HHS Public Access

Author manuscript

AIDS. Author manuscript; available in PMC 2018 November 13.

Published in final edited form as:

AIDS. 2017 November 13; 31(17): 2437–2439. doi:10.1097/QAD.0000000000001636.

HIV criminalization exacerbates subpar diagnosis and treatment across the US: response to the 'Association of HIV diagnosis rates and laws criminalizing HIV exposure in the United States'

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Keywords

HIV policy; HIV criminal exposure laws; HIV laws; HIV prevention; HIV diagnosis; HIV criminalization

In their article, "Association of HIV diagnosis rates and laws criminalizing HIV exposure in the United States" Sweeney *et al.* [1] find no association between a state's criminal exposure laws and the rates of HIV or AIDS diagnosis. Thirty-three states in the United States have implemented laws criminalizing behaviour, including needle sharing and sexual contact, that could put others at risk of transmission [2]. As highlighted by Sweeney *et al.* [1], the public health impact of these laws should be assessed. However, it was not considered that the annual number of diagnoses alone is uninformative without taking into account epidemiological trajectories. If an epidemic is growing, a constant number of annual diagnoses would actually correspond to a reduced rate of diagnosis among PLHIV. Conversely, the number of diagnoses may remain constant as an epidemic is brought under control if the percentage of PLHIV diagnosed increases. In fact, these inverse associations would be expected. Given that diagnosis is an integral component of treatment-as-prevention strategies, higher rates of diagnosis should be associated with curtailing of HIV epidemics.

We conducted the analysis described in Sweeney *et al.* [1], but stratified the diagnosis rate into two response variables: i) the proportion of PLHIV diagnosed, and ii) annual percentage change in HIV prevalence. The data required for the replication of the results, and the relevant analysis code, are provided at https://github.com/prathasah/US-law-and-HIV. All

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Conflicts of Interest

There are no conflicts of interest.

socio-economic factors described in [1] were used as explanatory variables. Since our first outcome normalized the total HIV diagnoses with the number of PLHIV (instead of the population size), we included population sizes of states as an additional explanatory variable in our model. Here, we present the results of the full models with all explanatory variables, and the subset of predictors that best explain the response variables (Table 1).

Counter to the conclusions of Sweeney *et al.*, our analyses indicate that laws criminalizing HIV exposure are associated with lower proportion of HIV diagnosis (full model: $\chi^2_1=5.82$, $P = 0.016$; subset model: $\chi^2_1=6.72$, $P = 0.009$), and increased HIV prevalence (full model: $\chi^2_1=4.21$, $P = 0.04$; subset model: $\chi^2_1=6.46$, $P = 0.011$). Educational attainment is associated with declining HIV prevalence and higher diagnosis rates. State population size and urbanicity are associated with higher proportions of PLHIV diagnosed and increasing prevalence, respectively.

As the authors and others have argued [1,3], laws criminalizing HIV exposure can deter people from seeking diagnosis. Given the effectiveness of current antiretrovirals in preventing HIV transmission, diagnosis and treatment are fundamental to both improving individual health outcomes as well as protecting others. Our analyses here underscore the importance of distinguishing between the impact of laws on HIV diagnosis and HIV transmission, as their combined effect on HIV diagnosis rate could be confounding and misleading. Our evaluations of these distinct outcomes demonstrate that laws criminalizing HIV exposure have a negative association with HIV testing, and a positive association with increasing HIV prevalence. Consequently, these laws may be exacerbating HIV transmission, as advocates for legal reform have argued [4]. Our results are consistent with studies that have documented the ramifications of HIV criminalization [5–7]. Our analyses demonstrate that laws criminalizing HIV exposure are not only ineffective, but counterproductive.

Acknowledgments

Funding: MCF was supported by National Institutes of Health grant T32 AI007524. AP and APG were supported by National Institutes of Health grants U01 GM105627 and U01 GM087719.

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Table 1

Full (i.e., with all the predictors) and subset (i.e., the best subset of predictors that explain the response) model results for HIV diagnoses and percentage change in HIV prevalence by HIV criminal exposure law and state-specific demographic characteristics in the United States. Bold numbers indicate a significant association ($P < 0.05$).

	Models			
	Full model		Subset model	
	β (±SE)	*P*	β (±SE)	*P*
Proportion of HIV diagnoses, states, 2008-2012				
HIV criminal exposure law	**-0.042 (0.017)**	**0.016**	**-0.042 (0.016)**	**0.010**
Median household income	0.000 (0.002)	0.873	0.000 (0.002)	0.886
Unemployment rate	**0.004 (0.001)**	**<0.001**	**0.003 (0.001)**	**<0.001**
Population size	**0.028 (0.007)**	**<0.001**	**0.027 (0.007)**	**<0.001**
Percentage of population				
Less than high school education	**-0.047 (0.005)**	**<0.001**	**-0.045 (0.005)**	**<0.001**
Residing in urban areas	-0.016 (0.009)	0.083		
Below poverty level	0.001(0.001)	0.646	0.001 (0.001)	0.340
Hispanic or Latino	-0.024 (0.022)	0.283	-0.026 (0.019)	0.164
Non-Hispanic black	-0.019(0.015)	0.202	-0.017 (0.013)	0.177
Non-Hispanic white	-0.038(0.020)	0.059	-0.032 (0.018)	0.086
Annual percentage change in HIV prevalence, states, 2009-2012				
HIV criminal exposure law	**0.625 (0.305)**	**0.040**	**0.712 (0.280)**	**0.011**
Median household income	-0.153 (0.192)	0.425		
Unemployment rate	**-0.343 (0.113)**	**0.002**	**-0.311(0.113)**	**0.006**
Population size	0.135 (0.164)	0.409		
Percentage of population				
Less than high school education	0.199 (0.144)	0.167	**0.326 (0.136)**	**0.017**
Residing in urban areas	**0.338 (0.159)**	**0.034**	**0.351 (0.133)**	**0.008**
Below poverty level	-0.102 (0.180)	0.574		
Hispanic or Latino	-0.284 (0.157)	0.071	**-0.376 (0.145)**	**0.010**
Non-Hispanic black	0.185 (0.128)	0.149		
Non-Hispanic white	0.083 (0.110)	0.449		