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Doping risk and career turning points in male elite road cycling (2005–2016)

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ABSTRACT

Objectives: Determine whether career paths of elite male professional riders explain the risk of being sanctioned for an Anti-Doping Rules Violation through the International Cycling Union.
Design, methods: A discrete-time logit model explored the link between career path and ADRV risk in a database of 10,551 riders engaged in the first three world divisions (2005–2016), including 271 sanctioned riders.
Results: Despite a longer career (7.8 years), sanctioned riders have a precarious path. The odds of finding a sanctioned rider within those who experienced a career interruption is 5.80 times higher than for a non-caught one. 61% of the caught riders have experienced a team change. The odds of finding a caught rider within those who experienced such a change is 1.35 times higher. 44% of caught riders start before 23 years, vs 34% for non-sanctioned ones. The odds of being sanctioned are 1.69 times higher for doped riders beginning before 23. The odds of finding a sanctioned rider are 1.94 times higher among those starting their careers before 2005 (establishment of Pro Tour), than those who started in 2008 or after. In that year, the Cycling Anti-Doping Foundation and the biologic passport were both launched.
Conclusions: Caught riders could have extended their more precarious careers with doping. The post-2005 generation effect could mean that riders are cleaner or slicker at hiding doping. The higher risk of being caught for riders starting after 23 might indicate that an early professional socialization reduces the risk by teaching them to be cleaner, or better at hiding doping.

1. Introduction

Since the 1960s, doping has been seen as the main threat to an athlete's health and sport integrity. The creation of the World Anti-Doping Agency (WADA) in 1999 and the establishment of WADA code in 2004 are viewed as the real start of anti-doping efforts. In 2005, the WADA launched the Anti-Doping Administration & Management System (ADAMS). Cycling is probably the sport affected the most by doping scandals in its image and its economy, especially since the end of the 1990s.[1] However, this discipline also strengthened its position as the leading sport in anti-doping. In 2008, the Union Cycliste Internationale (UCI) created the Cycling Anti-Doping Foundation (CADF), a fully independent body delegated to manage the overall anti-doping effort from the strategy set up to preliminary result management. Teams, race organizers, riders and the UCI fund the CADF. The CADF launched its own in-and-out competition testing program in 2008, including a biological passport.

However, to operate these anti-doping programs, cycling stakeholders base their actions on the existing knowledge about doping and its determinants as identified by previous reviews or meta-analyses.[2–4] Within this large range of academic works, some scholars assume that athletes are workers and that their sportive career can be a work career. Considering performance production as a job allows one to assume the subjective decision to dope as the objective result of labor and employment constraints rather than a moral transgression[5]. In other words, doping ensues from a freewill alteration[6]. In this perspective, Mazanov[7] highlights that enhancing supplements[8] or doping could be a response to social constraints and in particular, employment and labor. In terms of employment, performance incentives included in contracts of athletes or support personnel[9] could lead to illicit enhancing practices to prevent or deal with injury and fatigue[10], but also to cope with

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workload in or out of competition[11]. From this point of view, athletes could be seen as employees like any others, using drugs in the workplace for dealing with their profession.

Our purpose here is to address this question of the link between doping use and employment as professional cyclists by focusing our attention on riders' careers as a succession of employment situations. But a career is also relative to each rider's personal situation, but also to the context of the competitive system. For our part, we observed careers that occurred since the establishment of the Pro Tour in 2005, important achievement in male road cycling commercialization and "*mondialisation*/globalization" processes initiated in the 1990s.[1] The system is based on the distinction of three team levels: continental (3rd division), continental professional (2nd division), and world team (1st division). UCI makes participation compulsory for teams in the race of their respective level in addition to those they want to do at the other levels. Even if cycling classics and the Grand Tours confined teams mainly to Europe, their race activities could be now developed worldwide.

In the same perspective of the previous works about the link between doping and professional constraints,[12,7] our main hypothesis is that riders sanctioned by UCI for ADRV present some specific characteristics in terms of career in the context of the Pro Tour (2005) establishment. Then, the risk of finding a sanctioned rider could increase according to his characteristics or turning points[13] in career path like interruption or team change.

2. Materials and methods

Data including the entire population of 10,551 riders engaged for at least one year in the first three world divisions from 2005 to 2016 were collected. These data primarily came from the UCI for the years 2005–14 and were complemented during the period of 2015–16, in addition to being consolidated with reliable public information collected on websites dedicated to cycling. In this database, 271 road riders among the 400 riders of all disciplines who had been caught and sanctioned by the UCI for anti-doping rules violations (ADRVs) during the period could be identified. The collection process that provided us with this original and unique database took five years, from 2012 to 2017.

Three types of variables within our dataset were used. The first, timeless, described the riders with an identification number and birthdate. The second type consisted of "event data," such as the number of years in a career, interruption for any reason or team change. Among these events, the following was obviously included in our dependent variable: the record of being caught committing an ADRV for the first time. The third type consisted of duration data, which assumed values based on previous events or for each season included in the time frame of 2005–2016: career duration, age at the start of the career, interruption, team change and team division. All of the quantitative variables were discretized with the exception of career duration. The variable "starting year of the career" was split into a trichotomic variable. We distinguished those who began their careers before 2005 from those who began between 2005–2007 and those after 2008. By building two cut-offs (2005 and 2008), this variable allowed us to study the effect of the implementation of the anti-doping policy in 2008 (especially biologic passport) as well as the new competition system, the Pro Tour, in 2005 (Table 1).

Our aim was to estimate an event history model,[14,15] especially a time-discrete logistic model of the duration[16–18] between the beginning of a career and an ADRV. This estimation necessitated data preparation in two steps. First, some careers began before our observation window (2005–2016) or ended after it, or a large proportion of riders had not been caught for ADRVs. This is why we defined the censoring scheme of our analysis to compute risk duration (see Fig. 1).

Table 1
Doping risk and career description in the three UCI world divisions (2005–2016).

	ADRV		Non ADRV	
	N	%	N	%
Total	271	100%	10,280	100%
Career duration				
Mean	7.8		3.9	
Career interruption				
No	225	83%	8737	85%
Yes	45	17%	1543	15%
Team changes				
No	105	39%	6993	68%
Yes	166	61%	3285	32%
Start year				
Before 2005	120	44%	1331	13%
2005–2007	59	22%	2541	25%
2008 and after	92	34%	6408	62%
Start age				
Less than 23	152	56%	6835	66%
23 and more	119	44%	3445	34%

This censoring scheme is based on Yamagushi.[15] The main clock taken into account for our analysis was the duration of time elapsed since starting a career. Some riders, such as D, E and G in the figure, started their careers during the period of observation. Rider E was caught during the period, and the associated duration was the time interval between the career start and the ADRV. Rider D ended his career without an ADRV, and the duration in which he was at risk of being caught was the interval between the start and the end of the career. Rider G was present in the professional peloton at the end of 2016, and the duration obtained for him was the computed time interval between his start and 2016.

Critical situations were the left-censored observations (A&B) as the situation of the 1451 riders (real left-censored observations) who started before 2005. In this case, we had to complete for each the year of his entrance with biographical information available on the internet. Then, for example, we counted the career duration as starting at 1 for a rider of the 2005 cohort and as beginning at 8 for those who started in 1998. In the case of a few riders (such as B or E in Fig. 1) who made comebacks after their first sanctions, the career sequence following such a comeback was excluded from the dataset.

The second step of data preparation consisted of building a person-year file in which the initial individual-row file was transformed to a new file with a row for each person period, for example, a row for each year a rider was exposed to the risk of being caught. In each row, binary data were built indicating if the rider was caught in an ADRV. This variable was always 0 (not caught) in the first n-1 lines of a rider in the person-year file. In the case of the last line, it was 1 or 0 indicating whether the rider was caught or not, respectively. This binary index was used as a dependent variable for the logit model estimation.

Data statistical analysis was run on R 3.4.2 version software (R Core Team, 2017), and we especially used the GLM function of the stats package to estimate logit models. Based on our person-period file with no missing data, the binary logistic regression was executed normally through the introduction of our variables one by one. Odds ratios were given with a 95% confidence interval (CI), and the significance level was set at 0.05.

3. Results

Two categories of results emerged from our analysis. The first one concerns career duration and stability. The second category is about the moment in a rider's life and in the context of the Pro Tour competitive system (Table 2).

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