

A CRITICAL EXAMINATION OF THE LINK BETWEEN GAMING MACHINES AND GAMBLING- RELATED HARM

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ABSTRACT

It remains irrefutable that electronic gaming machines are associated with gambling-related harms. Although research on electronic gaming machines has predominantly focussed on their structural characteristics and to a lesser extent, situational variables contributing to the emergence of gambling-related harms, the precise causal mechanisms of these variables in the aetiology of gambling disorders remains inconclusive. In addition, it remains debatable as to whether or not electronic gaming machines have higher rates of problem gambling as a proportion of participants compared to other forms. Contributing to this state of uncertainty are methodological difficulties related to jurisdictional differences in the geographical location, distribution, density, and configuration of machines (payback percentages and volatility), socio-cultural and demographic features, and availability of and involvement in other gambling modes typically associated with gambling disorders. In addition, questionnaire and survey items have tended to elicit information on preferred or identified problem forms of gambling. Accordingly, gambling-related harms tend to be attributed to such identified forms without taking into consideration intensity (expenditure and frequency) and involvement in gambling modes in aggregate. It is therefore postulated that directing attention to electronic gaming machines over other forms equally capable of causing harm is not an optimal approach to harm minimisation. It may prove to be more fruitful to investigate the complex interaction between cultural/social values, accessibility and availability of all gambling products in aggregate within a community and the factors that promote participation in multiple forms rather than a narrow focus on a limited range of products.

Keywords: Electronic gaming machines, gambling disorder, harm, gambling-related harm, structural characteristics, situational characteristics

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1 INTRODUCTION

That excessive gambling and gambling disorders result in substantial personal, familial and social harms is indisputable. Evidence of elevated rates of depression and suicidality, anxiety, substance use, marital discord and domestic violence, bankruptcy, lost productivity and criminal offences are consistently found in both clinical and general population studies (see Grant & Potenza, 2004; Petry, 2005; Productivity Commission, 1999; 2010). Setting aside some minor ‘soft’ activities (e.g., incidental raffles), technically any form of gambling can be considered to have the potential to cause harm (Gainsbury & Blaszczynski, 2012). Activities that incorporate features permitting high event frequencies/and or capacity for large bet placements are capable of generating substantial accumulated losses; consequently, degree of gambling involvement and intensity contributes to the emergence and severity of experienced harms (Gainsbury & Blaszczynski, 2012). It is therefore reasonable to argue that forms of gambling that (a) are easily accessible, and (b) have a comparatively greater propensity to create significant harm, either singularly or in combination with other forms, represents an appropriate target for responsible gambling public health interventions.

It is relevant to emphasise that gambling-related harms are not necessarily contingent on the presence of a gambling disorder, that is, a non-substance behavioural addiction as defined in DSM-V (APA, 2013). It is often overlooked that such harms may emerge in the context of recreational gamblers gambling more than intended in the absence of impaired control, or engaging in episodic sessions characterised by excessive expenditure and/or binges (Blaszczynski, Ladouceur, & Moodie, 2008; Nower & Blaszczynski, 2003). Consistent with a public health model (Korn & Shaffer, 1999), and as highlighted by Blaszczynski and Nower (2002), gamblers represent a heterogeneous population characterised by a multiplicity of cognitive, neurobiological, conditioning, and cultural factors instrumental in initiating and subsequently maintaining persistence in gambling. Harm minimisation and efforts to decrease incidence rates should be inclusive of all gambling and predominantly directed at the broader societal level (primary prevention), supplemented by targeting variables at the individual level (secondary and tertiary interventions). For a proportion of gamblers, harms develop as a result of excessive involvement and/or subsequent attempts to recoup (chase) losses (Lesieur, 1979) in the absence of any addictive condition; thus recreational gamblers, in the same vein as social drinkers, can experience occasional harms as a consequence of excessive indulgence independent of any gambling disorder or psychiatric comorbidity. On the other hand, some people turn to gambling in response to emotional distress with dissociation negatively reinforcing habitual behaviours, while others develop a psychological dependence (addiction) on gambling. Accordingly, it is argued that the focus of attention ought not to be necessarily on identifying the ‘addictive’ qualities of any one particular gambling product, but rather on those features,

characteristics and environmental context that contribute and/or promote excessive gambling and that create harm across the full spectrum of the gambling population.

Although some forms of gambling are not strongly associated with gambling disorders, for example, lotteries and scratch cards (Harrigan & McLaren, 2011; Binde, 2011), other forms have been consistently implicated to varying degrees, for example, wagering, sport betting, electronic gaming machines, and casino table games (Binde, 2011; Young & Matthew, 2009). Binde (2011), in an attempt to determine the relative harms associated with specific forms of gambling analysed 18 international prevalence studies. He found interactive Internet, casino, electronic gaming machines, and high stakes unregulated gambling to be the forms most associated with problem gambling. However, widespread jurisdictional differences in the availability of, and accessibility to, varied types of gambling opportunities typify or 'map' the appearance of national and local gambling environments (Meyer, Hayer, & Griffiths, 2007; Parke & Griffiths, 2006). In addition, methodological approaches and instruments used to assess prevalence of gambling disorders (Currie & Casey, 2008; Gambino, 2011; Stinchfield Govoni, & Frisch, 2007), player participation in multiple forms (British Gambling Prevalence Study, 2010), imprecise definitions of harms (Neal, Delfabbro, & O'Neil, 2005), and insufficient data describing directions of causality preclude our ability to disentangle the causal attributes of harms associated with each specific form of gambling. For example, Reith (2001) refers to local variables, product variations, locations, and regulatory controls as factors potentially mediating harms associated with gambling products, concluding that, in the UK at least, not enough is known about the interactivity and impact of these variables.

Further, important methodological difficulties in research studies can also prevent a thorough understanding of the differential levels of harmfulness and addictiveness associated with various forms of gambling. With the exception of a few studies conducted in in-vivo settings with actual gamblers (Schrans & Schellinck, 2002, 2007; Blaszczynski, Gainsbury, & Karlov, 2013; Blaszczynski, Sharpe, & Walker, 2001), most have used analogue samples of students or media recruited participants in laboratory settings exposed to choice/decision making tasks. For ethical reasons, participants in such studies are not exposed to the risk of personal losses but rather loss of credits or token amounts of money provided by the experimenter. Motivational and affective/emotional variables in such cases can be argued to differ significantly from those experienced by distraught gamblers in debt motivated to chase losses. Accordingly, caution needs to be applied in generalising self-report or behavioural findings to the general population of gamblers (Gainsbury & Blaszczynski, 2011).

Given that most studies employ cross-sectional designs assessing in-session behaviours and responses, further care must be taken when extrapolating such findings to apply across multiple sessions and/or their causal relationship to the development of gambling disorders. It may be that

the effects of structural characteristics associated with various forms of gambling on habitual play may depend on factors related to regularity of play and personality (Parke & Griffith, 2006) and/or an interaction of the two in combination with motivation, affective states, external stresses and changing gambling ecologies. Unlike medical disorders that often have a known cause and clinical progression, behavioural lifestyle and psychological conditions are typified by complex series of interactions with intra, extra and situational variables.

The complexity and difficulty in determining causal attributes is perhaps exemplified in part by the experience in Norway following the removal of slot machines in 2007 and re-introduction in 2008 of a new style video lottery terminals configured with low bet and prize sizes, mandatory limits on expenditure and breaks in play, and player exclusion options. In an analysis of available reports, Biggs (2011) noted conflicting descriptions with a finding of reduction in electronic gaming machine play among high intensity players with no substitution shift reported to other forms (e.g., Lund, 2009), as compared to increases found in both online participation and prevalence of problem gambling from 1.9% in 2008 to 2.1% in 2010 (Norsk Tipping, 2010 cited by Biggs, 2011). Concurrently, the proportion of the population reporting no gambling problems increased slightly from 85% to 87%, and the at-risk subpopulation, decreased from 10.9% to 8.6% over the same timeframe. Biggs (2011) postulated that the shift to Internet gambling reflected the growing popularity of online gambling independent of the slot machine environment and further concluded that the finding of a reduction in gambling participation and problems immediately following the EGM ban suggested that electronic machines do represent a significant contributor to gambling-related harm. However, the small increase in prevalence rates following the introduction of low intensity machines does appear to highlight the importance of assessing shifting trends within a gambling environment in any attempt to tease out forms contributing the most to gambling-related harms.

Setting many of these issues aside, electronic gaming machines have attracted particular attention in the literature. It is the consistent association with problem gambling and/or finding of increased participation among electronic gaming machines by problem gamblers (Afifi, Cox, Martens, Sareen, & Enns, 2010; Dorion & Nicki, 2001; Productivity Commission, 2010; Rush, Moxam, Shaw, & Urbanoski, 2002; Smith & Wynne, 2004; Urbanoski & Rush, 2006) and the high levels of expenditure on these forms (Productivity Commission, 1999; 2010; William & Wood, 2004) that has singled out this form as requiring special consideration if effective harm minimization in gambling is to be achieved. As a consequence, pressure at the political level has been applied to restrict access to, or remove, electronic gaming machines, while at the legal level, class actions have been taken (unsuccessfully) against video lottery gaming terminals on the basis of causal

role in the development of pathological gambling disorders (American Gaming Association, 2013).

The purpose of this paper is to consider and contextually evaluate what is known about harms associated with electronic gaming machines and whether these differ from those caused by other forms of gambling, and whether we can conclude that such machines are more harmful in comparison to other forms of gambling.

2 ELECTRONIC GAMING MACHINES (EGMS)

Electronic gaming machines are readily available and accessible within communities and therefore relatively popular, often ranked closely after lotteries and scratch cards (Productivity Commission, 1999). Popularly referred to as the ‘crack cocaine of gambling’ (Dowling, Smith, & Thomas, 2005), a descriptor apparently equally applied initially to keno, and subsequently to scratch-cards, VLTs and the Internet (Snowdon, 2013), electronic gaming machines are argued to represent that form of gambling with the greatest addictive potency and capacity to cause harm and impaired control (Dowling, Smith, & Thomas, 2005; Productivity Commission, 1999; 2010).

Over the last century, gaming machines have evolved from the 1985 mechanical slot machine versions developed by Charles Frey, considered a derivative of Sittman and Pitts’ (1891) earlier card based device, through to the prototypical electro-mechanic models in the 1950’s that were subsequently refined from 1964 until their replacement by the current generation of computerised electronic devices (Slot-machine-resource, 2013; Slotsgains.com, 2013). Although the popularity of lotteries far outweighs that for EGM play (Productivity Commission, 1999; 2010), higher levels of expenditure contributed by a large minority of players typify the latter.

Contemporary electronic gaming devices, more commonly referred to as electronic gaming machines (EGM), incorporate the class of machines described typically as ‘slots’ in the USA, ‘pokies’ or ‘poker machines’ in Australia, ‘VLTs’ (video lottery terminals) in Canada, USA and Europe, and ‘fruit machines’ and ‘fixed odds betting terminals’ (FOBT) in the UK. Although the types of games offered vary from slots with spinning reels, and virtual versions of poker, blackjack, scratch lottery, keno, roulette, and fixed odds betting terminals, (Griffiths, 2008), the outcomes are determined by computerised random number generator chips, a defining characteristic of these machines. In some European jurisdictions, VLTs resemble electronic equivalents of scratch lotteries where a central monitoring system allocates a finite number of ‘winning tickets’ to each terminal, each ticket selected by a random number generator (Legato, 2013).

Given the fact that technical specifications, regulatory requirements and number and type of approved games differ substantially across national and international jurisdictions, caution must be exercised in cross study

comparisons. Electronic gaming machines are generally either restricted to licenced premises (pubs, clubs, taverns) and casinos (Australia, USA, Europe), or located in restaurants, arcades, social clubs, supermarkets, petrol, train stations (e.g., Spain, Norway; see Meyer, Hayer & Griffiths, 2009) and, in the UK, bingo premises, adult gaming centres, betting offices, and alcohol licenced venues, and for fruit machines, family entertainment centres/arcades and non-gambling outlets accessible by children. Significant differences in core technology and features in electronic gaming machines may affect behaviours differentially. Even in machines with similar features, average revenue per machine differs substantially (Rintoul, Livingstone, Mellor, & Damien, 2013).

The differential effect caused by differences in the configuration within and between low and high intensity gaming machine features, for example, bet limits, reinforcement schedules, mandatory breaks in play, player information displays, warning signs, and player exclusion options, have not been fully explored, particularly in combination or as packages, on gamblers and gambling behaviour.

Of importance, most studies have focussed on the effect of these variables on one form of gambling, predominantly electronic gaming machines, without partialing out or controlling for the presence of other forms of gambling and/or their structural characteristics. Many of the above variables are not unique to gaming machines but found in other forms of gambling. For example, with regard to horse or sports betting, variable reinforcement schedules (not all favourite horses or teams win), breaks of varying periods occurring between horse/sports races/events, and information displays and warning signs are posted on notice boards, race guides, or material promoting sporting events. There is minimal understanding of the impact of these variables on non-electronic forms of gambling. This absence of data precludes any conclusive statement on the effect of unpredictable schedules of reinforcement or breaks in gambling on wagering behaviour, or their equivalence to those effects identified in electronic gaming machine play.

In addition, how the effects of variables associated with one form affects intensity of involvement and harms in other forms has not been fully elucidated. For example, losses associated with another form of gambling may result in an individual deciding to engage in slot machine play either in an attempt to recoup losses or motivated by a desire to escape stresses through the process of dissociation. Resulting harms are the consequence of the total accumulated expenditure on both wagering and gaming machines but may be attributed by the player to the latter.

3 SITUATIONAL AND STRUCTURAL CHARACTERISTICS

While numerous studies have described putative intra- and extra-personal risk factors for individual for the development of gambling disorders (see Johansson, Grant, Kim, Odlaug, & Gotestam, 2009; Raylu & Oei, 2002;

Nower & Blaszczynski, 2002), structural and situational factors are crucial determinants of cognitive belief structures, arousal and reinforcement schedules instrumental in the development and maintenance of gambling disorders. Situational factors are considered instrumental in influencing initial decisions to commence gambling, for example, geographical proximity, and distribution across socio-economically disadvantaged regions, accessibility, cultural beliefs and acceptance, and marketing/promotions (Griffiths, Hayer, & Meyer, 2007; Petry, 2005). As Abbott (2006) and Harrigan and McLaren (2011) have noted, differences in accessibility and the distribution of electronic gaming machines are not neatly correlated with the prevalence of gambling disorders. In a detailed review of exposure to electronic gaming machines and problem gambling prevalence rates, Abbott (2006) concluded that the relationship between these two variables appeared to break down at ratios greater than six to ten machines per 1,000 adults. Moreover, in some jurisdictions, national prevalence rates have reduced over time despite increases in the availability of electronic gaming machines, perhaps a reflection of adaptation processes taking effect (LaPlante & Shaffer, 2007). Abbott (2006) suggests location and differences in the configuration of structural features and regulatory provisions may account for counterintuitive observations of low gambling disorders and high machine numbers and vice versa.

Wardle, Keily, Astbury and Reith (2013) and others (Abbott, 2006; Welte, Wieczorek, Barnes, & Tidwell, 2006; White, Mun, Kauffman, Whelan, Regan, & Kelly, 2006) have all pointed to the complexities of contributory social and contextual factors: convenience of access, availability of machines, demographic characteristics, venue type including access to money and provision of alcohol, and hours of operation. Indeed, as Abbott (2006) notes, reductions and placement of caps on the maximum permissible number of electronic gaming machines in a jurisdiction appears to have minimal impact on problem gambling prevalence rates. Given that few studies have attempted to map and/or disentangle the effects of multiple combinations and permutations of socio-cultural, demographic and contextual factors in the development of gambling disorders, it becomes difficult to point to any single or multiple interactive agents that can be considered as primary in generating gambling-related harms. Consideration, it is argued, ought to be given to the totality of individual, social and contextual factors taking into account participation in all forms of gambling in the aggregate (rather than an over-emphasis on single forms) if a comprehensive harm minimisation policy is to be implemented.

Although data is consistent in demonstrating a functional relationship between density and distribution of EGMs and socio-economic disadvantage (Rintoul, Livingstone, Mellor, & Damien, 2013; Wardle, Keily, Astbury, & Reith, 2013), many situational and structural factors are not unique to electronic gaming machines but are generic to all forms: particularly the growing emergence of interactive, online and Internet social media gambling.

For example, online facilities allow rapid and continuous play with large stakes on Internet-based card games, wagering, table casino games including slots/poker-machines, and lotteries to be purchased, and without regard to regional/geographic restrictions. In some regards the availability of online forms of gambling represent easier access, convenience and in many respects, a greater density of distribution across socio-demographic regions as compared to electronic gaming machines located in land-based venues. More research is required to determine the impact of the shifting gambling environment on gambling-related harms.

Nevertheless, the relationship between EGM density, proximity, and socio-economic disadvantage, and the regressive nature of gambling, point to the notion that EGMs are especially harmful. Whether or not this relationship holds true and reflects the peculiar and unique addictive features of gaming machines relative to other forms, or that gaming machines are more popular among disadvantaged income status subpopulations is yet to be fully elucidated. Electronic gaming machines are associated with gambling-related harms but perhaps no more so than other forms. As Abbott (2006) notes, problem gambling associated with electronic gaming machines are typically of shorter duration and more transient compared to horse wagering. It may well be that the apparent difference in the visibility of electronic gaming machines compared to other forms associated with problems is a reflection of the greater number of such players (e.g., White, Mun, Kauffman, Whelan, Regan, & Kelly, 2006), propensity for players to seek treatment as a result of being targeted by responsible gambling promotions, and/or gender differences in help seeking behaviours.

Acknowledging inherent difficulties in assessing prevalence rates and gambling-related harms, and the reliance on gross measure of gambling expenditure as 'proxy indicators' of harm, Rintoul, Livingstone, Mellor, and Damien (2013) concluded that high EGM density in disadvantaged socio-economic regions contributes to a disproportionate share of EGM losses and problem gambling prevalence rates (Doran & Young, 2010; Wardle, Keily, Astbury, & Reith, 2013; Welte, Wiczorek, Barnes, & Tidwell, 2006; Wheeler, Rigby, & Huriwai, 2006; Welte, Wiczorek, Barnes, Tidwell, & Hoffman, 2004; White, Mun, Kauffman, Whelan, Regan, & Kelly, 2006). But, as White, Mun, Kauffman, Whelan, Regan and Kelly (2006) conclude, while gaming machines play was a predictor of gambling problems, there is inconclusive evidence that electronic gaming machines lead to problem gambling.

Characteristics, including but not limited to, reel spin speed (Delfabbro, Falzon, & Ingram, 2005; Ladouceur, & Sévigny, 2006), maximum bet (multi-line multi-credit) (Livingstone, Wooley, Zazryn, & Bakacs, 2008); big wins and prize sizes (Crew-Brown, Blaszczyński, & Russell, 2013; Delfabbro & Winefield, 1999), reinforcement schedules (Dixon, MacLin, & Daugherty, 2006), 'stop' buttons, free spin and bonus games features (Parke & Griffith, 2006), lighting and sounds (Finlay, Marmurek, Kanetkar, & Londerville,

2005), note acceptors/denomination (Blaszczynski, Sharpe, & Walker, 2001; Hansen, & Rossow, 2010), return to player percentage and volatility (Coates, & Blaszczynski, 2013; Harrigan, 2007; Weatherly, & Brandt, 2005), losses disguised as wins (Jensen, Dixon, Harrigan, Sheepy, Fugelsang, & Jarick, 2013), near misses (Dillen & Dixon, 2008; Dixon & Schreiber, 2011; Clark, Astley-Jones, & Gray, 2009; Clark, Crooks, Clarke, Aitken, & Dunn, 2012), absence of responsible gaming signage (Monaghan, & Blaszczynski, 2009, 2010) are considered to represent factors that influence continued play and incurred losses. Again, relationships are not clear-cut. Not all EGMs contain all these features, nor are all these features necessary to make EGMs problematic; for example, VLTs in Canada have limited bet and payout sizes, but are more problematic than slots (which have no limits) suggesting it may be the context or location that is relevant.

Although studies have conclusively demonstrated that structural characteristics and the core technology of machines influence in-session patterns of play, time on device and maximising revenue per customer, no studies have established their effect across sessions on the development of persistence in play or development of gambling disorders. Indeed, with reference to UK category C and D machines, Parke and Griffith (2006) acknowledge the lack of clarity as to whether near misses, sound effects and other features induce frustration, cognitive regret and aggression and subsequently gambling involvement and the etiology of gambling disorders.

To add to its complexity, some electronic gaming machines appear to be more attractive than others (Livingstone, Woolley, Zazryn, & Bakacs, 2008). In their analysis of electronic gaming machines in the South Australian market and qualitative data from regular and problem gamblers, these authors found four games generating net gaming revenue in excess of statewide averages. Despite similar return to player percentages and random reinforcement schedules with frequency over bet size favoured, similar preferences between regular and problem gamblers for low credit bets and maximum line bets, and no "...significant difference between gambler segments in terms of attractiveness of gambling machine features" (p.12), some machines achieved high net gaming revenue due to higher average bets while others did so because of higher utilisation rates. As expected, game features that induce players to lose more quickly and more than intended are also more likely to cause harm. However, although the primary focus of research has been directed to electronic gaming machines, many players also engage in multiple other forms of gambling capable of generating significant losses rendering it important to assess not only expenditure on electronic gaming machines but losses aggregated across all forms.

Currently, therefore, what can be stated with confidence is that structural features affect in-session play but their contribution to the etiology/development of gambling disorders is presumed rather than confirmed. Despite this, the intrinsic core defining features of rapid and continuous play limited only by fatigue or exhausted funds, immediate

outcome feedback, and random schedule of reinforcement resistant to extinction are argued to represent the most virulent components of electronic gaming machines that contribute to excessive expenditure and impaired control among players (Livingstone, Wooley, Zazryn, Bakacs, & Shami, 2008; Parke & Griffiths, 2007). As noted above, geographical proximity, socio-demographic, and contextual variables are influential factors contributing in varying measure to the emergence of gambling-related harms.

4 CAUSALITY AND HUMAN-MACHINE INTERACTIONS

In 2010, an out-of-court settlement in the matter of *Brochu v. Loto-Quebec*, class action brought on behalf of video lottery terminal gamblers in the Canadian province of Quebec, gave rise to the legal determination that VLTs did not cause pathological gambling. This decision can be interpreted as suggesting, in relation to electronic gaming machines, that such a machine may be a necessary but not sufficient condition for the development of a gambling disorder. Accordingly, in the context of a gambling human-machine interaction, individual factors need to be taken into account when determining causality and facets of psychological and emotional harm. Evidence of high rates of psychiatric comorbidities found among problem gamblers suggests that for a proportion, comorbid conditions precede and/or act as a precursor for gambling disorders. In these cases, psychological and/or emotional harms may be manifest prior to, and exacerbated by, rather than causally related to participation in electronic gaming machine play. For example, a depressed individual may gravitate to excessive game-play motivated by attempts to resolve general financial pressures; in such circumstances the causal attribution of some harm (depression) to EGMs would be unfounded, and overstated in respect to existing financial pressures augmented by gambling. Accordingly, care should be exercised in teasing out the causal relationship between harm and electronic gaming machines.

Having stated this, irrespective of the direction of causality, responsible gambling strategies directed to electronic gaming machines are warranted from a public health harm minimisation perspective (Harrigan & McLaren, 2011). Acknowledging variations in both structural and situational variables and the consequent need to exercise caution when comparing and interpreting the results of cross-cultural studies (Biggs, 2011), research studies are consistent in reporting a strong association between electronic gaming machines, gambling disorders and gambling-related harm: Australia (Livingstone et al, 2008; Productivity Commission, 1999; 2010); Great Britain (Griffiths, 2008); Brazil, Oliveira, & Silva, 2001); New Zealand (Clarke, Pulford, Bellringer, Abbott, & Hodgins (2012); and Europe (Meyer, Hayer, & Griffiths, 2007). As Meyer, Hayer and Griffiths (2008) state “It has been found that as EGMs spread, they tend to displace almost every other type of gambling as well as the problems that are associated with them”(p. xxi).

5 HARM

In critically examining the relationship between harm and electronic gaming machines, it is important to define and delineate the construct of fundamental interest, that is, harm in its various guises. Blaszczynski, Ladouceur and Moodie (2008) argued that all gambling-related harm originates from individuals exceeding either or both their level of 'discretionary disposable income', and/or 'discretionary leisure time'. 'Discretionary disposable income' is defined as residual income remaining after financial obligations, and 'discretionary leisure time' as the amount of free time remaining once all social, employment and family obligations are met. These parameters set the threshold of affordability for gambling; once the disposable income and time thresholds are exceeded, opportunity costs are incurred; that is, money and time intended for other expenses or social/family purposes are redirected to gambling. In this context, harm emanating from these two sources can range along a continuum from intermittent and inconsequential to recurrent and extremely severe; such harms can be construed as potentially affecting the full spectrum of participants from recreational through to problem gamblers. This is consistent with Neal, Delfabbro, and O'Neil's (2005) formulation adopted in Australia as national definition of harm; "*Problem gambling characterised by difficulties in limiting money/and/or time spent on gambling which leads to negative consequences for the gambler, others or for the community period*" (p. i).

Currie and Casey (2008) and the Victorian Competition and Efficiency Commission (2012) point to the simplistic and limited approach adopted by psychometric instruments in quantifying harm. Most use a dichotomous yes/no response to indicate the presence of either a restricted or defined range of harms, with scoring based on the unfounded assumption that all harms are of equivalent value in calculating scores (Currie & Casey, 2008). Although scores on problem gambling screens reliably differentiate probable pathological gamblers from non-problem gamblers (Stinchfield, 2002, 2003), items refer to non-specific or vague harms; for example, causing health problems, anxiety or depression, criticism, and guilt. There are currently no comparative studies that have attempted to differentiate the nature, extent and severity of harms associated specifically with EGMs with those manifested in other single or aggregated gambling activities. Thus, the current state of knowledge does not support the notion that any type of harm is unique to or found to be more prevalent in one gambling product compared to another. In other words, similar harms are found among many forms of gambling and are generic to the effects of excessive time and money expenditure. In this regard, the literature has focussed predominantly on cognitive, psychophysiological, structural and situational variables influential in extending or moderating sessions of play on EGMs without controlling for involvement in non-EGM gambling.

The Victorian Competition and Efficiency Commission (2012) highlighted the challenges involved in estimating the costs of problem gambling. The lack of reliable data, issues of causality, absence of taxonomy and measures to categorise and assess impacts, and disagreements relating to personal and social, and valuation of intangible costs, make it extremely difficult to calculate direct and indirect costs, and to apportion gambling-related harms to specific forms (Victorian Competition and Efficiency Commission, 2012). The Commission adopted a framework that separated economic from personal costs. The former encompassed direct and indirect impacts on resources: provision of treatment services, costs associated with lost productivity, bankruptcy, and divorce, involvement of judicial and regulatory systems, and financial costs incurred by excessive losses; and the latter, emotional distress, relationship conflicts, and psychiatric morbidities. The intangible costs associated with the impact on mental well-being, the Commission concluded, accounted for the substantial proportion of overall social and economic costs of excessive gambling.

Estimates of social and economic costs of gambling typically do not disentangle the types and severity of harms associated with, let alone differentiating those unique to, specific forms of gambling. That most recreational and problem gamblers participate in multiple forms of gambling with one or more preferred forms reported (Davidson & Rodgers, 2010), and the latter identifying one or more as the cause of their problems, precludes such analyses achieving definitive conclusions (Currie & Casey, 2008). As discussed below, the evidence is now growing that there is a positive relationship between intensity of involvement (participation in multiple forms) in gambling and the presence of gambling-related harms (Gainsbury, Russell, Hing, Wood, & Blaszczynski, in press; McCready, Mann, Zhao, & Eves, 2009; Wardle, Moody, Spence, Orford, Volberg, Jotangia, Griffiths, Hussey, & Dobbie, 2011).

5.1 EGMs and harm

Evidence that EGMs are particularly addictive and associated with gambling-related harm are primarily based on two sources of data; proportion of expenditure accounted for by problem gamblers, and type of gambling reported by helpline callers and treatment-seeking individuals.

5.1.1 EGMs, expenditure and gambling disorders

Given harms are related to expenditure, the latter is often used as a proxy measure for the former. On this basis, objective data obtained from government taxation revenue in Australia indicates that EGMs represent the single largest source of gambling tax revenue (50-60%) for all States and Territories (with the exception of Western Australia, where such machines are restricted to one casino) (Productivity Commission, 1999, 2010; ACT

Auditor-General, 2012). Lower rates are found in other jurisdictions, for example 36% in Hungary (Demetrovics, 2007) and the Netherlands (Goudriaan et al., 2007), 40% in Spain (Becona, 2007). In Canada, 29% comes from lotteries, 19% from VLTs and 21% from slot machines at racetracks (Marshall, 2009 cited in Harrigan, 2011). In the UK, the gaming machine sector is the most profitable for industry accounting for 70% of revenue (Griffiths, 2009).

In their detailed analysis of Canadian (Ontario) gaming revenue, Williams and Wood (2004) calculated that approximately 35% of revenue originated from problem gamblers, a figure roughly consistent with the 15-33% reported in earlier studies (Productivity Commission, 1999; Gerstein et al., 1999). Of this expenditure, gaming machines were found to account for 61% compared to 52% for horse racing, 35% casino table games, and 19% for lotteries. Although taking care to ensure the accuracy of data elicited from respondents, Williams and Wood (2004) found that only 37% of sample provided responses that could be considered as meeting their requirement for reliability. This finding is consistent with other studies that have questioned the accuracy of self-reported data, even with the use of prospective monitoring (Blaszczynski, Ladouceur, Goulet, & Savard, 2008). For example, in an analysis of the impact of reducing maximum note denomination to AUD\$20 on gaming machine bill acceptors, 15% to 20% of survey respondents reported a reduction on expenditure and venue visitations (Brodie, 2003). Those in the high-risk problem gambling group reported the greatest shift (30% to 40%) in expenditure. Subsequent analysis revealed no long-term reduction in machine metered transactions leading the author to conclude that individuals do not behave as they report, or that the impact of the reduced note denomination had only marginal economic consequences. That no economic consequences were found despite high-risk gamblers reducing expenditure “calls into question the assumption that problem gambling contributes about 33% (Productivity Commission estimate) of all gambling revenue” (p.4)

Further, Williams and Wood (2004) used the PGSI to detect moderate and problem gamblers but did not examine the link between gambling status and various other specific form of gambling. Thus, although the expenditure on gaming machines represented the highest proportion, it remains unclear whether this single form, or a combination of multiple forms, predominantly causes harms given evidence that problem gamblers engage in multiple forms. Research is required to establish the relative proportion lost on each form of gambling by problem gamblers.

Harrigan and McLaren (2011) reviewed studies on problem gambling rates across Canadian provinces. Consistent with other research (Davidson & Rogers, 2010), electronic gaming machines were reportedly the most prevalent form reported by problem gamblers. Although Harrigan and McLaren (2011) found most studies reviewed reported an almost linear relationship between expenditure and problem gambling status for EGMs, similar trends were observed for other forms of gambling. Interestingly,

Davidson and Rodgers (2010) found that 87% of electronic gaming machine players gambled on at least one other activity other than lotteries; only 5.2% reported exclusive play on gaming machines. For high frequency players across all forms, 31% gambled on four or more activities.

This raises some interesting perspectives. Dowling, Smith and Thomas (2005) reviewed the data relating to the prevalence of gambling disorders among individuals engaged in specific forms of gambling activities. Citing the Productivity Commission (1999) data, these authors noted that 4.67% of EGM players compared to 6.12% for casino gamblers met criteria for gambling problems. The British Gambling Prevalence Survey, 2010 (Wardle, Moody, Spence, Orford, Volberg, Jotangia, Griffiths, Hussey, & Dobbie, 2011) found that problem gambling rates among past year gamblers was highest for club/pub poker (12.8%) followed by online slot machine players (9.1%), and Category B2 fixed odds betting terminal (8.8%) players, respectively. Thus, problem gambling on electronic gaming machines, as a proportion of the number of participants in each form, are comparable to other types of gambling that allow high frequency and placement of large bet sizes. Also noteworthy is the relationship between number of forms of gambling engaged in and gambling status. Wardle, Moody, Spence, Orford, Volberg, Jotangia, Griffiths, Hussey, and Dobbie (2011) in their analysis of the 2010 British Gambling Prevalence survey, and LaPlante, Nelson, LaBrie and Shaffer's (2009) secondary analysis of the 2007 survey data, found that problem gambling rates were highest among those regularly participating in multiple forms, increasing from around 2% for those participating in one to two forms to 28% for those with nine or more. This relationship can be expected if one accepts the premise that harms are related to expenditure and that expenditure is more likely to be associated with intensity of gambling (indexed by expenditure and frequency), either on one form or participation in multiple forms. Excessive amounts may be spent, taking into account frequency of bets, on one or two forms, or smaller amounts spread across many of those forms accepted as being generally linked to problem gambling. Of course, the direction of causality remains uncertain. Excessive expenditure in one or across multi-modal forms may reflect maladaptive motivations, attempts to chase losses, or a combination of both. Further research is required to answer this question.

In Australia, Davidson and Rodgers (2010) found a comparative decline in problem gambling prevalence rates between 2001 and 2009 with a downward trend not only for electronic gaming machine participation but also frequency of gambling across most activities. This could be expected and is consistent with the above if total expenditure is reduced for all forms of gambling given that harms are associated with excessive expenditure. However, these authors concluded that, "*The considerable overlap between gambling activities means that it is not possible to separate the significance of any single activity from other activities without undertaking complex*

statistical analyses, and even these would be of questionable interpretation” (p.28).

5.1.2 EGMs and gambling disorders

Strong evidence of the potential harmfulness of electronic gaming machines emanates from the self-reports of gambling helpline callers and clinical populations. These machines in their various guises are among the most frequently reported form of gambling reported by treatment-seeking problem gamblers in Australia (Productivity Commission, 1999, 2010), Belgium (Druine, 2007), Denmark (Linnet, 2007), Finland (Jaakkola, 2007), Germany (Meyer & Hayer, 2007), Iceland (Olason & Gretarsson, 2007), Netherlands (Goudriaan, de Bruin, & Koeter, 2007), Poland (Dzik, 2007), Slovak Republic (Zivny & Okruhlica, 2007), and Sweden (Jonsson & Ronneberg, 2007). However, it is possible that this represents a highly biased sub-population given that the majority of individuals meeting criteria for a gambling disorder do not seek treatment, and that at any one time, approximately 3% to 30% are in treatment (Cunningham, 2005; Slutske 2006; Suurvali, Hodgins, Toneatto, & Cunningham, 2008; Suurvali, Hodgins, Toneatto, & Cunningham, 2008; Volberg, 1999). It may be that electronic gaming machines are the form that causes the greatest harm, or alternatively, that those who attribute electronic gaming machines of all forms they participate in as the primary problem, or who are exposed to information related to treatment availability, are the ones more likely to seek help and overrepresented among treatment seeking populations. It remains to be established whether or not non-treatment seeking problem gamblers are similar in their profiles and pattern of expenditure and preferences to those presenting at clinics or calling helplines. If not, the validity of extrapolating expenditure patterns from a select sample remains questionable.

6 CONCLUSIONS

As with other forms allowing for the possibility of generating excessive gambling expenditure and accumulation of losses, electronic gaming machines are associated with significant personal, familial and socio-economic harms. Proportional to their respective population participation rates, the prevalence of gambling disorders and harms generated by electronic gaming machines appear to be comparable to those observed in a number of other gambling products.

The conclusion reached earlier by Dowling, Smith and Thomas (2005) remains applicable to date, that is, that the data suggesting that electronic gaming machines represent the most addictive form is inconclusive. Partly accounting for this lack of clarity are the methodological difficulties and cross-jurisdictional differences found in most studies. This includes the failure to determine the relative proportion of expenditure associated with each form

of gambling that individuals engage in, and determining if the harms originate from one specific form, or the totality of losses aggregated across all forms. Available evidence suggests that there appears to be a relationship between gambling status and participation in multiple gambling products. Yet, this is not a simple or necessarily accurate conclusion given complexities in interpreting causal relationships exist as noted by Wardle, Moody, Spence, Orford, Volberg, Jotangia, Griffiths, Hussey, and Dobbie (2011). These authors stated, “*Preliminary analysis conducted for this report [British Gambling Prevalence Survey 2010] shows that using different measures of gambling involvement (i.e., number of activities, frequency of play, volume of engagement) alters the results and shows different patterns of associations between problem gambling activity*” (p.97).

Electronic gaming machines are associated with harms and this is an undeniable claim. Whether or not it is the most virulent form that requires special public health attention over and above other gambling products is debatable. Dowling, Smith and Thomas’ (2005) and Griffiths (2008) conclusions remain valid in that the empirical evidence is unable to support the contention that such machines are necessarily associated with the highest level of gambling disorders. It is argued that rather than directing attention to electronic gaming machines over other forms equally capable of causing harm is not an optimal approach to harm minimisation. It may prove to be more fruitful to investigate the complex interaction between cultural/social values, accessibility and availability of all gambling products in aggregate within a community and the factors that promote participation in multiple forms rather than a narrow focus on a limited range of products.

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