# A Mathematical Model of Population Dynamics about the Internet Gaming Addiction

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WHO [3] acknowledged addiction to internet gaming as a real disorder, named Internet Gaming Disorder (IGD), which is generally defined as "Persistent and recurresnt use of the internet to engage in games, often with other players, leading to clinically significant impairment or distress" [1]. As the number of internet users appears to steadily increase each year, IGD is bound to increase as well [1]. The question how this increase will take place, and what factors have the largest impact on this increase, naturally arises. A prevailing reason why internet gamers transition into addiction is the social aspect of the game. As stated in [2], "Internet and role-playing games possess more addictive potential than offline games because of their inherent social reinforcements". It is suggested that the social nature of online games "reinforces gaming instead of criticizing it." In other words, social interaction between gamers may be an underlying mechanism to the increase of IGD.

We consider a system of ordinary differential equations as a simple mathematical model of the population dynamics about the internet gaming. We assume three stages about the internet gamer's state: moderate ($M$), addictive ($A$), and under treatment ($R$). The moderate state means the stage in which the gamer can control him/herself about playing the internet game. The addictive state means the stage in which the gamer plays the internet game pathologically (i.e., without properly controlling him/herself). We suppose that there are some chances for the addictive gamer to have a medical or/and therapeutic treatment after being identified his/her addictive gaming by him/herself or by some others near him/her. It is assumed that under the treatment the gamer has no effective contact to the other gamers on web, so that such a gamer has no significant contribution to the population dynamics, like an isolated infective individual in the epidemic dynamics. The transition of the gamer's state between the moderate and the addictive stages is significantly affected by the social nature of internet gaming [2]. As the activity of social interaction gets higher, the gamer would be more likely to become addictive. With the inherent social reinforcement of internet game, the addictive gamer would hardly re-control his/herself to recover to the moderate gamer. Our result on the model demonstrates the importance of earlier initiation of a system to check the IGD and lead to some medical/therapeutic treatment. Otherwise the number of addictive gamers would become larger beyond the socially controllable level.

$$\frac{dM}{dt} = \lambda - f(M,A)M + g(M,A)A - \mu_{\mathrm{M}}M + \rho R$$
$$\frac{dA}{dt} = f(M,A)M - g(M,A)A - \sigma A$$
$$\frac{dR}{dt} = \sigma A - \rho R - \mu_{\mathrm{R}}R$$

**References**

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