Testing The Effectiveness Of Anti-Doping Work — An Agent-Based Analysis

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Illicit drug use is still one of biggest issues the competitive sports world has to face. Barely a month passes without a popular doping case or a new doping scandal. In 1999, the World AntiDoping Agency (WADA) was founded to fight doping particularly in competitive sports. From this date on, WADA's annual budget has steadily increased up to a total of US$28.2 Million in 2016 (WADA, 2017). The official Anti-Doping Testing Figures show that the rate of positive Tests lingers at approximately 2% (WADA, 2015). But this seems to be considerably underestimating the true doping prevalence. A recent review revealed the difficulty of predicting the real extent of doping. Depending on the estimation method, the researchers found doping rates that range from 14 to 39% (de Hon, Kuipers, & van Bottenburg, 2015).

Because the real extend of doping behavior in competitive sport and the effectiveness of different anti-doping policies are incommensurable in reality due to social desirability and punishment, researchers develop various game theory models based on rational choice theory (for an overview see Westmattelmann, Goelden, Schewe, & Hokamp, 2014). These models operate with a low degree of complexity as otherwise they would not be analytically solvable. However, we are able to formalize theories on complex social processes like doping behavior patterns in sports by making use of agent-based modeling. Thus, an essential advantage of an agent-based approach compared to game theory models is that the former can model a high degree of complexity. Therefore, the aim of this research project is to evaluate the effectiveness of different antidoping strategies by using agent-based modeling to provide concrete recommendations for antidoping organizations.

Our multi-period agent-based model on doping is based on three interacting 'objectives', namely competitive athletes, an anti-doping laboratory and an anti-doping agency. The agency announces anti-doping rules and imposes fines and bans. The anti-doping laboratory executes doping controls under a system whereby control frequency and efficiency are imperfect so that not every doped and tested athlete is detected as a doper. In each time period athletes compete for income in a rank-order tournament. We assume that usage of doping increases an athlete's chance of success in the rank-order tournaments. In particular, we consider four agent types: (a) rational, (b) suggestible, (c) compliant and (d) erratic. Rational sportspersons may use doping substances with respect to an expected utility-maximizing approach. A suggestible athlete takes the doping behavior present in his social network into account. A compliant agent accepts and follows the rules of the anti-doping agency. An erratic player wants to act rulecompliantly but may commit doping unintentionally.

Performing the agent-based simulation combined with a sensitivity analysis, we test how different anti-doping measures influence athletes' doping behavior. The main results of the sensitivity analysis show that an increased doping test efficiency is the most powerful action followed by an increased frequency of anti-doping tests and higher fines. These findings show that on the one hand that there is a strong need for investments in diagnostics and extension of anti-doping controls. On the other hand, WADA seems to face a huge funding gap to implement powerful anti-doping work. The demand for more funding is particularly relevant when compared to the size of the industry, an annual budget of US$28.2 Million is an infinitesimally small number compared to the tens of billions US$ that are invested in competitive sports every year. Even though our simulation model provides realistic prevalence rates of doping that go in line with the results of de Hon, Kuipers, and van Bottenburg (2015), the model can not nessarily be seen as a simulation of the real and complex extent of doping. Our focus rather lies on analyzing changes in athlete's doping behavior as a result of different anti-doping policies, since this relation is not measurable in the real world. In addition, we specifically consider that the anti-doping organizations are willing to fight doping in all conscience and do not try to hide doping cases. Therefore, the introduction of customers as a fourth objective could be a feasible model extension. Buechel, Emrich and Pohlkamp (2016) show that customers may have an important impact on doping in professional sports and that transparency about doping test is necessary but not sufficient to overcome the doping issue. In the future, our model can be used to test the influence of prize-money distribution, whistleblowing or back-controlling on the doping behavior to generate further policy recommendations for the fight against doping.

References

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