The WAGER Vol. 9(16) – Regional Index of Gambling Exposure – An Acid Test

April 21, 2004

Early last week, officials discovered that a train car parked near a Boston subway station was leaking hydrochloric acid. A hazardous materials response team was quickly called in to assess the situation and determine the potential exposure of neighborhood residents and commuters to the dangerous toxin (Associated Press, 2004). To measure exposure, officials need to gather information about dose (e.g., how much of the hydrochloric acid was leaking), potency (e.g., the acid's concentration), and duration (e.g., how long the acid had been leaking). The idea of environmental exposure, used commonly in public health fields, also can be applied to the social environment (McGuire, 1964). Exposure to certain social settings can influence behavior and mental health in ways similar to how exposure to toxins influences physical health. For example, the introduction of a casino into a community might result in increases in gambling problems and depression. This week's WAGER reviews an article by Shaffer, LaBrie, and LaPlante (2004) that develops a regional model of exposure to "social phenomena" and applies that model to gambling.

Shaffer and colleagues (2004) based their Regional Exposure Model (REM) on standardized exposure gradients used to measure toxin levels. These gradients include measures of dose (i.e., how much), potency (i.e., how strong), and duration (i.e., how long) of the toxin's presence in the environment. The model:

$$\text{Regional Exposure} = a + b_1(f)D_{ose} + b2(f)P_{otency} + b3(f)T_{ime} + \ldots\ b_i(f)X_i + \text{error}$$

is general so that the measures can be weighted, other measures can be added, and the function can be made nonlinear (e.g., the model could be made to reflect a relationship between exposure and problems that was positive at moderate levels, but negative at low or high levels of exposure).

To illustrate the utility of the model, the authors applied the REM to measure regional exposure to gambling and test the effects of that exposure on gambling problems. Using data from the 1997 Economic Census (United States Census Bureau, 1997) and the first annual report of the American Gaming Association (American Gaming Association, 2002), the authors operationally defined dose, potency, and duration to calculate a Regional Index of Gambling Exposure (RIGE). Shaffer et al. (2004) calculated (1) dose as the combination of the number of casinos and the number of people employed by casinos in a specific area, (2) potency as the number of different types of gambling available in a specific area, and (3) duration as the length of time since casino gambling was legalized in a specific area. After applying this RIGE at the statewide level and identifying Nevada as the state with the highest RIGE score, the authors applied the RIGE at the county level in Nevada, comparing county RIGE scores to problem and pathological gambling prevalence in each county, information obtained from a study of gambling problems in Nevada (Volberg, 2002). Because the size of casinos within Nevada varied dramatically from county to county (e.g., the seven Douglas County casinos had an average of 1,000 employees each whereas the 6 Nye County casinos had an average of 100 employees each), the county-level model used two employee measures – the number of casino employees and the proportion of employed people who worked in casinos.

Table 1. Gambling Exposure and Gambling Problems in Nevada Counties (adapted from Shaffer et al., 2004).

County	Data from US Economic Survey and AGA Report (American Gaming Association, 2002)					RIGE Score	Data from Volberg Study (Volberg, 2002)		
	Dose			Potency	Duration		Prevalence		n
	Cas-inos	Casino Emp.	All Emp.	Venues	Years Legal		Path. Gamb.	Prob. Gamb.	
Clark	209	151,834	529,065	6	70	4.43	4.8	3.6	525
Douglas	7	7,398	16,055	6	70	2.10	15.4	7.7	13
Washoe	48	27,213	159,171	6	70	2.00	2.0	3.0	101
Elko	11	4,619	19,945	6	70	0.69	14.3	7.1	14
Nye	6	621	12,161	6	70	-1.74	0.0	0.0	8
Humboldt	3	536	7,964	6	70	-2.13	0.0	0.0	5
Carson City	3	750	20,446	6	70	-2.18	0.0	0.0	19
Churchill	2	175	8,495	6	70	-3.18	0.0	0.0	9

Note: Emp. = Employees; Path. = Pathological; Prob. = Problem; RIGE score = Z(casinos) + Z(casino employees) + Z(casino employees / all employees); "Casinos" and "casino employee" measures were both log transformed to normalize the distributions; Duration and potency are constant, so do not appear in the equation; Problem and pathological gambling scores obtained from Volberg (2002).

Not surprisingly, Clark County, home to Las Vegas, had the highest gambling exposure score. It did not, however, have the highest prevalence of gambling problems. Both Douglas and Elko counties had higher rates of gambling problems than Clark County. Overall, in the four counties that scored above the mean on gambling exposure, some participants in Volberg's sample had gambling problems, and in the four counties that scored below the mean on gambling exposure, Volberg's study found no problem or pathological gamblers. Correlations between exposure and pathological gambling and exposure and problem gambling were both moderately high ($r = .54$, $p < .001$ and $r = .70$, $p < .001$, respectively).

Shaffer et al.'s (2004) study lends limited support to the hypothesis that increased exposure to gambling can lead to increased gambling problems. However, as the authors are quick to point out, there are several limitations to this application of the Regional Exposure Model. One of the greatest limitations, at least to their statewide analysis, is that the data from the US Economic Survey does not include information about Native American Tribal gambling establishments and employees. As a result, the RIGE scores for certain states (e.g., Washington) might grossly underestimate the actual level of exposure in the state. Specific to the Nevada county level analysis, the data on gambling problems from Volberg's report include small sample sizes for many of the counties. The two highest county prevalence rates are based on sample sizes of 13 and 14 and might not be representative of the counties as a whole – in both cases, two of the participants surveyed met criteria for pathological gambling and one met criteria for problem gambling. More generally and like other social indicators approaches, a strength and weakness of this effort to measure exposure is that the flexibility of the model lends itself to arbitrary specification of its terms. Weighting variables differently or applying alternate functions to the Index can alter results and conclusions. Consequently, it is important to conduct more work on the validity of the Exposure Model as it is applied to different fields and social phenomena. Finally, analysis of gambling exposure at the regional level necessarily disregards information about exposure at the individual level. Although this model provides details about trends in exposure and gambling problems at the macro level, it cannot tell us how exposure affects individuals' gambling habits. For example, the overall prevalence of gambling problems might be elevated in a highly exposed state such as Nevada, but it is possible (and has been found — see Volberg, 2002) that individuals who only recently have moved to Nevada account for this high prevalence.

Despite its limitations, the importance of this study lies in its development of a theoretical model of exposure that can be operationalized, standardized, and applied not only to gambling, but to other objects of addiction and to any multitude of other social phenomena. Such an exposure gradient can be used to conduct epidemiological studies, test theories of exposure and adaptation, and select regions and populations for study according to their exposure level. The strategy used to design the Regional Exposure Model also can be used to design a Personal Exposure Model, applicable at the individual level. Together these models can provide a comprehensive way to measure exposure and test its effects on disorders and problems at both a societal and individual level.

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