



Michael V. O'Brien  
City Manager

CITY OF WORCESTER

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Attachment for Item # 9.17 A

May 7, 2013

TO THE WORCESTER CITY COUNCIL

COUNCILORS:

Per your request, attached please find an informational communication relative to Electronic Gaming Machines (EGMs) and slot machine gaming as received by Michael P. Hirsh, MD, Acting Commissioner of Public Health.

Respectfully submitted,

Michael V. O'Brien  
City Manager



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**CITY OF WORCESTER, MASSACHUSETTS**  
Division of Public Health

Michael P. Hirsh, MD, FACS, FAAP  
Acting Commissioner

Derek S. Brindisi  
Director

**DATE:** May 2, 2013  
**TO:** Michael V. O'Brien, City Manager  
**FROM:** Michael P. Hirsh, MD, Acting Commissioner of Public Health  
**RE:** Human Response to Electronic Gaming

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After an extensive literature review of Electronic Gaming Machines (EGMs), I am providing you with a report relative to the human brain and behavioral response to participating in slot machine gaming.

### **History**

It is common knowledge, in the gaming industry, that casino facilities generate an environment that is comfortable and enticing. Johnson and Mayer describe casino interiors that “embod[y] a multitude of environmental stimuli, such as architectural design, colors, furnishings, textures, lighting, ceiling height, aromas, and signage.”<sup>1</sup> Similarly to the general atmosphere, the slot machines are also built to attract patrons and extend play. Gambling experts from one hundred years ago predicted the impact of auditory stimuli on the public, “no doubt the addition of music to the slot machines is intended to create a passion for throwing away nickels and dimes.”<sup>2</sup> For many years, and now with advanced technology, slot machines have provided a rapid, continuous and repetitive means of betting; they also lack alternative responses or a cue for quitting, which has been shown to prolong gambling in spite of progressive losses.<sup>3</sup> Modern technology and computers allow for more stimulation and faster play on EGMs, which increases the potential for addiction.

### **High Risk EGMs**

EGMs generate up to 80% of casino and betting outlet revenue<sup>4</sup> and have “earned a reputation for being a high-risk game more closely associated with gambling problems than many other types of gambling.”<sup>5</sup> Based on their own study of gaming in Rhode Island, Breen and Zimmerman found that problem gambling developed after just one year of EGM use, while traditional types of gambling led to problem gambling after more than three and one half years.<sup>5</sup> When considering forms of gambling, poker is a slow game which requires knowledge and skill, roulette is slow due to time for people to place bets are made and for the wheel to spin. Fisher and Griffiths explain, “Slot machines are fast, aurally and visually stimulating and rewarding, require a low initial stake, provide frequent wins, require no pre-knowledge to commence play, and may be played alone.”<sup>6</sup> Many experts report that EGMs enable gamers to achieve 300 – 1200 plays per hour. Each play exhibits a physiological response, or doses, in the human brain. Shao et al. studied the human body’s neurological response while using slot machines. They used functional magnetic resonance imaging (MRI) to study when and where the brain is stimulated during play. The tests demonstrated that pleasure centers were stimulated “while watching the game reels spin” but showed lower response signals “following winning game outcomes.”<sup>7</sup>



Essentially, the gamer is more excited by the anticipation of a win, than by the win itself. That is to say, the body is most stimulated by the near-miss during play on slot machines. Habib and Dixon found that, “near-miss outcomes uniquely activated brain regions associated with wins for the pathological gamblers.”<sup>8</sup> Scientific experimentation on rats further evidences the effect of near-misses on dopamine receptors in the brain. Winstanley et al. concluded from such experimentation that, “dopamine modulates reward expectancy following the experience of almost winning during slot machine play, via activity at D2 receptors, and this may result in an enhancement of the near-miss effect and facilitate further gambling.”<sup>9</sup> Chase and Clark used functional MRI to study the human brain during EGM use and found “near-miss outcomes may enhance dopamine transmission in disordered gambling.”<sup>10</sup> Based on these studies, the perception of “almost-winning” and the anticipation of an outcome, while playing slot machines, stimulate the pleasure centers of the human brain which can lead to addiction.

## Conclusion

Research cited in this report evidences that EGMs are designed to stimulate the gamer in such a way to promote and prolong play. The addictiveness of EGMs is because of their ability to rapidly deliver “doses” of play; up to 1200 plays per hour. Studies show EGMs can lead to addiction after one year, while other types of gambling take an average of three and one half years to develop addiction. Incorporation of the “near-miss” into the EGMs essentially “tricks” the player to feel satisfaction as long as they continue to play, regardless of wins or losses. All of these points evidence the addictiveness of EGMs, including slot machines.

Respectfully submitted,



Michael P. Hirsh, MD  
Acting Commissioner

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<sup>1</sup> Johnson, L. Mayer. KJ and Champaner. E.(2004). “Casino Atmospherics from a Customer’s Perspective: A Re-Examination.” *UNLV Gaming Research & Review Journal* 8.2: 1-10.

<sup>2</sup> Quinn, J. P. (1969). Gambling and gambling devices. In Patterson Smith reprint series in criminology, law enforcement, and social problems: Vol. 48. Montclair, NJ: Patterson Smith Publishing Corporation. (Originally published 1912).

<sup>3</sup> Breen, R. B. & Zimmerman, M. (2002) Rapid onset of pathological gambling in machine gamblers. *Journal of Gambling Studies*, **18**, 31–43.

<sup>4</sup> Ghezzi PM, Lyons CA, Dixon MR. Gambling in socioeconomic perspective. In Bickel WK, Vuchinich RE, (eds) *Reframing Health Behavior Change with Behavioral Economics* Lawrence Erlbaum: New Jersey; 2000. 313–338.338.

<sup>5</sup> Breen, R. B. & Zimmerman, M. (2002) Rapid onset of pathological gambling in machine gamblers. *Journal of Gambling Studies*, **18**, 31–43.

<sup>6</sup> Fisher, S. & Griffiths, M. (1995) Current trends in slot machine gambling: research and policy issues. *Journal of Gambling Studies*, **11**, 239–247.

<sup>7</sup> Shao R, Read J, Behrens TE, Rogers RD. Shifts in reinforcement signaling while playing slot-machines as a function of prior experience and impulsivity. *Transl Psychiatry*. 2013 Jan 15;3:e213.

<sup>8</sup> Habib R, Dixon MR. Neurobehavioral evidence for the ‘Near-Miss’ effect in pathological gamblers. *J Exp Anal Behav*. 2010;93:313–328.

<sup>9</sup> Winstanley CA, Cocker PJ, Rogers RD. Dopamine modulates reward expectancy during performance of a slot machine task in rats: evidence for a ‘near-miss’ effect. *Neuropsychopharmacology*. 2011;36:913–925.

<sup>10</sup> Chase HW, Clark L. Gambling severity predicts midbrain response to near-miss outcomes. *J Neurosci*. 2010;30:6180–6187.