encompassing of different types of partnerships, whether committed couples, or casual, or short-term partners. The underlying public health premise of partner notification is to offer HIV testing to people who may have been exposed to HIV infection either through sexual or injecting drug contacts, to reach those with undiagnosed HIV, and to prevent further transmission. The impetus therefore is to notify as many partners of their potential exposure as possible. Results from our review found that on average, the ratio of partners identified per index case through partner notification services was two (range 0.58−5.58), demonstrating the importance of encouraging index patients to identify all partners who may have been exposed. Furthermore, as no single approach to disclosure is acceptable to everyone, choice is important. People diagnosed with HIV should be given options for partner notification and be allowed to choose different methods for different partners, or to decline altogether. For example, they may want to use a passive approach to contact some partners, whom they feel comfortable notifying on their own, but may prefer the provider to assist them in contacting others.

In summary, WHO recommends a range of approaches to increase partner testing as an important way to reach people with undiagnosed HIV and link them to treatment. Couples testing, as recommended by WHO since 2012, is one of these approaches, and mutual disclosure can have additional benefits. WHO has now broadened this recommendation to support a range of partner notification and testing approaches and strongly encourages countries to routinely recommend these voluntary partner testing options to all people with HIV.

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References

1. Davey DLJ, Wall KM. **Need to include couples' HIV counselling and testing as a streategy to improve HIV partner notification services.** *AIDS* 2017; **31**:2435–2436.
2. Dalal S, Johnson CJ, Fonner V, Kennedy CE, Siegfried N, Figueroa C, Baggaley R. **Improving HIV test uptake and case finding with assisted partner notification services.** *AIDS* 2017; **31**:1867–1876.
3. Chiou PY, Lin LC, Chen YM, Wu SC, Lew-Ting CY, Yen HW, *et al.* **The effects of early multiple-time PN counseling on newly HIV-diagnosed men who have sex with men in Taiwan.** *AIDS Behav* 2015; **19**:1773–1781.
4. Udeagu CC, Shah D, Shepard CW, Bocour A, Guiterrez R, Begier EM. **Impact of a New York City Health Department initiative to expand HIV partner services outside STD clinics.** *Public Health Rep* 2012; **127**:107–114.
5. Rosenberg NE, Mtande TK, Saidi F, Stanley C, Jere E, Paile L, *et al.* **Recruiting male partners for couple HIV testing and counselling in Malawi's option B+ programme: an unblinded randomised controlled trial.** *Lancet HIV* 2015; **2**: e483–e491.
6. World Health Organization. *Consolidated guidelines on HIV testing services.* Geneva, Switzerland: World Health Organization; 2015.
7. World Health Organization. *Guidance on couples HIV testing and counselling – including antiretroviral therapy for treatment and prevention in serodiscordant couples: recommendations for a public health approach.* Geneva: World Health Organization; 2012.
8. World Health Organization. *Guidelines on HIV self-testing and partner notification: supplement to consolidated guidelines on HIV testing services.* Geneva: World Health Organization; 2016.

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

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 behaviours, 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 people living with HIV (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

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.

	Models			
	Full model		Subset model	
	β (±SE)	P value	β (±SE)	P value
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		

SE, standard error of the coefficient. Bold numbers indicate a significant association ($P < 0.05$).

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: the proportion of PLHIV diagnosed and 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 socioeconomic factors described in [1] were used as explanatory variables. As 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: $\chi_1^2 = 5.82$, $P = 0.016$; subset model: $\chi_1^2 = 6.72$, $P = 0.009$) and increased HIV prevalence (full model: $\chi_1^2 = 4.21$, $P = 0.04$; subset model: $\chi_1^2 = 6.46$, $P = 0.011$). 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.

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Conflicts of interest

There are no conflicts of interest.

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References

1. Sweeney P, Gray SC, Purcell DW, Sewell J, Babu AS, Tarver BA, *et al*. **Association of HIV diagnosis rates and laws criminalizing HIV exposure in the United States.** *AIDS* 2017; **31**:1483–1488.
2. Stan Lehman J, Carr MH, Nichol AJ, Ruisanchez A, Knight DW, Langford AE, *et al*. **Prevalence and public health implications of state laws that criminalize potential HIV exposure in the United States.** *AIDS Behav* 2014; **18**:997–1006.
3. Galletly CL, Pinkerton SD. **Conflicting messages: how criminal HIV disclosure laws undermine public health efforts to control the spread of HIV.** *AIDS Behav* 2006; **10**:451–461.
4. McClelland A, French M, Mykhalovskiy E, Gagnon M, Manning E, Peck R, *et al*. **The harms of HIV criminalization: responding to the 'association of HIV diagnosis rates and laws criminalizing HIV exposure in the United States'.** *AIDS* 2017; **31**:1899–1900.
5. Lee SG. **Criminal law and HIV testing: empirical analysis of how at-risk individuals respond to the law.** *Yale J Health Policy Law Ethics* 2014; **14**:194–238.
6. Adam BD, Elliott R, Corriveau P, English K. **Impacts of criminalization on the everyday lives of people living with HIV in Canada.** *Sex Res Soc Policy* 2014; **11**:39–49.
7. Bernard EJ, Cameron S. *Advancing HIV Justice 2: building momentum in global advocacy against HIV criminalisation.* Brighton/Amsterdam: Justice Network and GNP+; 2016.