	0.0159	0.0219
	(4.99)	(5.69)	(8.30)	(0.43)	(0.48)	(1.07)
Basement	0.0231***	0.0193***	0.0152***	0.0400***	0.1021***	0.0865***
	(3.52)	(3.89)	(4.88)	(2.77)	(6.03)	(8.86)
Short Sale	−0.0822***	−0.0818***	−0.0817***	0.3531***	0.3422***	0.3410***
	(−14.38)	(−14.82)	(−14.83)	(18.52)	(17.81)	(18.39)
Tenant	−0.0729***	−0.0721***	−0.0702***	0.2570***	0.2966***	0.2882***
	(−14.28)	(−16.27)	(−18.31)	(13.10)	(14.02)	(15.87)

Exhibit 3 | (continued)

Effect of a Nearby Rehab Center on a Home's Price and Liquidity with Different Location Controls

	Dependent Variable: *ln(Sale Price)*			Dependent Variable: *ln(Days on Market)*		
	(1)	(2)	(3)	(4)	(5)	(6)
Vacant	−0.0309***	−0.0326***	−0.0345***	0.1171***	0.1393***	0.1301***
	(−9.74)	(−12.22)	(−20.51)	(7.81)	(8.97)	(12.79)
Taxes ($)	0.0001***	0.0001***	0.0001***	−0.0001**	−0.0001***	−0.0001***
	(10.40)	(10.45)	(13.13)	(−2.17)	(−3.20)	(−6.69)
HOA Fees	0.0660***	0.0681***	0.0635***	−0.0847***	−0.1136***	−0.1100***
	(9.93)	(11.85)	(16.69)	(−4.25)	(−5.04)	(−8.49)
ln(Time on Market)	0.0014*	0.0016**	0.0015***			
	(1.67)	(2.40)	(2.79)			
ln(List Price)				0.5101***	0.2620***	0.2991***
				(11.71)	(5.67)	(11.74)
Constant	11.4958***	11.4429***	11.5281***	−4.1742***	−1.1906**	−1.6416***
	(156.44)	(260.80)	(259.87)	(−7.64)	(−2.12)	(−4.76)
Location Controls (Census Tracts)	✓			✓		
Location Controls (Blocks Groups)		✓			✓	
Location Controls (Blocks)			✓			✓
Year Fixed Effects	✓	✓	✓	✓	✓	✓

Notes: This table presents results of hedonic OLS models showing the effect of a nearby (i.e. within 0.125 mile) rehab facility on a property's sale price and time on market, while controlling for different spatial / area fixed effects. Errors are clustered by spatial area in each regression respectively. *T*-statistics are in parentheses. The number of observation in columns 1–3 is 116,663; the number of observation in columns 4–6 is 205,281.

*Significant at the 10% level.

**Significant at the 5% level.

***Significant at the 1% level.

Exhibit 4 | Effect of a Nearby Rehab and Methadone Treatment Center on a Home's Price and Liquidity

	Dependent Variable: *ln(Sale Price)*	Dependent Variable: *ln(Days on Market)*	Dependent Variable: *ln(Sale Price)*	Dependent Variable: *ln(Days on Market)*
	(1)	(2)	(3)	(4)
Rehab Center ≤ 1/8 Mile	−0.077**	−0.009		
	(−2.44)	(−0.04)		
Meth. Center ≤ 1/8 Mile			−0.174**	0.192
			(−2.35)	(0.33)
ln(Age of Home)	−0.063***	0.125***	−0.063***	0.125***
	(−118.93)	(10.89)	(−118.92)	(10.86)
Acreage	0.019***	0.026***	0.019***	0.027***
	(42.37)	(5.22)	(42.38)	(5.24)
Sq. Ft.	0.000***	−0.000***	0.000***	−0.000***
	(232.99)	(−7.14)	(233.00)	(−7.10)
Bedrooms	−0.023***	0.093***	−0.023***	0.093***
	(−23.53)	(11.70)	(−23.52)	(11.69)
Bathrooms	0.024***	−0.054***	0.024***	−0.053***
	(22.80)	(−5.75)	(22.80)	(−5.73)
Foreclosure	−0.153***	−0.025	−0.153***	−0.026
	(−36.57)	(−0.62)	(−36.60)	(−0.64)
Number of Levels	−0.018***	0.077***	−0.018***	0.077***
	(−18.27)	(9.51)	(−18.27)	(9.51)
Pool	0.027***	−0.038**	0.027***	−0.038**
	(11.63)	(−2.04)	(11.62)	(−2.03)
Basement	0.039***	−0.062***	0.039***	−0.061***
	(24.13)	(−4.68)	(24.13)	(−4.67)
Short Sale	−0.115***	0.529***	−0.115***	0.528***
	(−20.08)	(11.42)	(−20.07)	(11.41)
Tenant	−0.080***	0.078**	−0.080***	0.078**
	(−21.18)	(2.46)	(−21.19)	(2.45)
Vacant	−0.041***	0.240***	−0.041***	0.240***
	(−34.67)	(22.44)	(−34.66)	(22.42)
Taxes ($)	0.000***	0.000*	0.000***	0.000*
	(91.96)	(1.82)	(91.95)	(1.86)
HOA Fees	0.059***	−0.076***	0.059***	−0.076***
	(41.51)	(−5.07)	(41.50)	(−5.05)
ln(Time on Market)	0.050***		0.050***	
	(45.52)		(45.45)	
ln(Sale Price)		1.254***		1.248***
		(7.48)		(7.44)

Exhibit 4 | (continued)

Effect of a Nearby Rehab and Methadone Treatment Center on a Home's Price and Liquidity

	Dependent Variable: *ln(Sale Price)*	Dependent Variable: *ln(Days on Market)*	Dependent Variable: *ln(Sale Price)*	Dependent Variable: *ln(Days on Market)*
	(1)	(2)	(3)	(4)
Listing Density	0.000*** (21.93)		0.000*** (21.95)	
Competition		0.000*** (21.48)		0.000*** (21.50)
Location Controls	√	√	√	√
Year Fixed Effects	√	√	√	√

Notes: This table presents the results of hedonic 3SLS models showing the effect of a nearby (i.e., within 0.125 mile) rehab facility, and a rehab facility that treats methadone addiction specifically, on a property's sale price and time on market; constant omitted here for brevity. Z-statistics are in parentheses. The number of observations in columns 1–4 is 110,361.

*Significant at the 10% level.

**Significant at the 5% level.

***Significant at the 1% level.

methadone clinics. Columns 3 and 4 in Exhibit 4 display the results of the same 3SLS estimations as columns 1 and 2, but confining the treatment variable to a dummy variable that equals one if the home is within 0.125 mile of a methadone clinic. The coefficient estimates in Exhibit 4 indicate that homes within 0.125 miles of a methadone clinic sell for approximately a 17% discount relative to homes that are located further away, holding other factors constant. There is little evidence, however, that these clinics affect nearby home liquidity. Overall, Exhibit 4 provides evidence that the market differentiates among risks generated by these potential externalities, and the treatment centers that may be perceived as having a higher risk to their neighbors have a much greater impact on the surrounding real estate market.

As a robustness check, in Exhibit 5 we explore the extent to which the control groups matter, finding results generally consistent with those in Exhibit 4. A critique of hedonic models for estimating any externality might be that the interpretation of the dummy variable essentially defines the control group as homes not located near (within 0.125 miles) the potential externality. Defining the control group in this way may present some unobserved spatial heterogeneity issues. To address this issue, in Exhibits 5 and 6 we estimate the same regressions as Exhibit 4, but confine the sample to homes that are located within 1.5 miles, 1 mile, and 0.6 miles of a rehab facility respectively. The results are consistent with the initial 3SLS estimates in Exhibit 4, and by extension, the initial OLS estimates in Exhibits 2 and 3. Both exhibits show that homes near substance abuse

Exhibit 5 | Effect of a Nearby Rehab Facility on a Home's Sale Price and Days on Market

	Dependent Variable: *ln(Sale Price)*	Dependent Variable: *ln(Days on Market)*	Dependent Variable: *ln(Sale Price)*	Dependent Variable: *ln(Days on Market)*	Dependent Variable: *ln(Sale Price)*	Dependent Variable: *ln(Days on Market)*
	Within 1.5 Miles of a Rehab Facility		Within 1 Mile of a Rehab Facility		Within 0.6 Miles of a Rehab Facility	
	(1a)	(1b)	(2a)	(2b)	(3a)	(3b)
Rehab Center ≤ 1/8 Mile	−0.076**	−0.008	−0.077**	−0.083	−0.075**	−0.331
	(−2.34)	(−0.03)	(−2.42)	(−0.34)	(−2.27)	(−1.34)
ln(Age of Home)	−0.063***	0.133***	−0.059***	0.060	−0.063***	0.102
	(−30.75)	(3.60)	(−20.19)	(1.34)	(−12.40)	(1.60)
Acreage	0.022***	0.017	0.020***	0.045*	0.028***	0.015
	(12.14)	(0.91)	(7.61)	(1.85)	(5.83)	(0.35)
Sq. Ft.	0.000***	−0.000**	0.000***	−0.000	0.000***	−0.000
	(57.61)	(−2.31)	(42.39)	(−0.59)	(25.45)	(−1.08)
Bedrooms	−0.023***	0.123***	−0.025***	0.144***	−0.026***	0.211***
	(−5.92)	(4.30)	(−4.44)	(3.42)	(−2.96)	(3.21)
Bathrooms	0.028***	−0.018	0.018***	0.040	0.027***	−0.048
	(6.69)	(−0.51)	(2.88)	(0.81)	(2.58)	(−0.60)
Foreclosure	−0.147***	0.014	−0.171***	−0.195	−0.188***	−0.628**
	(−9.84)	(0.11)	(−7.62)	(−1.00)	(−4.93)	(−2.11)
Number of Levels	−0.025***	0.079***	−0.021***	0.046	−0.018**	0.110
	(−6.57)	(2.64)	(−3.81)	(1.05)	(−1.99)	(1.64)
Pool	0.021**	0.034	0.016	−0.103	0.027	−0.134
	(2.17)	(0.48)	(1.16)	(−0.97)	(1.12)	(−0.77)

Exhibit 5 | (continued)

Effect of a Nearby Rehab Facility on a Home's Sale Price and Days on Market

	Dependent Variable: *ln(Sale Price)*	Dependent Variable: *ln(Days on Market)*	Dependent Variable: *ln(Sale Price)*	Dependent Variable: *ln(Days on Market)*	Dependent Variable: *ln(Sale Price)*	Dependent Variable: *ln(Days on Market)*
	Within 1.5 Miles of a Rehab Facility		Within 1 Mile of a Rehab Facility		Within 0.6 Miles of a Rehab Facility	
	(1a)	(1b)	(2a)	(2b)	(3a)	(3b)
Basement	0.040***	0.004	0.034***	0.052	0.029*	−0.105
	(6.44)	(0.08)	(3.71)	(0.71)	(1.91)	(−0.89)
Short Sale	−0.122***	0.389**	−0.106***	0.315	−0.166***	0.006
	(−6.04)	(2.56)	(−3.23)	(1.25)	(−3.06)	(0.02)
Tenant	−0.099***	0.038	−0.114***	0.018	−0.140***	0.161
	(−6.82)	(0.32)	(−5.82)	(0.11)	(−4.47)	(0.65)
Vacant	−0.044***	0.218***	−0.046***	0.254***	−0.034***	0.304***
	(−9.59)	(5.59)	(−7.05)	(4.66)	(−2.97)	(3.68)
Taxes ($)	0.000***	0.000	0.000***	0.000***	0.000***	0.000**
	(23.21)	(1.13)	(15.54)	(3.58)	(11.40)	(2.22)
HOA Fees	0.068***	−0.104**	0.078***	−0.128*	0.079***	−0.151
	(11.98)	(−1.98)	(9.59)	(−1.72)	(5.73)	(−1.36)
ln(Time on Market)	0.043***		0.019***		0.010	
	(10.91)		(3.80)		(1.50)	
ln(Sale Price)		1.023**		0.071		0.295
		(1.98)		(0.12)		(0.39)
Listing Density	0.000***		0.000***		0.000**	
	(6.30)		(4.33)		(2.35)	

Exhibit 5 | (continued)

Effect of a Nearby Rehab Facility on a Home's Sale Price and Days on Market

	Dependent Variable: *ln(Sale Price)*	Dependent Variable: *ln(Days on Market)*	Dependent Variable: *ln(Sale Price)*	Dependent Variable: *ln(Days on Market)*	Dependent Variable: *ln(Sale Price)*	Dependent Variable: *ln(Days on Market)*
	Within 1.5 Miles of a Rehab Facility		Within 1 Mile of a Rehab Facility		Within 0.6 Miles of a Rehab Facility	
	(1a)	(1b)	(2a)	(2b)	(3a)	(3b)
Competition		0.000*** (8.80)		0.000*** (6.26)		0.000*** (5.95)
Location Controls	✓	✓	✓	✓	✓	✓
Year Fixed Effects	✓	✓	✓	✓	✓	✓

Notes: This table presents the 3SLS results of simultaneous estimation of the effect of a nearby rehab facility on a home's selling price and liquidity (time on market), changing the sample to vary the control groups by smaller radii from a rehab center. *Z*-statistics are in parentheses. The number of observations in columns 1–2 is 7,711; the number of observations in columns 3–4 is 3,589; the number of observations in columns 5–6 is 1,324.

*Significant at the 10% level.

**Significant at the 5% level.

***Significant at the 1% level.

Exhibit 6 | Effect of a Nearby Rehab Facility that Treats Methadone Addiction

	Dependent Variable: *ln(Sale Price)*	Dependent Variable: *ln(Days on Market)*	Dependent Variable: *ln(Sale Price)*	Dependent Variable: *ln(Days on Market)*	Dependent Variable: *ln(Sale Price)*	Dependent Variable: *ln(Days on Market)*
	Within 1.5 Miles of a Rehab Facility		Within 1 Mile of a Rehab Facility		Within 0.6 Miles of a Rehab Facility	
	(1a)	(1b)	(2a)	(2b)	(3a)	(3b)
Meth. Center ≤ 1/8 Mile	−0.169**	−0.020	−0.179**	−0.086	−0.168**	−0.289
	(−2.21)	(−0.04)	(−2.37)	(−0.15)	(−2.17)	(−0.52)
ln(Age of Home)	−0.063***	0.129***	−0.059***	0.061	−0.063***	0.104
	(−30.70)	(3.49)	(−20.14)	(1.35)	(−12.30)	(1.64)
Acreage	0.022***	0.018	0.020***	0.045*	0.028***	0.014
	(12.17)	(0.99)	(7.62)	(1.84)	(5.83)	(0.33)
Sq. Ft.	0.000***	−0.000**	0.000***	−0.000	0.000***	−0.000
	(57.63)	(−2.17)	(42.43)	(−0.61)	(25.54)	(−1.10)
Bedrooms	−0.023***	0.122***	−0.024***	0.145***	−0.026***	0.216***
	(−5.88)	(4.26)	(−4.42)	(3.45)	(−2.91)	(3.29)
Bathrooms	0.028***	−0.016	0.018***	0.040	0.027***	−0.047
	(6.70)	(−0.45)	(2.89)	(0.81)	(2.59)	(−0.59)
Foreclosure	−0.148***	0.004	−0.173***	−0.196	−0.193***	−0.653**
	(−9.90)	(0.03)	(−7.71)	(−1.00)	(−5.06)	(−2.19)
Number of Levels	−0.025***	0.078***	−0.021***	0.047	−0.018**	0.109
	(−6.58)	(2.60)	(−3.84)	(1.05)	(−2.04)	(1.62)
Pool	0.021**	0.035	0.016	−0.103	0.026	−0.135
	(2.16)	(0.50)	(1.15)	(−0.97)	(1.10)	(−0.78)

Exhibit 6 | (continued)

Effect of a Nearby Rehab Facility that Treats Methadone Addiction

	Dependent Variable: *ln(Sale Price)*	Dependent Variable: *ln(Days on Market)*	Dependent Variable: *ln(Sale Price)*	Dependent Variable: *ln(Days on Market)*	Dependent Variable: *ln(Sale Price)*	Dependent Variable: *ln(Days on Market)*
	Within 1.5 Miles of a Rehab Facility		Within 1 Mile of a Rehab Facility		Within 0.6 Miles of a Rehab Facility	
	(1a)	(1b)	(2a)	(2b)	(3a)	(3b)
Basement	0.040***	0.006	0.035***	0.051	0.030*	−0.104
	(6.44)	(0.13)	(3.72)	(0.70)	(1.94)	(−0.89)
Short Sale	−0.121***	0.383**	−0.106***	0.318	−0.165***	0.029
	(−6.02)	(2.52)	(−3.21)	(1.26)	(−3.03)	(0.07)
Tenant	−0.099***	0.031	−0.114***	0.019	−0.142***	0.158
	(−6.84)	(0.26)	(−5.84)	(0.12)	(−4.52)	(0.64)
Vacant	−0.044***	0.216***	−0.047***	0.254***	−0.034***	0.303***
	(−9.58)	(5.52)	(−7.08)	(4.67)	(−3.03)	(3.66)
Taxes ($)	0.000***	0.000	0.000***	0.000***	0.000***	0.000**
	(23.18)	(1.26)	(15.44)	(3.56)	(11.24)	(2.16)
HOA Fees	0.068***	−0.100*	0.077***	−0.130*	0.078***	−0.159
	(11.94)	(−1.90)	(9.53)	(−1.75)	(5.65)	(−1.43)
ln(Time on Market)	0.042***		0.020***		0.012*	
	(10.81)		(3.93)		(1.67)	
ln(Sale Price)		0.955*		0.082		0.322
		(1.85)		(0.14)		(0.43)
Listing Density	0.000***		0.000***		0.000**	
	(6.42)		(4.40)		(2.48)	

Exhibit 6 | (continued)

Effect of a Nearby Rehab Facility that Treats Methadone Addiction

	Dependent Variable: *ln(Sale Price)*	Dependent Variable: *ln(Days on Market)*	Dependent Variable: *ln(Sale Price)*	Dependent Variable: *ln(Days on Market)*	Dependent Variable: *ln(Sale Price)*	Dependent Variable: *ln(Days on Market)*
	Within 1.5 Miles of a Rehab Facility		Within 1 Mile of a Rehab Facility		Within 0.6 Miles of a Rehab Facility	
	(1a)	(1b)	(2a)	(2b)	(3a)	(3b)
Competition		0.000*** (8.86)		0.000*** (6.25)		0.000*** (5.89)
Location Controls	✓	✓	✓	✓	✓	✓
Year Fixed Effects	✓	✓	✓	✓	✓	✓

Notes: This table presents 3SLS results of simultaneous estimation of the effect of a nearby rehab facility that treats methadone addiction on a home's selling price and liquidity (time on market), changing the sample to vary the control groups by smaller radii from a rehab center. *Z*-statistics are in parentheses. The number of observations in column 1 is 7,711; the number of observations in column 2 is 3,589; the number of observations in column 3 is 1,324.

*Significant at the 10% level.

**Significant at the 5% level.

***Significant at the 1% level.

treatment centers are still negatively impacted, and by approximately the same magnitudes. Indeed, the last two columns are particularly striking. Given that this is already a "within neighborhood" estimation, by controlling for location, the fact that the substance abuse treatment center result is robust when the control group is reduced to 1 mile and 0.6 miles indicates that unobserved spatial heterogeneity is not likely driving the core results of this paper. More intuitively, this provides strong evidence that the substance abuse treatment center effect is not simply a "bad part of town effect," in that we are comparing "apples with apples" across the dimension of location; and, the principle characteristic distinguishing the variation in prices in these areas is the presence of a nearby substance abuse treatment center. Based on these results, we cannot conclude that there is a robust impact on property liquidity, but there appears to be a robust negative relationship between the presence of a substance abuse treatment center and nearby home values.

Conclusion

In this study, we find evidence that residential substance abuse treatment centers adversely impact the price of neighboring homes. We find that homes within 1/8 mile of a treatment center sell for approximately 8% less than otherwise comparable homes that are located further away. Furthermore, we find that the market differentiates between potential risks that nearby treatment centers may carry, as living near a methadone clinic that treats opiate addictions such as heroin or morphine may be associated with a reduction in home values by as much as 17%. We find little evidence that nearby treatment centers affect a home's time on market.

Examining this particular externality is important to the broader literature on neighborhood externalities and environmental factors, as well as the specific literature on the issue of residential treatment centers. The PPACA has expanded MH/SUD coverage and made intensive treatment options affordable, and as a result, demand for effective substance abuse treatment is increasing. Operating a treatment center is a growing industry and it is reasonable to assume that new centers will be built nationally, many of which will be sited near or within residential communities. Indeed, there is very little that individuals and localities can do to prohibit a substance abuse treatment center from locating in a residential area because alcohol and drug addiction is considered to be a handicap and thus alcoholic/addicts in recovery are members of a protected class under the federal anti-discrimination housing laws. Hence, as residential treatment centers become more common, it is important to understand all their effects, including the effects they may have on nearby real estate and how markets price the potential risk of nearby externalities.

Endnotes

[1] For a more complete review on the impact of environmental externalities, see Boyle and Kiel (2001).

[2] Consistent with other real estate studies, we culled outliers from our data set, confining our data to more "typical" range of homes listed at less than $1,000,000, fewer than 10 bedrooms, fewer than 16 acres (99% of observations), property taxes paid that were less $10,000 (99% of observations), and younger than 150 years old (99% of observations). For our other dependent variable of interest, time on market, we similarly trim the 1% extremes. Generally, the findings are not sensitive to dropping these observations. Further, important to disclose how our data has been trimmed for transparency and replicability. As an additional quality check, a sample of the MLS data was compared to county tax records, which contain data on price and housing characteristics.

[3] There were approximately 153, 96, and 60 properties listed within 0.175 miles, 0.15 miles, and 0.125 miles of a rehab treatment facility respectively, over the time period of our study. Given the very recent and projected growth of rehab centers nationally, future research will be able to take advantage of additional homes (data points) being bought and sold near rehab facilities.

[4] The choice of this radius does not fundamentally alter the qualitative conclusions of this study. The definition of one's "backyard" is somewhat ambiguous, and may differ depending on an individual's perception. Some externality studies use 0.1 mile, 0.2 mile, or 0.3 mile as a radius to examine a given externality. While similar results are obtained looking at bands slightly larger and slightly smaller, we follow Congdon-Hohman (2013) and use 1/8 mile in most of our tabulated regression results. An easy way to think of 0.125 miles, 0.15 miles, and 0.175 miles is that these are 2.5 minute, 3 minute, and 3.5 minute walks respectively (assuming a pace of 3 miles per hour).

[5] For recent examples of amenity or disamenity studies of externality effects, see Asabere and Huffman (1991), Gibbons (2004), Linden and Rockoff (2008), Pope (2008), Rossi-Hansberg, Sarte, and Owens (2010), Campbell, Giglio, and Pathek (2011), Hoen, Wiser, Cappers, Thayer, and Sethi (2011), Daneshvary, Clauretie, and Kader (2011), Grout, Jaeger, and Plantinga (2011), Daneshvary and Clauretie (2012), Congdon-Hohman (2013), Guignet (2013), Linn (2013), Munneke, Sirmans, Slade, and Turnbull (2013), and Wentland, Waller, and Brastow (2014).

[6] Recent examples include neighborhood foreclosure effects (Harding, Rosenblatt, and Yao, 2009; Lin, Rosenblatt, and Yao, 2009; Agarwal, Ambrose, Chomsisengphet, and Sanders, 2010).

[7] Kuminoff, Parmeter, and Pope (2010) survey 69 hedonic studies and found that 80% rely on linear, semi-log, or log-log functional form. We have explored a number of non-linear functional forms and our results remain robust. Rather than repeat all of the above models with various non-linear explanatory variables, the authors will produce results of alternative specifications upon request.

[8] For example, we use the following property specific variables: square footage, age, acreage, number of bedrooms, bathrooms, number of stories, new, vacant, HOA fees, whether it has a pool, a tenant, a basement, and whether it is a short sale or foreclosure. We also include year fixed effects to control for variation over time.

[9] When we explore different location controls later, we will cluster by location (e.g., census tract, block group, or block).

[10] For example, see Yavas and Yang (1995), Knight (2002), and Turnbull and Dombrow (2006).

[11] Specifically, both our paper and Zahirovic-Herbert and Turnbull (2008) calculate C in the following way: "The days-on-market or selling time is $s(i) - l(i) + 1$, where $l(i)$ and $s(i)$ are the listing date and sales date for house i. Denoting the listing date and

sales date for house j by $l(j)$ and $s(j)$, the overlapping time on the market for these two houses is $\min[s(i), s(j)] - \max[l(i), l(j)]$. The straight-line distance in miles between houses i and j is $D(i, j)$. The measured competition for house i is: $C(i) = \Sigma_j (1 - D(i, j))^2\{\min[s(i), s(j)] - \max[l(i), l(j)]\}$ where the summation is taken over all competing houses j, that is, houses for sale within one mile and 20% larger or smaller in living area of house i" (Zahirovic-Herbert and Turnbull, 2008).

[12] At the suggestion of a reviewer, we also identify the system by using different control variables. A simple way to do this is to use different location controls. We use ZIP Code fixed effects in the price equation, and census tract fixed effects in the time on market equation. Generally, the results are not very sensitive to which location controls are used in each equation. Further, the results are similar when we use the Turnbull and Dombrow (2006) method alone to identify the system.

[13] According to Belsley (1988), when there are strong interrelations among error terms, 3SLS is used instead of 2SLS in estimating systems of equations because it is more efficient. Specifically, one would expect unobservables that contribute to error in estimating price to be also correlated the error in liquidity.

[14] See www.census.gov for more detail, specifically: http://www.census.gov/geo/www/cob/tr_metadata.html#gad.

References

Agarwal, S., B. Ambrose, S. Chomsisengphet, and A.B. Sanders. Thy Neighbor's Mortgage: Does Living in a Subprime Neighborhood Affect One's Probability of Default? *Real Estate Economics*, 2012, 40:1, 1–22.

Asabere, P. and F. Huffman. Historic Districts and Land Values. *Journal of Real Estate Research*, 1991, 6:1, 1–8.

Augusta Chronicle. Neighbors Oppose Upscale Rehab Facility in South Augusta. http://chronicle.augusta.com.news/health/2013-08-05/neighbors-oppose-upscale-rehab-facility-south-augusta, August 5, 2013.

Belsley, D.A. Two- or Three-stage Least Squares? *Computational Economics*, 1988, 1, 21–30.

Beronio, K., R. Po, L. Skopec, and S. Glied. ASPE Research Brief. Affordable Care Act Will Expand Mental Health and Substance Use Disorder Benefits and Parity Protections for 62 Million Americans. http://aspe.hhs.gov/health/reports/2013/mental/rb_mental.cfm, February 20, 2013.

Boyle, M. and K. Kiel. A Survey of House Price Hedonic Studies of the Impact of Environmental Externalities. *Journal of Real Estate Literature*, 2001, 9:2, 117–44.

Campbell, J.Y., S. Giglio, and P. Pathak. Forced Sales and House Prices. *American Economic Review*, 2011, 101:5, 2108–31.

City of Edmonds v. Oxford House, Inc., et al., 514 U.S. 725, 1995.

Congdon-Hohman, J. The Lasting Effects of Crime: The Relationship of Discovered Methamphetamine Laboratories and Home Values. *Regional Science and Urban Economics*, 2013, 43:1, 31–41.

Connery, H. Alcohol Use and Abuse—A Harvard Medical School Special Health Report. 2011. Fact Sheet MHPAEA. http://www.dol.gov/ebsa/newsroom/fsmhpaea.html. HUD Disability Rights in Housing. http://portal.hud.gov/hudportal/HUD?src=/program_offices/fair_housing_equal_opp/disabilities/inhousing.

Coulson, N.E. and R.M. Leichenko. The Internal and External Impact of Historical Designation on Property Values. *Journal of Real Estate Finance and Economics*, 2001, 23: 1, 113–24.

Daneshvary, N. and T.M. Clauretie. Toxic Neighbors: Foreclosures and Short-Sales Spillover Effects from the Current Housing-Market Crash. *Economic Inquiry*, 2012, 50:1, 217–31.

Daneshvary, N., T.M. Clauretie, and A. Kader. Short-Term Own-Price and Spillover Effects of Distressed Residential Properties: The Case of a Housing Crash. *Journal of Real Estate Research*, 2011, 33:2, 179–207.

Gibbons, S. The Cost of Urban Property Crime. *Economic Journal*, 2004, 114, 441–63.

Grout, C.A., W.K. Jaeger, and A.J. Plantinga. Land-use Regulations and Property Values in Portland, Oregon: A Regression Discontinuity Design Approach. *Regional Science and Urban Economics*, 2011, 48:2, 98–107.

Guignet, D. What Do Property Values Really Tell Us? A Hedonic Study of Underground Storage Tanks. *Land Economics*, 2013, 89:2, 211–26.

Harding, J.P., E. Rosenblatt, and V.W. Yao. The Contagion Effect of Foreclosed Properties. *Journal of Urban Economics*, 2009, 66:3, 164–78.

Hite, D., W. Chern, F. Hitzusen, and A. Randall. Property-Value Impacts of an Environmental Disamenity: The Case of Landfills. *Journal of Real Estate Finance and Economics*, 2001, 22, 185–202.

Hoen, B., R. Wiser, P. Cappers, M. Thayer, and G. Sethi. Wind Energy Facilities and Residential Properties: The Effect of Proximity and View on Sales Prices. *Journal of Real Estate Research*, 2011, 33:3, 279–316.

Ihlanfeldt, K and T. Mayock. Panel Data Estimates of the Effects of Different Types of Crime on Housing Prices. *Regional Science and Urban Economics*, 2010, 40, 161–72.

Knight, J. Listing Price, Time on Market and Ultimate Selling Price: Causes and Effects of Listing Price Changes. *Real Estate Economics*, 2002, 30:2, 213–37.

Krainer, J. A Theory of Liquidity in Residential Real Estate Markets. *Journal of Urban Economics*, 2001, 49:1, 32–53.

Kuminoff, N.V., C.F. Parmeter, and J.C. Pope. Which Hedonic Models Can We Trust to Recover the Marginal Willingness to Pay for Environmental Amenities? *Journal of Environmental Economics and Management*, 2010, 60:3, 145–60.

Levitt, S.D. and C. Syverson. Market Distortions When Agents Are Better Informed: The Value of Information in Real Estate Transactions. *Review of Economics and Statistics*, 2008, 90:4, 599–611.

Lin, Z., E. Rosenblatt, and V.W. Yao. Spillover Effects of Foreclosures on Neighborhood Property Values. *Journal of Real Estate Finance and Economics*, 2009, 38:3, 387–407.

Linden, L. and J.E. Rockoff. Estimates of the Impact of Crime Risk on Property Values from Megan's Law. *American Economic Review*, 2008, 98:3, 1103–27.

Linn, J. The Effect of Voluntary Brownfields Programs on Nearby Property Values: Evidence from Illinois. *Journal of Urban Economics*, 2013, 78, 1–18.

McCluskey, J. and G. Rausser. Stigmatized Asset Value: Is it Temporary or Long-Term? *Review of Economics and Statistics*, 2003, 85:2, 276–85.

Munneke, H.J., C.F. Sirmans, B.A. Slade, and G. Turnbull. Housing Regulation, Externalities, and Residential Property Prices. *Real Estate Economics*, 2013, 41:3, 422–56.

Pope, D. and J. Pope. Crime and Property Values: Evidence from the 1990s Crime Drop. *Regional Science and Urban Economic*, 2012, 42, 177–88.

Pope, J. Fear of Crime and Housing Prices: Household Reactions to Sex Offender Registries. *Journal of Urban Economics*, 2008, 64, 601–14.

Reichert, A., M. Small, and S. Mohanty. The Impact of Landfills on Residential Property Values. *Journal of Real Estate Research*, 1992, 7:3, 297–314.

Rosiers, F.D. Power Lines, Visual Encumbrance and House Values: A Microspatial Approach to Impact Measurement. *Journal of Real Estate Research*, 2002, 23:3, 275–301.

Rossi-Hansberg, E., P-D. Sarte, and R. Owens. Housing Externalities. *Journal of Political Economy*, 2010, 118, 485–534.

SAMHSA. National Survey on Substance Abuse Treatment Services (N-SSATS). 2008. http://www.samhsa.gov/samhsanewsletter/Volume_18_Number_1/TreatmentFacilities.aspx.

Shaffer, H. Overcoming Addiction Paths Toward Recovery—A Harvard Medical School Special Health Report. 2012.

Thaler, R. A Note on the Value of Crime Control: Evidence from the Property Market. *Journal of Urban Economics*, 1978, 5:1, 137–45.

Turnbull, G. and J. Dombrow. Spatial Competition and Shopping Externalities: Evidence from the Housing Market. *Journal of Real Estate Finance and Economics*, 2006, 32:4, 391–408.

Wentland, S., B. Waller, and R. Brastow. Estimating the Effect of Crime Risk on Property Values and Time on Market: Evidence from Megan's Law in Virginia. *Real Estate Economics*, 2013, 42:1, 223–51.

Yavas, A. and S. Yang. The Strategic Role of Listing Price in Marketing Real Estate: Theory and Evidence. *Real Estate Economics*, 1995, 23:3, 347–68.

Zahirovic-Herbert, V. and G. Turnbull. School Quality, House Prices, and Liquidity. *Journal of Real Estate Finance and Economics*, 2008, 37, 113–30.

Claire R. La Roche, Longwood University, Farmville, VA 23909 or larochecr@longwood.edu.

Bennie D. Waller, Longwood University, Farmville, VA 23909 or wallerbd@longwood.edu.

Scott A. Wentland, Longwood University, Farmville, VA 23909 or wentlandsa@longwood.edu.

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1. Introduction

Substance use disorders (SUDs) are chronic health conditions that impose substantial costs, both costs fully internalized by the affected individual and costs externalized to society. For the affected individual, SUDs hinder overall health, employment, financial stability, and relationships, and can lead to incarceration and other legal consequences, and for some, death. In terms of negative externalities, SUDs are incredibly costly to society in terms of direct addiction treatment costs which have historically been financed by public payers within the U.S., increased costs of general healthcare, increased reliance on social services, traffic accidents, and crime and violence (Carpenter 2005; Balsa et al. 2009; French, Fang, and Balsa 2011; Jayakody, Danziger, and Pollack 2000; Anderson, Hansen, and Rees 2013; Markowitz and Grossman 2000; Popovici, Maclean, and French 2017; Terza 2002).

Overall, the annual costs of SUDs to the U.S. are estimated to be very high: $544B (Caulkins, Kasunic, and Lee 2014).[1] For comparison, government estimates suggest that heart disease and stroke, which are leading causes of mortality and morbidity, are associated with $359B each year in terms of healthcare costs and lost productivity in the U.S. (Department of Health and Human Services 2018).[2] Given these high costs, both private and public agents allocate substantial financial resources to curtail SUDs. For instance, the U.S. spends approximately $28B annually on direct SUD treatment, with 71% of this treatment financed by public payers (Substance Abuse and Mental Health Services Administration 2014).[3] While treatment programs are obviously heterogeneous, there is compelling evidence that numerous treatment modalities are clinically effective and cost-effective in reducing SUDs and associated

[1] This estimate is inflated by the authors from the original estimate of $481B (with $255B attributable to alcohol and $226B attributable to psychoactive drugs) in 2011 dollars to 2018 dollars using the Consumer Price Index (CPI).
[2] Inflated from the original estimate ($317B in 2011 dollars) to 2018 dollars using the CPI.
[3] Inflated by the authors from the original estimate of $23.4B in 2009 dollars to 2018 dollars using the CPI.

Pope and Pope 2012; Thaler 1978; Li et al. 2015; Davidoff and Leigh 2008), there is surprisingly little empirical work investigating the effect of SUDTCs. To the best of our knowledge, only one study explores this question. In a real estate study, La Roche, Waller, and Wentland (2014) apply three-stage-least squares to property sales data from Central Virginia over the period 2001 to 2011 to test for SUDTC effects. The authors document that SUDTCs are associated with an 8% reduction in residential property values. The results of La Roche, Waller, and Wentland (2014) suggest a substantial negative effect of SUDTCs on property values and provide *prime facie* support for NIMBY concerns. However, given the identification strategy employed by La Roche, Waller, and Wentland (2014), how best to interpret these findings is unclear. In particular, the three stage least squares approach used by LaRoche and colleagues is identified off non-linearities in the model. Such identification departs from approaches based on quasi-experimental variation that are used in many recent empirical economic studies studying factors that influence property values (outlined in Section 2.1).

Moreover, the net effect of SUDTCs on property value is *ex ante* ambiguous. In addition to the potentially negative aspects of SUDTCs articulated in NIMBY concerns, there are factors associated with SUDTCs that may in fact increase property values. First, if SUDTCs offer effective treatment to neighborhood residents, these facilities can reduce SUD prevalence and associated harms. Swensen (2015) shows that SUDTC entry reduces the level of SUDs, proxied by overdose deaths, within the local area. In terms of reducing costs associated with SUDs, recent economic work by Bondurant, Lindo, and Swensen (2018), and Wen, Hockenberry, and Cummings (2017) shows that SUDTCs reduce crime within the local area. Clinical evidence provides further support for the inverse treatment-crime relationship (Doran 2008; Ettner et al. 2006; McCollister et al. 2003; Rajkumar and French 1997; Westerberg et al. 2016).

In this paper, we follow the recent hedonic pricing model literature and estimate the effect of SUDTCs on residential property values using an SDD model. We use granular residential property value and administrative SUDTC data from Seattle, Washington. Specifically, we link property values data over the period 2003 to 2016 with geocoded government administrative data on the exact locations of all licensed SUDTCs in Seattle.

Several findings emerge from our analysis. First, we document that SUDTCs endogenously locate in lower property values areas, which implies that estimates generated in models which do not address such sorting are vulnerable to bias. Second, naïve (non-SDD) models that do not account for endogenous location choices produce estimates that imply a modest, but statistically significant, negative effect of SUDTC entry on property values of 3.4% to 4.6%. Third, when an SDD estimator is used, we find no statistically significant evidence that SUDTC entrance into a local area leads to changes property values. Indeed, in our preferred specifications we can rule out all but modest decreases in property values. Our findings are stable across numerous robustness checks, including alternative distance band specifications and time dynamics. Our findings suggest that anecdotal NIMBY concerns regarding the stigma associated with being located in close proximity to an SUDTC, and related reductions in residential property values, may not be fully warranted.

The paper proceeds as follows. Section 2 provides background on the related residential property value literature, SUDs, and SUDTCs. Our conceptual framework and empirical model are presented in Section 3. Data are reported in Section 4. Section 5 presents our main results and robustness checking. Section 6 concludes.

2. Background

2.1 Background on amenities and dis-amenities, stigma, and residential property values

In sum, the hedonic pricing literature documents that many forms of dis-amenities reduce residential property values. In addition to an initial decline in residential property values, several studies provide convincing evidence that this reduction in value persists over time. For instance, several environmental risks leave a permanent, or highly persistent, 'scar' on property values (McCluskey and Rausser 2003b). Put differently, even after the dis-amenity is removed from the local area, residential property values persistently remain at a lower level. The particular mechanisms behind a scaring effect are not entirely clear and are likely heterogeneous across dis-amenities, but this phenomena suggests that affected property owners may persistently own a less valuable asset. Given the importance of residential properties for overall wealth and financial well-being, permanent reductions in property values are concerning.

A key empirical challenge in estimating the effect of any local (dis)amenity on property values is the potential endogeneity of (dis)amenity location. Put differently, amenities and dis-amenities, including SUDTCs, are not likely to be randomly assigned across neighborhoods and instead are plausibly located based on the (presumably) rational decisions of economic agents; in our context SUDTC owners and operators. Taking such systematic location selection into account, Linden and Rockoff (2008) reevaluate the effect of sex offenders on property values using an SDD estimator, which creates treatment and comparison groups based on geographic distance to the sex offender location. Applying this model to data from Mecklenburg County, North Carolina, the authors document that, on average sex, offenders locate in lower property value areas, and failure to account for these endogenous location choices can lead to a substantial overestimate of the effect of a sex offender on property values. After accounting for the endongeous location of offenders, Linden and Rockoff find that the arrival of sex offender within

location choices and hence recover causal estimates of SUDTC effects on residential property values. Second, we test for potential stigma effects associated with SUDTCs.

2.2 Background on SUDs and SUDTCs

In 2016, 20 million U.S. residents 12 years and older, or 7.5% of the population, met diagnostic criteria for an SUD (Center for Behavioral Health Statistics and Quality 2017). According to the American Psychiatric Association (2013) SUDs 'occur when the recurrent use of alcohol and/or drugs causes clinically and functionally significant impairment, such as health problems, disability, and failure to meet major responsibilities at work, school, or home.' Afflicted individuals may act out in violent and reckless ways, and turn to illegal activities to procure funds to purchase substances. Many individuals with an SUD have co-occurring mental illness (Grant, Stinson, Dawson, Chou, Dufour, et al. 2004; Grant, Stinson, Dawson, Chou, Ruan, et al. 2004), which plausibly exacerbates substance-related problems.

In addition to individuals meeting the clinical definition of an SUD, millions of Americans engage in risky substance misuse such as binge drinking, heavy drinking, and nonmedical use of prescription drugs, and are thus at risk of developing an SUD.[6] For instance, in 2016, 24.5% and 6.0% of U.S. residents 12 year and older were classified as binge and heavy drinkers respectively, while 10.6% of adults used illicit drugs in the past 30 days (Center for Behavioral Health Statistics and Quality 2017).

Given the high levels of substance misuse, unintentional fatal alcohol poisonings and (overall) psychoactive drug overdoses are the leading causes of injury death in the U.S. with over

[6] According to the Centers for Disease Control and Prevention (CDC), binge drinking is defined as consuming five (four) or more drinks in one drinking session for men (women) while heaving drinking is defined as drinking two (one) or more drinks per day for men (women). Non-medical use of prescription medications is defined as the use of medications without a prescription from a healthcare provider, use of the medication in a manner other than as directed (e.g., taking a higher dosage than prescribed), and/or use only for the medication's psychotropic experience.

SUD treatment often begins with detoxification, a process that many times involves the use of medications to ease withdrawal symptoms (e.g., tremors, pain, and nausea) and allows the body to rid itself of substances. After detoxification is complete, there are a wide range of effective treatment options available to patients. For example, counselling services, outpatient care, residential treatment, and inpatient hospital care are all widely used, and in many cases, highly effective treatment modalities. In our analysis we focus on care that is offered in specialized outpatient and inpatient treatment centers (residential facilities and psychiatric hospitals). This modality of care represents the majority of care received within the U.S. Further, specialty care involves patients residing in the center and/or regularly visiting the center for an extended period of time (e.g., a common treatment duration is 30 days), and SUDTCs are large in size with approximately 88 patients on any given day receiving treatment.[7] Thus, if NIMBY concerns exist, we contend that they are most likely to be observed in this the type of care we consider in this study. We do not consider office-based care or treatment received in non-psychiatric hospitals. We refer interested readers to an excellent review of treatment modalities available to patients provided by the National Institute on Drug Abuse (2018).

3. Conceptual framework and empirical approach

3.1 Hedonic pricing model

Our empirical analysis, outlined below, is grounded in hedonic pricing theory. Within this framework residential properties are viewed as assets that provide owners with a bundle of characteristics that, in turn, affects utility. The characteristics that define the residential property as an asset include structural attributes (e.g., property size and quality; S_i) and neighborhood

[7] Authors' calculation based on the National Survey of Substance Abuse Treatment Services (N-SSATS).

concentric ring, with radius $k = r+\varepsilon$ with $\varepsilon>0$, form the comparison group. This identification strategy compares properties adjacent to an SUDTC with a comparison group of properties in very close proximity to, but just far enough away, so as to be unaffected by the SUDTC.

Figure 1 displays an example of a location-defined treatment group and comparison group. In our main specifications, we define the treatment group as those properties within 0.2 miles of a SUDTC as the treatment group and define those properties 0.2 to 0.4 miles from an SUDTC as the comparison group. Clearly the true geographic definitions of the treatment and comparison group are *a priori* unknown, and any selected definition is to some extent arbitrary. Moreover, it is plausible that the true definition varies across (dis)amenties (e.g., clandestine methamphetamine labs, parks, schools, and sex offenders) and, indeed, different studies use different distances (see studies applying an SDD cited in Section 2.1). Thus, in robustness checks, and following Dealy, Horn, and Berrens (2017), we re-estimate our SDD regressions using alternate distance-ring specifications. Results (reported later in the manuscript) are highly robust across these alternative specifications, which supports the hypothesis that our findings are not driven by selection of a specific treatment and comparison group combination.

Specifically, we apply the following SDD model:

$$\ln(P_{i,j,t}) = X_{i,j,t}\beta + (\theta_1 D_{i,j,t}^{0.2} + \theta_2 D_{i,j,t}^{0.4}) + (\theta_3 D_{i,jt,}^{0.2} + \theta_4 D_{i,jt,}^{0.4})\tau_{i,t}^{entry} + \alpha_{j,t} + \varepsilon_{i,j,t} \qquad (2)$$

In this equation, $P_{i,j,t}$ is the inflation adjusted sales price, where i indicates an individual property, j indicates the location of the property (i.e., zip code) and t indicates the time period (i.e., year) in which the property is sold. We take the logarithm to account for skewness in sales prices. In terms of explanatory variables, $X_{i,j,t}$ is vector of property characteristics, $\alpha_{j,t}$ is a vector of year-by-area fixed effects, and $\varepsilon_{i,j,t}$ is the error term.

opening is captured by $\tau_{i,t}^{entry}$, which indicates the time period after the SUDTC enters a local area and parallels the 'treatment*post' interaction in the canonical DD model. The parameter of interest (θ_3) estimates the change in property values for properties within 0.2 miles of an SUDTC relative to properties 0.2 to 0.4 miles and θ_4 will capture any time trends associated with properties in the general vicinity of where an SUDTC locates.

As noted in Section 2.1, another important consideration when estimating the effect of SUDTCs on property values is stigma, or a potential lasting effect of an SUDTC on proximal residential property values after the SUDTC has exited the local area. To test for stigma effects, we estimate an augmented version of Equation (2) that incorporates SUDTC exits:

$$\ln(P_{i,j,t}) = X_{i,j,t}\beta + (\theta_1 D_{i,j,t}^{0.2} + \theta_2 D_{i,j,t}^{0.4}) + (\theta_3 D_{i,j,t}^{0.2} + \theta_4 D_{i,j,t}^{0.4})\tau_{i,t}^{entry} + (\theta_5 D_{i,j,t}^{0.2} + \theta_6 D_{i,j,t}^{0.4})\tau_{i,t}^{exit} + \alpha_{j,t} + \varepsilon_{i,j,t} \quad (3)$$

In this specification $\tau_{i,t}^{exit}$ is an indicator variable for the time period after an SUDTC exits, and θ_5 will capture any rebound effect on property values of the SUDTC exiting. Thus, $\theta_3 + \theta_5$ will represent any lasting stigma effect of an SUDTC on property values. Stigma effects may occur if, for instance, SUDTCs permanently reduce SUD prevalence within the neighborhood, then this change could reduce SUD-related behaviors (crime, violence, etc.). On the other hand, if an SUDTC permanently draws individuals with SUDs and who engage in crime, violence, nuisance behaviors, and so froth into the neighborhood, then we may observe persistently lower residential property values. We test for such effects through Equation (3). We investigate joint significance of these terms with an *F*-test.

4. Data

4.1 Residential property sales data

4.2 SUD treatment centers (SUDTCs)

We obtain SUDTC information from the Substance Abuse and Mental health Services Administration's (SAMHSA) National Directory of Drug and Alcohol Abuse Treatment Programs (NDDAATP).[9] This directory includes all licensed specialty SUDTCs that are known to SAMHSA and complete the National Substance Abuse Treatment Services Survey (N-SSATS). The N-SSATS is used by SAMHSA to monitor SUD treatment service provision within the U.S.; we do not use the N-SSATS information directly in our study.

The NDDAATP is the premier resource available to prospective patients and providers seeking a center that can provide specialized SUD treatment for themselves, their family members, or their patients. Given the importance of being listed on this directory for SUDTCs, response rates for N-SSATS (which forms the survey frame for the NDDAATP) are very high: 91% to 96% over our study period. The NDDAATP directories include the name, exact street address (which we leverage in our study), offered services, and accepted forms of payments for all SUDTCs licensed to provide SUD treatment that are known to SAMHSA. In 2016, there were 18,087 known and licensed specialty SUDTCs in the U.S. (Substance Abuse and Mental Health Services Administration 2017). Thus, we are able to capture the vast majority of licensed specialty SUDTCs using these data. Moreover, the NDDAATP is the only dataset that includes exact location of specialty SUDTCs and is therefore the best available data for our study.

Specialty SUD treatment is defined by SAMHSA as a hospital, a residential facility, an outpatient treatment facility, or other facility with a SUD treatment program. For background,

[9] Data were accessed from the following website: https://wwwdasis.samhsa.gov/dasis2/nssats.htm (last accessed December 20, 2018).

our study period. While there is some evidence of clustering of SUDTCs in the central portion of Seattle, SUDTCs appear to operate in a range of different neighborhoods in the city.

A concern with our analysis is that zoning regulations may limit the locations in which an SUDTC may operate. As is the case with businesses in general, SUDTCs must locate in commercial zones. However, as discussed by La Roche, Waller, and Wentland (2014), there are numerous Federal regulations that prohibit many forms of discrimination in center location (e.g., the Fair Housing Act, Rehabilitation Act, Americans with Disabilities Act). In addition, we have communicated with administrators at the Washington State Substance Abuse Agency regarding zoning regulations related to SUDTC location. Our conversations with administrators at this agency suggest that there are no such regulations that will limit SUDTC location choices. Overall, our review of the available evidences suggests that SUDTCs face no additional (legal) restrictions on location than other businesses.

5. Results

5.1 Summary statistics

Table 1 presents the summary statistics of characteristics for all properties within 0.2 miles of where an SUDTC has located, and properties within 0.2 and 0.4 miles of where an SUDTC locates. Between 2003 and 2016, there was a total of 131,862 residential property sales, 8,982 of which were within 0.2 miles of an SUDTC and 22,671 that were within 0.2 and 0.4 miles. Median sale prices in Seattle are relatively high ($554K in January of 2016) in comparison to the U.S. median cities ($182k in January of 2016).[13] However, Seattle residential property values are comparable to other large U.S. cities such as New York City ($567K), Los Angeles ($559K), and San Diego ($529K); values reflect median prices in January 2016.

[13] Median home prices are obtained from https://www.zillow.com/research/data/ (accessed December 20, 2018).

parameter estimates for a model estimated with housing characteristics and year-zip code fixed effects, and column 3 additionally clusters standard errors at the zip code level. In all models coefficient estimates are negative and significant, suggesting that SUDTCs are associated lower residential property values. Coefficient estimates from table 2 imply that the entrance of an SUDTC in a neighborhood is associated with a 3.4% to 4.6% reduction in property values.[15]

5.4 SDD regression results

Table 3 presents testing for endogenous location choices by SUDTCs and the main regression results from our preferred SDD model. First, column 1 presents results from a test for endogenous location choice by SUDTC. In this test observations are dropped if the sale occurred within 0.4 miles of an SUDTC after the SUDTC becomes active (i.e., the only remaining SUDTC observations are before the SUDTC enters). This model allows us to test whether SUDTCs endogenously locate in areas with lower residential property values. Columns 2 and 3 present SDD models estimated using the full sample. Columns 4 and 5 present SDD estimates generated in the limited sales sample, where all observations are dropped that are outside of a 0.4 miles radius of an SUDTC. Columns 2 and 4 present results without the exit parameters, corresponding to Equation (2), and columns 3 and 5 present the results with the exit parameters included, corresponding to Equation (3). A full set of control variable coefficient estimates for the full sample model, including exit parameters, is reported in appendix table 1.

There are two main findings in table 3. First, in column 1 the $D^{0.4}$ parameter estimate is negative and statistically significant, documenting that on average SUDTCs endogenously locate in areas with lower residential property values. In particular, SUDTCs locate in areas with 2.2% lower property values. Second, once this endogeneity in location choice is accounted for through

[15] Semi-log point estimates are converted to percent changes using the following formula: $(exp^{\hat{\beta}} - 1) \times 100\%$.

comparison groups using geographic proximity to SUDTCs. To this end, in our main analysis, SUDTC distance bands for the treatment and comparison groups are defined as within 0.2 miles and within 0.2 to 0.4 miles of an SUDTC. We re-estimate Equation (2) in which we both expand and contract the distance based used to form the treatment and comparison groups. Results are presented for regressions using 0.1/0.3 miles, 0.1/0.4 miles, 0.1/0.5 miles, 0.2/0.4 miles (our baseline specification), 0.2/0.5 miles, 0.2/0.6 miles, 0.3/0.5 miles, and 0.3/0.6 miles distance band specifications. Table 4a presents results for the full sample and table 4b presents results for the limited sales sample. Treatment-entry and treatment-exit parameter estimates are statistically indistinguishable from zero in all specifications. Joint *F*-tests assessing stigma effects are also statistically indistinguishable from zero in every specification.

Second, we investigate time dynamics in the effects of SUDTC entry/exit on residential property values. As outlined by Wolfers (2006), in a study testing the effects of state unilateral divorce laws, it is plausible that the effect of an SUDTC entry/exit may change over time. Put differently, our primary specification, Equation (3), forces an abrupt change in property values at SUDTC entrance/exit than remains constant thereafter. This pattern may depart from real world SUDTC effects if the social disruption (e.g., crime, noise, traffic) or benefits (e.g., reduced SUD prevalence, increased economic activity) vary over time. To evaluate potential dynamics in the effect of SUDTCs on residential property values, we estimate an event-study model in the spirit of Autor (2003). In particular, we decompose the SUDTC entrance variable into one-year windows both before and after SUDTC entry. The omitted category is one year prior to SUDTC entrance. We impose endpoint restrictions: we assume that effects are not observable more than four years before or after SUDTC entrance (Kline 2012; McCrary 2007). We code all areas in which an SUDTC does not enter as zero for all lead and lag indicators (Lovenheim 2009). In

(ii) estimate the effect of SUDTCs that provide methadone treatment;[18] (iii) estimate models using quarter-by-year fixed effects to better capture seasonality in housing sales prices (U.S. Census Bureau 2018); (iv) estimate limited sales sample models with standard errors clustered at the zip code level; and (v) estimate full-sample models using a wild cluster bootstrap approach to estimate standard errors (Cameron & Miller, 2015).[19] Results generated in these alternate specifications are presented in appendix tables 3 to 6. Findings are comparable to our main results (table 3). Finally, we exclude all residential property value variables and re-estimate Equations (2) and (3). We exclude the property-level controls as some of these could plausibly be influenced by SUDTC entrances/exists if – for instance – these entrances/exits alter the composition of residential properties listed for sale, thus leading to over-controlling bias in our estimates (Angrist and Pischke 2008). Results, reported in appendix table 7, are not appreciably different from our adjusted models (table 3).

6. Discussion

SUDs are prevalent and harmful health conditions within the U.S. and other developed countries. Treatment can effectively allow afflicted individuals to obtain abstinence, which additionally can reduce the associated negative societal costs of SUDs. However, SUDTCs require a physical space to occupy. There are anecdotal NIMBY concerns that these centers increase crime, littering, noise, and nuisance behaviors, which stigmatizes these centers and potentially reduces property values for residences in close proximity to the SUDTCs. On the

[18] We study centers that offer OUD treatment – specifically centers offering methadone – as the U.S. is in the midst of an opioid epidemic and how best to address this epidemic is a pressing question facing local, state, and federal governments. We note that buprenorphine is also indicated to treat OUD. However, this medication is generally prescribed in general physicians' outpatient offices and not specialty treatment facilities such as we study here.
[19] In our main specifications we cluster at the SUDTC area and zip code level respectively.

following SUDTC entrance larger than 2.2% to 3.8% with 95% confidence. Our SDD estimates are robust to a wide range of specifications and sensitivity checks.

We note that our findings change when we apply the SDD model to account for endogenous location selection on the part of SUDTC owners and operators. In particular, we find no statistically significant evidence that SUDTCs affect property values when we apply the SDD estimator; coefficient estimates decline in magnitude and become statistically indistinguishable from zero. This pattern of results suggests that perhaps the perceived negative effects of SUDTCs on residential property values may be overstated. Previous economic research estimating dis-amenity effects also documents that failure to account for endogenous location choices can lead to estimates biased away from zero (Linden and Rockoff 2008). Our results thus link to a growing literature suggesting that empirical studies account for endogenous location choices when evaluating the effect of both amenities and dis-amenities on property values (Congdon-Hohman 2013; Dealy, Horn, and Berrens 2017; Linden and Rockoff 2008).

Local residents are often concerned that entrance of an SUDTC will impose costs on the neighborhood and, in turn, reduce residential property values. However, our findings suggest that the potential benefits of SUDTCs to the community may offset potential costs, leaving property values unchanged. Notably, SUDTCs reduce the prevalence of SUDs within the local area (Swensen 2015). Additionally, many studies document reductions in crime associated with SUDs treatment, and these effects have a considerable economic impact (Cohen and Piquero 2009; Doran 2008; McCollister et al. 2017; McCollister, French, and Fang 2010). In terms of SUDTCs, Bondurant et al., (2018) and Wen, Hockenberry, and Cummings (2017) show that that SUDTCs reduce both violent and financially motivated crimes in local areas. The social costs (e.g., legal system and healthcare costs) of one murder are very high: $11M (McCollister et al.

proximity to SUDTCs. We show that previous empirical evidence and anecdotes likely overstated the negative effects of SUDTCs on residential property values. While we did not study this question in our paper, it is possible that stigma against SUDTCs and NIMBY local efforts may have prevented these centers from optimally locating, which may impede treatment effectiveness and, in turn, patient outcomes and exacerbate social costs associated with SUDs.

Table 2: Effect of SUDTC Entrance and Exit on Residential Property values: Naïve OLS Model

Model:	(1)	(2)	(3)
Mean value of outcome variable ($1,000 in 2016 dollars):	487.56	487.56	487.56
$D^{0.2}$	-0.0467***	-0.0344***	-0.0344*
	(0.0054)	(0.0048)	(0.0181)
Constant	11.7253***	12.2773***	12.2773***
	(0.0566)	(0.0568)	(0.0740)
N	131,862	131,862	131,862
adj. R^2	0.533	0.646	0.646
Housing Characteristics	✓	✓	✓
Year FE	✓		
Year × Zip code Fixed Effects		✓	✓
Zip Code SE Cluster			✓

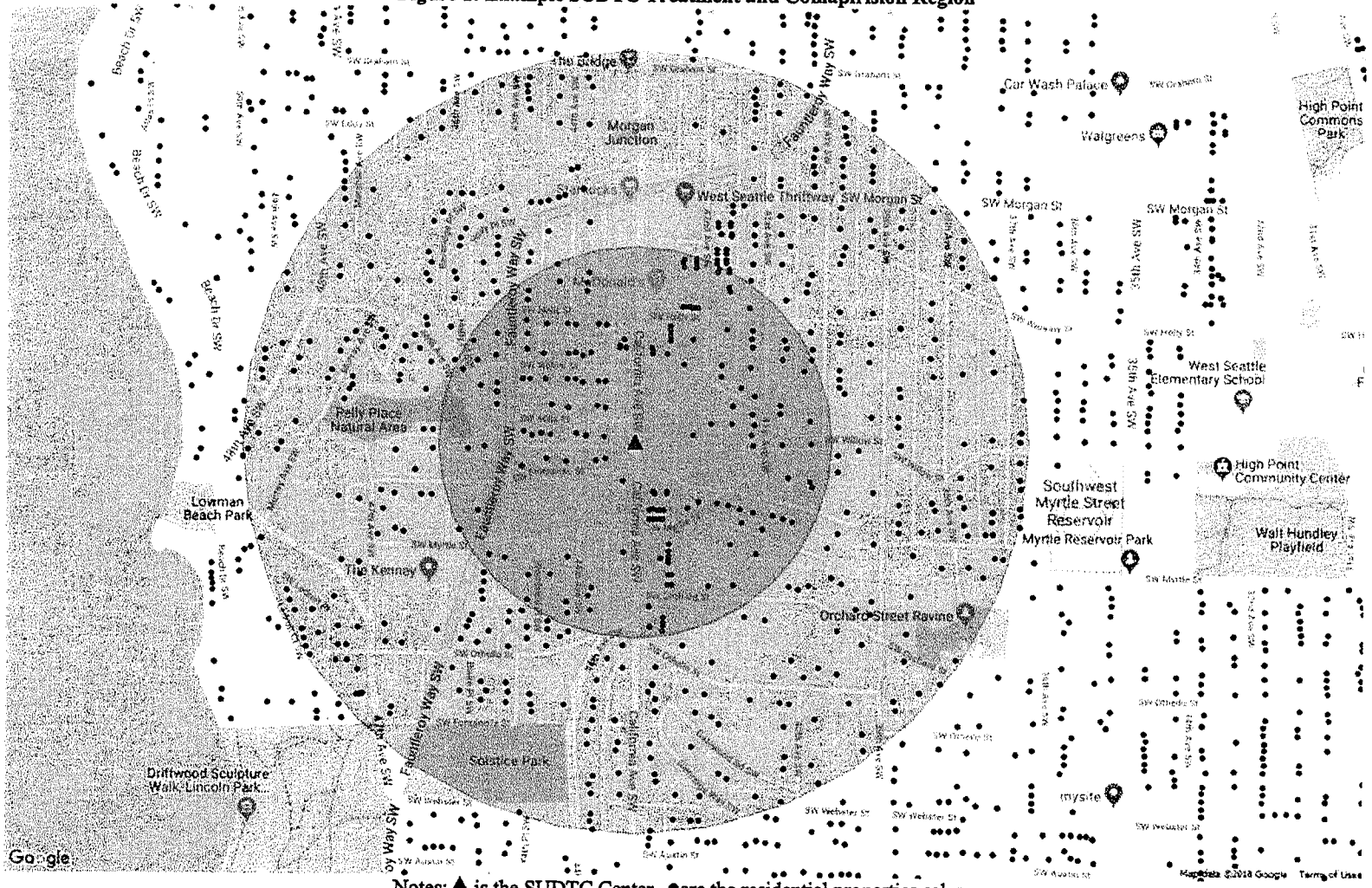
Notes: Standard errors in parentheses
$^{*}p < .1$, $^{**}p < .05$, $^{***}p < .01$.

Table 4A: Effect of SUDTC Entrance and Exit on Residential Property values: SDD Results with Alternative Distance Band Specifications – Full Sample

Model:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Treatment group	0.1	0.1	0.1	0.2	0.2	0.2	0.3	0.3
Comparison group	0.3	0.4	0.5	0.4	0.5	0.6	0.5	0.6
Mean value of outcome variable ($1,000 in 2016 dollars):	487.56	487.56	487.56	487.56	487.56	487.56	487.56	487.56
$D^{Treatment}$	-0.0168	-0.0169	-0.0174	-0.0080	-0.0081	-0.0078	0.0019	0.0021
	(0.0177)	(0.0199)	(0.0204)	(0.0137)	(0.0153)	(0.0169)	(0.0155)	(0.0161)
$D^{Comparison}$	-0.0199	-0.0242*	-0.0297*	-0.0228*	-0.0288*	-0.0365*	-0.0295	-0.0370*
	(0.0142)	(0.0130)	(0.0162)	(0.0125)	(0.0165)	(0.0182)	(0.0182)	(0.0195)
$D^{Treatment} * \tau^{entry}$	0.0117	0.0092	0.0105	-0.0111	-0.0085	-0.0107	-0.0081	-0.0110
	(0.0172)	(0.0188)	(0.0205)	(0.0143)	(0.0164)	(0.0165)	(0.0178)	(0.0174)
$D^{Comparison} * \tau^{entry}$	-0.0044	-0.0017	-0.0025	0.0008	-0.0014	0.0013	-0.0022	0.0011
	(0.0209)	(0.0182)	(0.0192)	(0.0177)	(0.0192)	(0.0192)	(0.0194)	(0.0193)
$D^{Treatment} * \tau^{exit}$	-0.0035	0.0029	-0.0030	0.0198	0.0117	0.0123	0.0123	0.0132
	(0.0251)	(0.0280)	(0.0287)	(0.0164)	(0.0158)	(0.0157)	(0.0158)	(0.0157)
$D^{Comparison} * \tau^{exit}$	0.0181	0.0115	0.0195	0.0096	0.0196	0.0202	0.0202	0.0206
	(0.0183)	(0.0151)	(0.0155)	(0.0161)	(0.0160)	(0.0144)	(0.0154)	(0.0139)
Constant	12.2830***	12.2918***	12.2979***	12.2923***	12.2992***	12.3107***	12.2960***	12.3074***
	(0.0750)	(0.0758)	(0.0754)	(0.0761)	(0.0758)	(0.0745)	(0.0760)	(0.0748)
N	131,862	131,862	131,862	131,862	131,862	131,862	131,862	131,862
adj. R^2	0.646	0.646	0.646	0.646	0.646	0.646	0.646	0.646
Housing Characteristics	✓	✓	✓	✓	✓	✓	✓	✓
Year × Zip code Fixed Effects	✓	✓	✓	✓	✓	✓	✓	✓
Zip Code SE Cluster	✓	✓	✓	✓	✓	✓	✓	✓

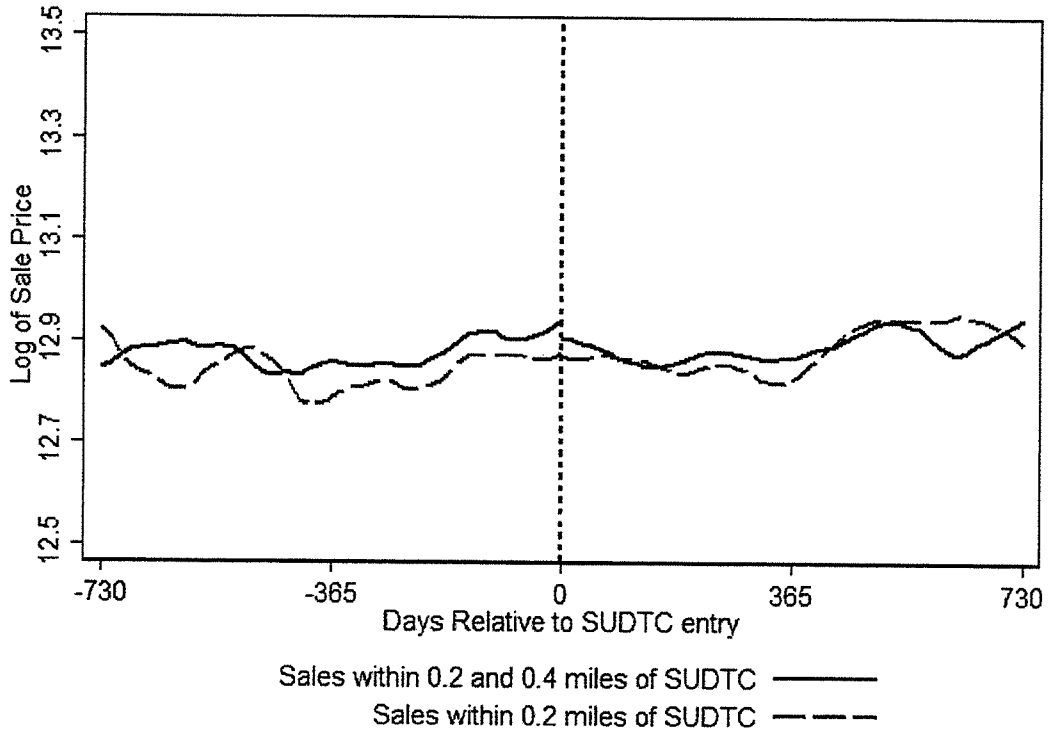
Notes: Standard errors in parentheses
* $p < .1$, ** $p < .05$, *** $p < .01$.

Figure 1: Example SUDTC Treatment and Comapirision Region



Notes: ▲ is the SUDTC Center, ● are the residential properties sales.
First circle: within 0.2 miles of SUDTC, Second Circle: within 0.2-0.4 miles of SUDTC

Figure 3: Trends in Residential Housing Prices in Seattle: Pre-and Post- SUDTC Entry



Notes: Data are centered around the SUDTC entry. The treatment group includes residential property sales that occur 0 to < 0.20 miles from an SUDTC. The comparison group includes residential property sales that occur 0.2 to 0.4 miles from an SUDTC. Epanechnikov local polynomial smoothing with bandwidth of 35 days.

Appendix Table 1: Effect of SUDTC Entrance and Exit on Residential Property values: SDD Model Full Set of Control Variable Coefficient Estimate

Control Variable Coefficient Estimates for Column (3) in Table 3	Beta (Standard error)
Mean value of outcome variable ($1,000 in 2016 dollars):	487.56
More than 1 No. of living unit (1= yes, 0 = no)	-0.0266** (0.0116)
No. of Stories	0.0257*** (0.0079)
No. of Bedrooms	-0.0115*** (0.0033)
No. of Bathrooms	-0.0024 (0.0033)
Age	0.0018*** (0.0005)
Age-squared	-0.0035 (0.0045)
Renovated (1= yes, 0 = no)	0.0578*** (0.0079)
Total Living (1,000 Square Feet)	0.1726*** (0.0060)
Total Basement (1,000 Square Feet)	0.0345*** (0.0063)
Total Garage (1,000 Square Feet)	0.0904*** (0.0104)
Total Porch (1,000 Square Feet)	0.1252*** (0.0199)
Total Deck (1,000 Square Feet)	0.1611*** (0.0146)
Percent Brick Stone	0.0004*** (0.0001)
Constant	12.2923*** (0.0761)
N	131,862
adj. R^2	0.646
Building Grade Variables	✓

Notes: All models estimated with OLS. Standard errors clustered at Zip Code level reported in parentheses.
* $p < .1$, ** $p < .05$, *** $p < .01$.

Appendix Table 3: Effect of SUDTC Entrance and Exit on Residential Property values: SDD Results with Alternate Fixed Effect and Clustering Specifications

Model:	(1) Full Sample	(2) Full Sample	(3) Full Sample	(4) Limited Sales Sample	(5) Limited Sales Sample	(6) Limited Sales Sample
Mean value of outcome variable ($1,000 in 2016 dollars):	487.56	487.56	487.56	476.84	476.84	476.84
$D^{0.2}$	-0.0080	-0.0043	-0.0080	-0.0036	-0.0295**	-0.0295**
	(0.0137)	(0.0157)	(0.0120)	(0.0141)	(0.0135)	(0.0135)
$D^{0.4}$	-0.0228*	-0.0246	-0.0228*			
	(0.0125)	(0.0149)	(0.0124)			
$D^{0.2}*_{\tau}{}^{entry}$	-0.0111	-0.0158	-0.0111	-0.0156	0.0073	0.0073
	(0.0143)	(0.0158)	(0.0173)	(0.0138)	(0.0142)	(0.0169)
$D^{0.4}*_{\tau}{}^{entry}$	0.0008	-0.0034	0.0008	-0.0184	-0.0148	-0.0148
	(0.0177)	(0.0192)	(0.0046)	(0.0204)	(0.0214)	(0.0181)
$D^{0.2}*_{\tau}{}^{exit}$	0.0198	0.0193	0.0198	0.0194	0.0119	0.0119
	(0.0164)	(0.0173)	(0.0176)	(0.0168)	(0.0170)	(0.0139)
$D^{0.4}*_{\tau}{}^{exit}$	0.0096	0.0275	0.0096	0.0113	0.0216	0.0216
	(0.0161)	(0.0171)	(0.0194)	(0.0222)	(0.0167)	(0.0175)
Constant	12.2923***	12.2558***	12.4368***	12.1275***	12.0576***	12.0576***
	(0.0761)	(0.0736)	(0.0000)	(0.1785)	(0.1685)	(0.1091)
N	131,862	131,862	131,862	31,653	31,653	31,653
adj. R^2	0.646	0.639	0.646	0.616	0.636	0.636
Housing Characteristics	✓	✓	✓	✓	✓	✓
Year × Zip code Fixed Effects	✓		✓			
Quarter Year Fixed Effects		✓		✓	✓	✓
Zip Code Fixed Effects		✓	✓	✓		
SUDTC fixed effects					✓	✓
Zip Code SE Cluster	✓	✓	✓	✓	✓	
SUDTC SE Cluster						✓
Wild Cluster Boot Strap at Zip Code level			✓			
Restricted to 0.4 miles				✓	✓	✓

Notes: All models estimated with OLS. Standard errors reported in parentheses. Treatment group is defined as all properties sold 0 to <0.2 miles from an SUDTC. Comparison group is defined as all properties sold 0.2 to 0.4 miles from an SUDTC. $^{*}p<.1$, $^{**}p<.05$, $^{***}p<.01$.

Appendix Table 5: Effect of SUDTC Entrance and Exit on Residential Property values: SDD Results Accounting for Multiple SUDTCs in Proximity to Property

Model:	(1) Full Sample	(2) Full Sample	(3) Limited Sales	(4) Limited Sales
Mean value of outcome variable:	487.56	487.56	476.84	476.84
$D^{0.2}$	-0.0079	-0.0080	-0.0302**	-0.0303**
	(0.0136)	(0.0137)	(0.0138)	(0.0137)
$D^{0.4}$	-0.0224*	-0.0228*		
	(0.0126)	(0.0125)		
$D^{0.2}*_{\tau}{}^{entry}$	-0.0050	-0.0110	0.0105	0.0066
	(0.0131)	(0.0134)	(0.0161)	(0.0173)
$D^{0.2}*_{\tau}{}^{entry}*\theta^{Secondary\ SUDTC}$	-0.0099	-0.0009	-0.0167	-0.0057
	(0.0347)	(0.0334)	(0.0238)	(0.0237)
$D^{0.4}*_{\tau}{}^{entry}$	0.0031	0.0007	-0.0097	-0.0087
	(0.0149)	(0.0177)	(0.0189)	(0.0185)
$D^{0.2}*_{\tau}{}^{exit}$		0.0197		0.0131
		(0.0155)		(0.0139)
$D^{0.4}*_{\tau}{}^{exit}$		0.0096		0.0290
		(0.0161)		(0.0178)
Constant	12.2952***	12.2923***	12.1314***	12.1369***
	(0.0762)	(0.0761)	(0.1041)	(0.1076)
N	131,862	131,862	31,653	31,653
adj. R^2	0.646	0.646	0.630	0.630
Housing Characteristics	✓	✓	✓	✓
Year × Zip code Fixed Effects	✓	✓		
Year Fixed Effects			✓	✓
SUDTC Fixed Effect			✓	✓
Zip Code SE Cluster	✓	✓		
SUDTC area SE Cluster			✓	✓
Restricted to 0.4 miles			✓	✓

Notes: Standard errors in parentheses. $\theta^{Secondary\ SUDTC}$ represents other SUDTCs in operation within 0.2 miles.
* $p < .1$, ** $p < .05$, *** $p < .01$.

Appendix Table 7: Effect of SUDTC Entrance and Exit on Residential Property values: SDD Results Excluding Residential Property Controls

Model:	(1) Full Sample	(2) Full Sample	(3) Limited Sales Sample	(4) Limited Sales Sample
Mean value of outcome variable ($1,000 in 2016 dollars):	487.56	487.56	476.84	476.84
$D^{0.2}$	-0.0343	-0.0344	-0.0639***	-0.0641***
	(0.0235)	(0.0235)	(0.0222)	(0.0220)
$D^{0.4}$	-0.0728***	-0.0734***		
	(0.0257)	(0.0257)		
$D^{0.2}*_{\tau}{}^{entry}$	-0.0003	-0.0095	0.0291	0.0226
	(0.0203)	(0.0237)	(0.0259)	(0.0277)
$D^{0.4}*_{\tau}{}^{entry}$	0.0199	0.0158	-0.0028	-0.0011
	(0.0302)	(0.0329)	(0.0206)	(0.0203)
$D^{0.2}*_{\tau}{}^{exit}$		0.0324		0.0235
		(0.0419)		(0.0336)
$D^{0.4}*_{\tau}{}^{exit}$		0.0162		0.0258
		(0.0285)		(0.0211)
Constant	13.4539***	13.4490***	12.8962***	12.9038***
	(0.0145)	(0.0154)	(0.0101)	(0.0106)
N	131,862	131,862	31,653	31,653
adj. R^2	0.403	0.403	0.466	0.467
Year × Zip code Fixed Effects	✓	✓		
Year Fixed Effects			✓	✓
SUDTC Fixed Effect			✓	✓
Zip Code SE Cluster	✓	✓		
SUDTC area SE Cluster			✓	✓
Restricted to 0.4 miles			✓	✓

Notes: Standard errors in parentheses. $^{*}p < .1$, $^{**}p < .05$, $^{***}p < .01$.

Congdon-Hohman, Joshua M. 2013. "The lasting effects of crime: The relationship of discovered methamphetamine laboratories and home values." *Regional Science and Urban Economics* 43 (1):31-41.

Davidoff, I. A. N., and Andrew Leigh. 2008. "How much do public schools really cost? Estimating the relationship between house prices and school quality." *Economic Record* 84 (265):193-206.

Dealy, Bern C, Brady P Horn, and Robert P Berrens. 2017. "The impact of clandestine methamphetamine labs on property values: Discovery, decontamination and stigma." *Journal of Urban Economics* 99:161-172.

Department of Health and Human Services. 2018. Costs and consequences of heart disease and stroke. Washtington, DC: Department of Health and Human Services.

Doran, Christopher M. 2008. "Economic evaluation of interventions to treat opiate dependence." *Pharmacoeconomics* 26 (5):371-393.

Espey, Molly, and Hilary Lopez. 2000. "The impact of airport noise and proximity on residential property values." *Growth and Change* 31 (3):408-419.

Ettner, Susan L, David Huang, Elizabeth Evans, Danielle Rose Ash, Mary Hardy, Mickel Jourabchi, and Yih-Ing Hser. 2006. "Benefit–cost in the california treatment outcome project: Does substance abuse treatment "pay for itself"?" *Health Services Research* 41 (1):192-213.

Freeborn, Beth A, and Brian McManus. 2010. "Substance abuse treatment and motor vehicle fatalities." *Southern Economic Journal* 76 (4):1032-1048.

French, Michael T, and Michael Drummond. 2005. "A research agenda for economic evaluation of substance abuse services." *Journal of Substance Abuse Treatment* 29 (2):125-137.

French, Michael T, Hai Fang, and Ana I Balsa. 2011. "Longitudinal analysis of changes in illicit drug use and health services utilization." *Health Services Research* 46 (3):877-899.

Gawande, Kishore, and Hank Jenkins-Smith. 2001. "Nuclear waste transport and residential property values: Estimating the effects of perceived risks." *Journal of Environmental Economics and Management* 42 (2):207-233.

Gibbons, Steve. 2004. "The costs of urban property crime." *The Economic Journal* 114 (499):F441-F463.

Grant, Bridget F, Frederick S Stinson, Deborah A Dawson, S Patricia Chou, Mary C Dufour, Wilson Compton, Roger P Pickering, and Kenneth Kaplan. 2004. "Prevalence and co-occurrence of substance use disorders and independentmood and anxiety disorders: Results from the national epidemiologic survey on alcohol and related conditions." *Archives of General Psychiatry* 61 (8):807-816.

Grant, Bridget F, Frederick S Stinson, Deborah A Dawson, S Patricia Chou, W June Ruan, and Roger P Pickering. 2004. "Co-occurrence of 12-month alcohol and drug use disorders and personalitydisorders in the united states: Results from the national epidemiologic survey on alcohol and related conditions." *Archives of General Psychiatry* 61 (4):361-368.

Holder, H. D. 1998. "Cost benefits of substance abuse treatment: An overview of results from alcohol and drug abuse." *Journal of Mental Health Policy and Economics* 1 (1):23-29.

Jayakody, R., S. Danziger, and H. Pollack. 2000. "Welfare reform, substance use, and mental health." *Journal of Health Politics Policy and Law* 25 (4):623-651.

McCrary, Justin. 2007. "The effect of court-ordered hiring quotas on the composition and quality of police." *American Economic Review* 97 (1):318-353.
Muehlenbachs, Lucija, Elisheba Spiller, and Christopher Timmins. 2015. "The housing market impacts of shale gas development." *American Economic Review* 105 (12):3633-59.
Murphy, S. M., and D. Polsky. 2016. "Economic evaluations of opioid use disorder interventions." *Pharmacoeconomics* 34 (9):863-887.
National Institute on Drug Abuse. 2018. Principles of drug addiction treatment: A research-based guide. Besthesa, MD: National Insitutes of Health.
Pope, Devin G, and Jaren C Pope. 2012. "Crime and property values: Evidence from the 1990s crime drop." *Regional Science and Urban Economics* 42 (1-2):177-188.
Pope, Jaren C. 2008. "Buyer information and the hedonic: The impact of a seller disclosure on the implicit price for airport noise." *Journal of Urban Economics* 63 (2):498-516.
Popovici, Ioana, Johanna Catherine Maclean, and Michael T French. 2017. Health insurance and traffic fatalities: The effects of substance use disorder parity laws. National Bureau of Economic Research, Inc.
Price, James I, Daniel W McCollum, and Robert P Berrens. 2010. "Insect infestation and residential property values: A hedonic analysis of the mountain pine beetle epidemic." *Forest Policy and Economics* 12 (6):415-422.
Rajkumar, Andrew S., and Michael T. French. 1997. "Drug abuse, crime costs, and the economic benefits of treatment." *Journal of Quantitative Criminology* 13 (3):291-323.
Rauterkus, Stephanie Yates, and Norman Miller. 2011. "Residential land values and walkability." *Journal of Sustainable Real Estate* 3 (1):23-43.
Rudd, Rose A, Puja Seth, Felicita David, and Lawrence Scholl. 2016. "Increases in drug and opioid-involved overdose deaths—united states, 2010–2015." *MMWR. Morbidity and Mortality Weekly Report* 65.
Schori, Maayan. 2011. "Valuation of drug abuse: A review of current methodologies and implications for policy making." *Research on Social Work Practice* 21 (4):421-431.
Substance Abuse and Mental Health Services Administration. 2004. National Survey of Substance Abuse Treatment Services (N-SSATS): 2003. Data on substance abuse treatment facilities. Rockville, MD: Substance Abuse and Mental Health Services Administration.
———. 2014. Projections of national expenditures for treatment of mental and substance use disorders, 2010–2020. Rockville, MD.
———. 2017. National Survey of Substance Abuse Treatment Services (N-SSATS): 2016. Data on substance abuse treatment facilities. Rockville, MD: Substance Abuse and Mental Health Services Administration.
Swensen, Isaac D. 2015. "Substance-abuse treatment and mortality." *Journal of Public Economics* 122:13-30.
Terza, Joseph V. 2002. "Alcohol abuse and employment: A second look." *Journal of Applied Econometrics* 17 (4):393-404.
Thaler, Richard. 1978. "A note on the value of crime control: Evidence from the property market." *Journal of Urban Economics* 5 (1):137-145.
U.S. Census Bureau. 2018. Median and average sales prices of new homes sold in united states. Washington, DC: U.S. Census Bureau.
Voicu, Ioan, and Vicki Been. 2008. "The effect of community gardens on neighboring property values." *Real Estate Economics* 36 (2):241-283.