



Published in final edited form as:

Am J Prev Med. 2020 September ; 59(3): 449–454. doi:10.1016/j.amepre.2020.03.014.

Marijuana Vaping in U.S. Adults: Evidence From the Behavioral Risk Factor Surveillance System

Stephen R. Baldassarri, MD, MHS¹, Deepa R. Camenga, MD, MHS², David A. Fiellin, MD³,
Abigail S. Friedman, PhD⁴

¹Department of Internal Medicine, Section of Pulmonary, Critical Care, and Sleep Medicine, Yale School of Medicine, New Haven, Connecticut;

²Department of Emergency Medicine, Yale School of Medicine, New Haven, Connecticut;

³Department of Internal Medicine, Section of General Internal Medicine, Yale School of Medicine, New Haven, Connecticut;

⁴Department of Health Policy and Management, Yale School of Public Health, New Haven, Connecticut

Abstract

Introduction: As of January 14, 2020, states have reported 2,668 cases of e-cigarette, or vaping, product-use associated lung injury to the Centers for Disease Control and Prevention. Most cases involved cannabinoids. This study identifies current risk factors for adult marijuana vaping by analyzing 2017 and 2018 Behavioral Risk Factor Surveillance System data.

Methods: Data on 8,255 people who recently used marijuana were analyzed in September 2019. Sample-weighted multivariate logistic regressions considered a binary indicator for vaping as the primary method of marijuana use. Adjusting for demographic controls, regressions assessed the association between marijuana vaping and marijuana use for medical purposes (versus non-medical only), current conventional cigarette use, current nicotine e-cigarette use, and two mental health variables. Demographic controls were binary indicators for female sex, Hispanic ethnicity, race, and having completed 1 of college.

Results: Odds of marijuana vaping were higher among those who reported using for medical purposes ($AOR_{age18-24years}=3.8$, 95% CI=1.91, 7.67; $AOR_{age25-54years}=1.8$, 95% CI=1.02, 3.08; $AOR_{age55-64years}=2.3$, 95% CI=0.75, 7.07) and lower among people who smoked combustible cigarettes ($AOR_{age18-24years}=0.2$, 95% CI=0.06, 0.65; $AOR_{age25-54years}=0.2$, 95% CI=0.10, 0.26; $AOR_{age55-64years}=0.1$, 95% CI=0.05, 0.34). Vaping nicotine e-cigarettes was associated with greater odds of vaping marijuana for adults aged 25–54 years ($AOR=4.6$, 95% CI=2.70, 7.78) but not those aged 18–24 years ($AOR=0.9$, 95% CI=0.33, 2.26).

Address correspondence to: Stephen R. Baldassarri, MD, MHS, Section of Pulmonary, Critical Care, and Sleep Medicine, Yale School of Medicine, 300 Cedar Street, TAC-455 South, New Haven CT 06520. stephen.baldassarri@yale.edu.

Publisher's Disclaimer: This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

Conclusions: Among people who use marijuana, adults reporting medical marijuana use were more likely to vape as their primary mode of consumption, whereas conventional cigarette smokers were less likely to do so. Use of nicotine e-cigarettes was associated with a greater likelihood of vaping marijuana for adults aged 25–54 years.

INTRODUCTION

As of February 18, 2020, a total of 2,807 cases of e-cigarette, or vaping, product use-associated lung injury (EVALI) were reported to the Centers for Disease Control and Prevention by 50 states.^{1,2} The vast majority of these cases involved vaping tetrahydrocannabinol, marijuana's primary psychoactive component.¹ Marijuana use is legal in 11 states and the District of Columbia for adults over aged older than 21 years, with medical use legal in 33 states.

Addressing this outbreak requires an understanding of marijuana vaping patterns in the U.S. In a nationally representative 2017 sample of U.S. adults, 14.6% reported past-year marijuana use, with 12.9% smoking marijuana, 4.7% vaping, and 6.7% reporting multiple modes of consumption.³ However, cannabis vaping may be more prevalent among those using for medical (versus non-medical) purposes ($p=0.09$)⁴ and among users of nicotine e-cigarettes.⁵

This study's purpose is to identify correlates of adult marijuana vaping by analyzing the Centers for Disease Control and Prevention's 2017 and 2018 Behavioral Risk Factor Surveillance System (BRFSS) data. It is hypothesized that vaping as the primary mode of marijuana consumption is more common among adults using marijuana for medical purposes—who might avoid smoking for health reasons—and less common among conventional cigarette smokers, who may be more comfortable with smoking as a means of consumption.

METHODS

The BRFSS is an annual, cross-sectional telephone survey that is state- and nationally representative for non-institutionalized U.S. adults. Questions focus on health conditions, risk behaviors, and use of preventive services.⁶

Data on 8,255 people who recently used marijuana were analyzed in September 2019. Analyses considered 2017 and 2018 BRFSS data for states fielding marijuana modules and current e-cigarette use questions. These modules asked the number of days (in the past 30) the respondent used *marijuana or hashish*, whether use was for medical or non-medical purposes, and the primary mode of consumption. The analytic sample covered adults aged 18–64 years reporting past-month marijuana use in 15 states (N=8,255): Alaska, California, Florida, Georgia, Idaho, Maryland, Minnesota, Montana, New Hampshire, North Dakota, Ohio, Oklahoma, South Carolina, Tennessee, and Wyoming. Analyses followed BRFSS guidance in using the probability weights indicated for each marijuana module.⁷

Summary statistics described demographic differences between people who used marijuana (PWUM) in the past 30 days by primary mode of consumption, and the percentage who

favored vaping marijuana by state. Sample-weighted multivariate logistic regressions assessed the association between a binary indicator for vaping as the primary method of marijuana use and indicators for reporting any marijuana use for medical purposes (versus non-medical only), current conventional cigarette use, current nicotine e-cigarette use, and two mental health variables—the percentage of the past 30 days they reported that their mental health was *not good*, and a binary indicator for whether they were ever told they had a depressive disorder. Demographic controls adjust for binary indicators for female sex, Hispanic ethnicity, and having completed 1 year of college, plus a categorical race variable with “white” as the reference group. To enhance generalizability, state and year fixed effects absorbed time-invariant differences in states’ policy environments and common time trends, respectively. As no analytic sample state implemented new recreational or medical marijuana policies or changed the legality of smokable marijuana during the study period, state fixed effects should absorb such policies’ impacts on marijuana vaping and misreporting. Finally, missing observation indicators were included for all independent variables. Stata, version 14.2 was used to conduct all analyses.

RESULTS

Table 1 presents summary statistics by respondents’ main mode of marijuana consumption. Relative to those who primarily smoked marijuana (the largest subgroup), those who primarily vaped marijuana were more likely to report medical use (71% for vapers vs 55% for smokers; Wald test, $p=0.001$), less likely to smoke conventional cigarettes (13% vs 42%; $p<0.001$), more likely to use e-cigarettes (23% vs 14%; $p=0.052$), and more likely to have attended college (76% vs 54%; $p<0.001$).

Table 2 describes each state’s marijuana legalization policies alongside its prevalence of marijuana vaping among PWUM. Marijuana vaping among PWUM was most common in Florida (15%; one of two states in this sample prohibiting smokable marijuana preparations, California (13%; where recreational use was legal), and Idaho (12%; where neither medical nor recreational use was legal).

Multivariate logistic regressions identified correlates of reporting vaping as one’s primary mode of marijuana use (Table 3). Respondents who used marijuana for medical purposes were more likely to vape it as their primary mode of consumption, relative to those who did not report medical use ($AOR_{age18-24years}=3.8$, 95% CI=1.91, 7.67; $AOR_{age25-54years}=1.8$; 95% CI=1.02, 3.08; $AOR_{age55-64years}=2.3$, 95% CI=0.75, 7.07). Mental health coefficients tended to be statistically insignificant, though conventional cigarette smoking showed a negative association with marijuana vaping ($AOR_{age18-24years}=0.2$, 95% CI=0.06, 0.65; $AOR_{age25-54years}=0.2$, 95% CI=0.10, 0.26), $AOR_{age55-64years}=0.1$, 95% CI=0.05, 0.34). Use of nicotine e-cigarettes showed a significant and positive association with marijuana vaping for prime-aged adults ($AOR_{age25-54years}=4.6$, 95% CI=2.70, 7.78) but not emerging adults ($AOR_{age18-24years}=0.9$, 95% CI=0.33, 2.26).

DISCUSSION

This research reports results from a cross-sectional analysis of marijuana vaping in a representative sample of adults from 15 U.S. states. Consistent with prior research, marijuana vaping was far less prevalent than marijuana smoking,³ with the former comprising about one tenth of adult marijuana use in this sample. Among PWUM, those who vaped marijuana were more likely to do so for medical purposes and less likely to smoke combustible cigarettes. E-cigarette use was associated with a greater odds of marijuana vaping for prime-aged adults (25–54 years) but not emerging adults (18–24 years).

These findings have significant implications. As EVALI cases have disproportionately involved vaping cannabinoids, brief screenings for marijuana use and mode of consumption in at-risk individuals might expedite diagnosis and treatment. Evidence that the relationship between vaping nicotine and vaping marijuana differs by age group suggests such screenings should not be predicated on nicotine vaping. Indeed, current evidence implicates vitamin E acetate in the EVALI outbreak, an additive primarily found in tetrahydrocannabinol e-liquids, not nicotine e-cigarettes.^{8,9}

Although cannabinoids have therapeutic potential,¹⁰ risks of use may vary by route of administration.^{11–14} As those using marijuana for medical reasons appear more likely to vape it, providers need evidence on the risks of different consumption modes in order to identify the safest options, accounting for mode of consumption and potency. Specifically, vaporized marijuana may deliver higher doses than smoked marijuana.¹⁵ High-potency oils are commonly available for vaping but not smoking, potentially affecting toxicity risk. Though marijuana smoking is toxic to the lung¹⁶ and chronic use may yield a greater risk of developing chronic bronchitis,¹³ current evidence does not support an independent effect on emphysema or lung cancer development.¹⁷ Robust research is urgently needed to better understand these issues.

Limitations

This study has several limitations. First, self-reported data are subject to reporting bias, particularly around illicit behaviors. Similarly, self-assessed medical versus non-medical marijuana use is subjective and potentially impacted by social desirability bias. Reassuringly, the multivariate regressions' state fixed effects adjust for impacts of state marijuana policies on marijuana use and misreporting. Next, as respondents could only select one mode of marijuana use, this may not reflect their sole method of consumption. Finally, with data on 15 states, results may not generalize nationwide.

CONCLUSIONS

Among PWUM, those who vaped marijuana were more likely to use it for medical purposes and less likely to smoke combustible cigarettes. Vaping nicotine e-cigarettes was associated with greater odds of vaping marijuana among prime-aged adults but not emerging adults. Clinicians must account for these risk factors when caring for patients.

ACKNOWLEDGMENTS

Dr. Baldassarri reports receiving grants from the National Institute on Drug Abuse (K23DA045957). No other financial disclosures were reported by the authors of this paper.

REFERENCES

1. CDC. Outbreak of Lung Disease Associated with E-Cigarette Use, or Vaping. www.cdc.gov/tobacco/basic_information/e-cigarettes/severe-lung-disease.html. Published 2019 Accessed April 2, 2020.
2. Layden JE, Ghinai I, Pray I, et al. Pulmonary illness related to e-cigarette use in Illinois and Wisconsin - final report. *N Engl J Med*. 2020;382(10):903–916. 10.1056/NEJMoa1911614. [PubMed: 31491072]
3. Steigerwald S, Wong PO, Cohen BE, et al. Smoking, vaping, and use of edibles and other forms of marijuana among U.S. adults. *Ann Intern Med*. 2018;169(12):890–892. 10.7326/m18-1681. [PubMed: 30167665]
4. Pacula RL, Jacobson M, Maksabedian EJ. In the weeds: a baseline view of cannabis use among legalizing states and their neighbours. *Addiction*. 2016;111(6):973–980. 10.1111/add.13282. [PubMed: 26687431]
5. Morean ME, Lipshie N, Josephson M, Foster D. Predictors of adult e-cigarette users vaporizing cannabis using e-cigarettes and vape-pens. *Subst Use Misuse*. 2017;52(8):974–981. 10.1080/10826084.2016.1268162. [PubMed: 28323498]
6. Balluz L, Easton A, Garcia D, et al. Prevalence of selected risk behaviors and chronic diseases-- Behavioral Risk Factor Surveillance System (BRFSS), 39 states communities, United States, 2005. Published 2008.
7. CDC. The Behavioral Risk Factor Surveillance System (BRFSS) Complex Sampling Weights and Preparing 2018 BRFSS Module Data for Analysis. www.cdc.gov/brfss/annual_data/2018/pdf/Complex-Smple-Weights-Prep-Module-Data-Analysis-2018-508.pdf. Published 2019 Accessed April 2, 2020.
8. Blount BC, Karwowski MP, Morel-Espinosa M, et al. Evaluation of bronchoalveolar lavage fluid from patients in an outbreak of e-cigarette, or vaping, product use-associated lung injury - 10 states, August-October 2019. *MMWR Morb Mortal Wkly Rep*. 2019;68(45):1040–1041. 10.15585/mmwr.mm6845e2. [PubMed: 31725707]
9. Taylor J, Wiens T, Peterson J, et al. Characteristics of e-cigarette, or vaping, products used by patients with associated lung injury and products seized by law enforcement— Minnesota, 2018 and 2019. *MMWR Morb Mortal Wkly Rep*. 2019;68(47):1096–1100. 10.15585/mmwr.mm6847e1. [PubMed: 31774740]
10. National Academies of Sciences, Engineering, and Medicine. *The Health Effects of Cannabis and Cannabinoids: The Current State of Evidence and Recommendations for Research*. Washington, DC: The National Academies Press; 2017 10.17226/24625.
11. Koppel BS, Brust JCM, Fife T, et al. Systematic review: efficacy and safety of medical marijuana in selected neurologic disorders: report of the Guideline Development Subcommittee of the American Academy of Neurology. *Neurology*. 2014;82:1556–1563. 10.1212/wnl.0000000000000363. [PubMed: 24778283]
12. Hill KP. Medical marijuana for treatment of chronic pain and other medical and psychiatric problems: a clinical review. *JAMA*. 2015;313(24):2474–2483. 10.1001/jama.2015.6199. [PubMed: 26103031]
13. Tetrault JM, Crothers K, Moore BA, Mehra R, Concato J, Fiellin DA. Effects of marijuana smoking on pulmonary function and respiratory complications: a systematic review. *Arch Intern Med*. 2007;167(3):221–228. 10.1001/archinte.167.3.221. [PubMed: 17296876]
14. Mehra R, Moore BA, Crothers K, Tetrault J, Fiellin DA. The association between marijuana smoking and lung cancer: a systematic review. *Arch Intern Med*. 2006;166(13):1359–1367. 10.1001/archinte.166.13.1359. [PubMed: 16832000]

15. Spindle TR, Cone EJ, Schlienz NJ, et al. Acute effects of smoked and vaporized cannabis in healthy adults who infrequently use cannabis: a crossover trial. *JAMA Netw Open*. 2018;1(7):e184841. 10.1001/jamanetworkopen.2018.4841. [PubMed: 30646391]
16. Wu T-C, Tashkin DP, Djahed B, Rose JE. Pulmonary hazards of smoking marijuana as compared with tobacco. *New Engl J Med*. 1988;318(6):347–351. 10.1056/nejm198802113180603. [PubMed: 3340105]
17. Tashkin DP. Effects of marijuana smoking on the lung. *Ann Am Thorac Soc*. 2013;10(3):239–247. 10.1513/annalsats.201212-127fr. [PubMed: 23802821]
18. NORML. Medical Marijuana. <https://norml.org/legal/medical-marijuana-2>. Published 2019 Accessed April 2, 2020.
19. Ingles J Ohio Medical Pot Dispensaries Made \$500,000 In Sales In First Three Weeks. <https://radio.wosu.org/post/ohio-medical-pot-dispensaries-made-500000-sales-first-three-weeks#stream/0>. WOSU Radio Published 2 6, 2019 Accessed April 2, 2020.
20. Smith J Florida ends ban on smokable cannabis, opening door to tens of millions in new sales. <https://mjbizdaily.com/florida-ends-ban-on-smokable-cannabis-opening-door-to-tens-of-millions-in-new-sales/>. Marijuana Business Daily Published 3 18, 2019 Accessed April 2, 2020.
21. Associated Press. Medical marijuana online application system gets over 1,600 submissions on opening day. www.koco.com/article/oklahoma-awards-first-medical-marijuana-patient-licenses2/22830860#. Published 2018 Accessed April 2, 2020.
22. Gillispie M, Stewart C. 4 medical marijuana stores open in Ohio. www.daytondailynews.com/news/state--regional-govt--politics/first-medical-marijuana-sold-ohio-stores-open/WCjebDhNesyVxaVHQhoNNK/. Dayton Daily News Published 1 16, 2019 Accessed April 2, 2020.

Table 1.

Summary Statistics by Primary Mode of Marijuana Use, 2017–2018

Main mode of use	Smoke	Eat or drink	Vape	Other	Missing
	Mean % (95% CI)	Mean % (95% CI)	Mean % (95% CI)	Mean % (95% CI)	Mean % (95% CI)
Percent of people who use marijuana	77.2	8.1	10.5	3.8	0.5
Medical marijuana use	55.2 (0.516, 0.588)	60.3 (0.510, 0.696)	71.5 (0.624, 0.806)	71.1 (0.596, 0.825)	36.9 (0.171, 0.568)
Conventional cigarette use	41.5 (0.380, 0.451)	13.4 (0.086, 0.182)	13.1 (0.051, 0.211)	25.4 (0.144, 0.364)	44.6 (0.238, 0.654)
Nicotine e-cigarette use	14.3 (0.119, 0.167)	10.9 (0.041, 0.177)	23.3 (0.147, 0.319)	23.6 (0.128, 0.344)	22.7 (0.070, 0.383)
Female	38.0 (0.344, 0.417)	46.2 (0.366, 0.557)	45.3 (0.349, 0.557)	31.0 (0.189, 0.430)	24.3 (0.082, 0.404)
Age, years	35.5 (34.589, 36.355)	37.0 (34.789, 39.211)	37.2 (34.995, 39.332)	31.2 (28.792, 33.557)	36.0 (32.228, 39.771)
Any college	53.7 (0.501, 0.573)	72.7 (0.636, 0.817)	76.4 (0.683, 0.845)	58.3 (0.440, 0.727)	46.4 (0.259, 0.669)
Hispanic	18.7 (0.154, 0.219)	18.5 (0.107, 0.263)	20.3 (0.110, 0.295)	24.9 (0.128, 0.371)	9.2 (−0.028, 0.212)
Race					
White	64.9 (0.614, 0.684)	66.2 (0.566, 0.757)	70.4 (0.614, 0.793)	65.8 (0.512, 0.804)	77.2 (0.632, 0.911)
Black	15.8 (0.134, 0.183)	9.7 (0.055, 0.140)	10.9 (0.042, 0.176)	8.5 (0.027, 0.143)	9.5 (−0.006, 0.195)
Asian	5.6 (0.032, 0.080)	9.8 (0.018, 0.178)	4.4 (0.009, 0.078)	3.7 (−0.017, 0.090)	4.2 (−0.010, 0.094)
Other	12.0 (0.097, 0.143)	12.8 (0.062, 0.194)	10.6 (0.051, 0.162)	20.6 (0.058, 0.353)	5.8 (0.012, 0.104)
N	6,598	676	642	277	62

Notes: Data from the 2017–2018 BRFSS describe demographics of past-30-day marijuana users by their mode of consumption, for states that fielded marijuana and current e-cigarette use modules. Statistics are sample-weighted and adjusted for survey design. Means code the following missing values as 0: medical marijuana use (0.5%), sex (0.02%), Hispanic (0.6%), education (0.04%), race (1.9%), conventional cigarette use (0.2%), and nicotine e-cigarette use (0.1%).

BRFSS, Behavioral Risk Factor Surveillance System.

Table 2.

Residents Who Use Marijuana Reporting Vaping as Their Primary Mode of Use by State

State	Recreational marijuana legal pre-2019?	Comprehensive medical marijuana legalization (effective date)	Home cultivation legal?	Edibles legal?	Smokable marijuana allowed under MML pre-2019?	Percent of PWUM who report vaping as primary mode of consumption (95% CI)
Alaska	Yes	3/4/1999	Yes	Yes	Yes	3.4% (0.009, 0.059)
California	Yes	11/6/1996	Yes	Yes	Yes	12.6% (0.091, 0.161)
Florida	No	1/3/2017	No	Yes	No ^a	15.0% (0.102, 0.198)
Georgia	No	–	–	–	–	5.7% (0.020, 0.094)
Idaho	No	–	–	–	–	11.8% (0.051, 0.185)
Maryland	No	10/1/2013	No	No	Yes	10.4% (0.071, 0.138)
Minnesota	No	5/30/2014	No	No	No	7.8% (0.063, 0.092)
Montana	No	11/2/2004	Yes	Yes	Yes	7.4% (0.045, 0.103)
New Hampshire	No	7/23/2013	No	Yes	Yes	6.7% (0.036, 0.097)
North Dakota	No	3/1/2019 ^b	No	No	–	4.1% (0.001, 0.072)
Ohio	No	1/16/2019 ^b	No	Yes	Yes	5.2% (0.027, 0.078)
Oklahoma	No	8/25/2018 ^c	Yes	Yes	Yes	0.8% (–0.008, 0.024)
South Carolina	No	–	–	–	–	4.6% (0.013, 0.079)
Tennessee	No	–	–	–	–	3.7% (0.015, 0.058)
Wyoming	No	–	–	–	–	2.4% (0.007, 0.041)

Notes: Data from the 2017–2018 BRFSS on those states fielding both current marijuana and e-cigarette use questions describe the percent of past-30-day marijuana users who report vaping as their primary mode of consumption, by state. Dates when medical marijuana legalization went into effect and characteristics of these laws are also presented by state.^{18–22}

^aFlorida's law was amended to allow smokable preparations beginning 3/18/2019. All Florida residents in this study's analytic sample were interviewed before that date.

^bThese states legalized marijuana from dispensaries but did not allow home growing. Thus, the effective date listed is the date that state's first medical marijuana dispensary opened (3/1/2019 for North Dakota, 1/16/2019 for Ohio).

^cOklahoma passed medical marijuana on 6/26/2018, but did not award its first licenses to patients until 8/25/2018. Thus, the latter date is given as the law's effective date. All Oklahoma residents in this study's analytic sample were interviewed prior to that date.

BRFSS, Behavioral Risk Factor Surveillance System; MML, medical marijuana laws; PWUM, people who use marijuana.

Table 3.

Multivariate Logistic Regressions: Marijuana Use

Sample	Vaping is primary mode of marijuana use (n=642)		
	(1) Ages 18–24 OR (95% CI)	(2) Ages 25–54 OR (95% CI)	(3) Ages 55–64 OR (95% CI)
Medical marijuana use	3.8263 ** (1.910, 7.667)	1.7774 * (1.025, 3.084)	2.3051 (0.751, 7.071)
History of a depressive disorder	1.9347 (0.669, 5.598)	0.9546 (0.512, 1.781)	1.1100 (0.405, 3.041)
Poor mental health, % of past 30 days	1.3656 (0.370, 5.040)	0.5574 (0.238, 1.303)	0.2384 * (0.069, 0.823)
Conventional cigarette use	0.1930 ** (0.058, 0.646)	0.1576 ** (0.096, 0.259)	0.1339 ** (0.053, 0.335)
Nicotine e-cigarette use	0.8658 (0.332, 2.260)	4.5849 ** (2.702, 7.778)	1.9120 (0.483, 7.565)
Demographic controls?	Yes	Yes	Yes
Fixed effects	State, Age, Year	State, Age, Year	State, Age, Year
N	1,279	4,935	1,731

Notes: Boldface indicates statistical significance

* $p < 0.05$;

** $p < 0.01$.

Sample-weighted multivariate logistic regressions use data from the 2017–2018 BRFSS to consider how marijuana use and marijuana vaping relate to respondent demographics, mental health, and tobacco use, as well as use of marijuana for medical reasons. Demographic controls are binary indicators for female sex, Hispanic ethnicity, race (black, Asian, Native Hawaiian/Pacific Islands, American Indian/Alaska Native, multiple race, other race), and completed 1 or more years of college, as well as binary missing-observation indicators for each of those demographics. Additional missing-observation indicators are included for all control variables listed in the table above. The reference group is non-Hispanic, white males with no college education. SEs are clustered by the primary sampling unit.

BRFSS, Behavioral Risk Factor Surveillance System.