Who Are the Doctoral Students Who Drop Out? Factors Associated with the Rate of Doctoral Degree Completion in Universities

Robin Wollast[1], Gentiane Boudrenghien[1], Nicolas Van der Linden[2], Benoît Galand[1], Nathalie Roland[1], Christelle Devos[1], Mikaël De Clercq[1], Olivier Klein[2], Assaad Azzi[2], & Mariane Frenay[1]

[1] Psychological Research Institute, Faculty of Psychology and Education, Université catholique de Louvain, Belgium

[2] Center for Social and Cultural Psychology, Faculty of Psychological Science and Education, Université libre de Bruxelles, Belgium

Correspondence: Robin Wollast, Psychological Research Institute, Faculty of Psychology and Education, Place du Cardinal Mercier 10, Boîte L3.05.01, 1348 Louvain-La-Neuve, Belgium. E-mail: robin.wollast@uclouvain.be and mariane.frenay@uclouvain.be

Abstract

The issue of considerable dropout rate in doctoral programs is well documented across a large number of countries. However, few studies address the factors associated with doctoral completion among Non-U.S. countries, multiple universities and fields of research. Nor do they investigate the interactions between these factors. The present paper aimed to overcome these limitations and analyzed the population of doctoral students in all disciplines of the two largest universities of the French-speaking Community of Belgium (N = 1509). Specifically, we focused on several factors: gender, nationality, marital status, master grade, whether students continued at the same university when transitioning to the doctoral degree, whether they continued in the same field, age at registration, research field and funding (i.e., type of funding and associated job requirements). Findings indicate that four factors (marital status, master grade, research field and funding) are directly associated with dropout rate when all factors are considered jointly in the same model. Furthermore, results indicate that some of these factors, such as the marital status and gender, interact. In addition, we found that an accumulation of risk factors leads to a massive increase in dropout rates. Finally, a time course analysis revealed that the highest dropout rate occurs during the first two years and is related to the absence of funding or scholarship. The results, limits and futures perspectives are discussed.

Keywords: doctoral study, persistence, attrition, higher education, quantitative methods

1. Introduction

PhD students are usually high achievers, who are among the brightest and most successful students. Moreover, they are subjected to a highly selective process (Ali & Kohun, 2006; Golde, 2000). However, compared to all other degrees, the rate of completion in doctoral studies, which is estimated at 50% (e.g., Golde, 2005; Walker, Golde, Jones, Bueschel, & Hutchings, 2008), is the lowest (Ampaw & Jaeger, 2011). Researchers are increasingly concerned about the high number of PhD candidates who fail to graduate as dropping out can have numerous negative consequences on PhD students (Levecque, Anseel, De Beuckelaer, Van der Heyden, & Gisle, 2017; Ali & Kohun, 2007; Bowman & Bowman, 1990) and their advisor (Devos, Boudrenghien, Van der Linden, Azzi, et al., 2016). In this context, one line of research has focused on the factors that influence doctoral completion. This research, although interesting, has several limitations that we aimed to address in the present paper. For example, little attention has been devoted to the interaction between different factors associated with doctoral degree completion.

1.1 Factors Related to Doctoral Completion

In recent years, a number of studies have been conducted to identify the factors leading to doctoral success. Most of these studies solely relied on qualitative approaches and focused specifically on subjective aspects such as mental health and well-being. In this paper, we present a study that examined the objective aspects associated with doctoral success such as socio-demographic variables, academic achievement indicators, and financial factors. Specifically, we focused on gender, nationality, marital status, undergraduate grade, age, scientific discipline, change of university, change of field of research, and funding.

Several authors found that men are (slightly) more likely to complete their doctorate than women, sometimes even when other factors are taken into account such as the scientific discipline (Groenvynck, Vandevelde, & Van Rossem, 2013; Van Ours & Ridder, 2003; Visser, Luwel, & Moed, 2007). Other authors found no effect of gender on doctoral completion (Mastekaasa, 2005; Van der Haert, Arias Ortiz, Emplit, Halloin, & Dehon, 2013; Wright & Cochrane, 2000; Spronken-Smith, Cameron, & Quigg, 2018). In an attempt at reconciling these contradictory results, Ampaw and Jaeger (2011) pointed out that studies showing no significant gender differences have used multivariate analyses or included multiple academic fields. They further suggested that confounding factors were at play. In other words, according to these scholars, the issue is not whether or not women graduate at a lower rate than men but whether or not women receive less support and opportunities (e.g., funding) than men.

Nationality is another factor seemingly related to doctoral success. Specifically, studies conducted in the US and Europe found that foreign students enjoyed higher completion rates their "native" counterparts (Espenshade & Rodriguez, 1997; Groenvynck et al., 2013; Wright & Cochrane, 2000). However, in Belgium, Van der Haert et al. (2013) found no effect of nationality on completion.

Concerning academic achievement, for PhD students with the highest undergraduate GPA, the rate of completion is five times higher than for students with the lowest grade (Visser et al., 2007; Wright & Cochrane, 2000). However, in their meta-synthesis, Bair and Haworth (2004) concluded that academic achievement indicators like GPA are not effective predictors of doctoral completion.

Age is another factor which has been related to doctoral completion. The youngest PhD students at the start of their research career (20-26 years) enjoy higher completion rates than the oldest (27-75 years; Groenvynck et al., 2013; Van der Haert et al., 2013; Wright & Cochrane, 2000; Spronken-Smith, et al., 2018). However, in their meta-synthesis, Bair and Haworth (2004) concluded that age did not satisfactorily distinguish completers from non-completers.

Contrary to demographic factors, the effect of funding on doctoral completion seems robust. All things being equal (including academic achievement), students who are awarded a fellowship have higher completion rates than students who are awarded an assistantship or who are totally self-supporting (Ampaw & Jaeger, 2011; Ehrenberg & Mavros, 1995, 1992). In the Dutch-speaking part of Belgium, Groenvynck et al. (2013) also observed that students awarded a fellowship have higher doctoral completion rates than those awarded an assistantship, but they also found that junior researchers with funding unrelated to fundamental research have the lowest chances of success.

Several studies have shown that doctoral completion varies depending on discipline. Indeed, students in natural sciences, applied sciences and medical sciences are more likely to complete their PhD than those in arts, humanities and social sciences (Espenshade & Rodriguez, 1997; Groenvynck, et al., 2013; Seagram, Gould, & Pyke, 1998; Wright and Cochrane, 2000). However, Van der Haert et al. (2013) observed that the effect of discipline disappears when the type of funding is taken into account.

Although significant effects have been found for all the factors mentioned above, several authors have highlighted that discipline and funding are the most robust predictors of doctoral completion (Groenvynck et al., 2013; Wright and Cochrane, 2000). For example, Spronken-Smith et al. (2018) found that candidates in health sciences had the highest completion rates, whereas candidates in business had the shortest time-to-degree.

1.2 Limitations of Previous Research

The literature on doctoral completion is limited in several ways. First, several studies focused on one institution and/or on a limited number of disciplines. Second, most studies solely focused on samples of American PhD students (e.g., Jairam & Kahl, 2012; De Valero, 2001), which are not necessarily representative of all PhD students across the world. Third, some results are inconsistent (e.g., contradictory results concerning gender), which may be explained by a lack of studies examining interactions effects. Several authors suggested interactions potentially interesting to explore. For example, gender and discipline interact (Ampaw & Jaeger, 2011; Groenvynck et al., 2013; Mastekaasa, 2005; Visser et al., 2007) as do gender and funding (Ampaw & Jaeger, 2011). Still with regard to gender, Ampaw and Jaeger (2011) suggested that, for female students, marital status could have an effect on degree completion. Moreover, confounding effects of funding on the relationship between discipline and doctoral completion may be at play, as some disciplines may be more likely to attract more prestigious funding (Groenvynck et al., 2013). Such effects were highlighted in van der Haert et al.'s (2013) study.

Fourth, there is no study investigating the cumulative effect of risk factors on the rate of doctoral completion. Adopting a cumulative risk perspective allows to test whether the number of risk factors faced by a doctoral student is more important for predicting doctoral completion than the type of risk factor (Kolvin, Miller, Fleeting, & Kolvin,

1988; Sameroff, Seifer, Baldwin, & Baldwin, 1993; Rutter, 1979). In addition, very little is known about the crucial period of doctoral completion by using time course analyses.

Finally, it is important to point out that higher education systems are very specific to their countries. In this regard, there is a tendency to overgeneralize the results in the current literature which can lead to neglecting the context and thus to wrong analogies between countries and systems. In other words, lack of cross-country research may lead researchers to overlook such contextual differences, leading to an overgeneralization of the results.

1.3 The Present Study

In the present study, we used data from doctoral students enrolled in the two largest French-speaking universities in Belgium. In 2015-2016, these two public universities enrolled more than 50,000 students, including more than 3,200 PhD students spread across 25 different fields of research. Thus, in contrast to much of the literature, all disciplines in both universities were taken into account.

We first examined completion rates in a large sample of doctoral students from both universities. Based on our literature review, we then investigated the effect of potential predictors of doctoral completion by means of univariate and multivariate analyses. Finally, we explored the cumulative effect of risk factors on the rate of doctoral degree completion and time-to-degree.

1.4 Objectives

The first objective of the present study was to analyze the direct and interactive effects of different factors on doctoral success. We propose that several factors will predict the rate of doctoral completion. Specifically, we expect that (1) men will have higher completion rates than women, (2) Belgian PhD students will have lower completion rates than other students (3), younger PhD students (20-26 years) will have higher completion rates than older PhD students (27-75 years), (4) PhD students with higher GPA grades will have higher completion rates than students with lower grades, (5) students in health sciences and in sciences and technology will have higher completion rates than students in humanities and social sciences, (6) PhD students without funding will have lower completion rates than funded students..

In addition, we examine the role of other factors such as marital status, whether the student transferred from another university (Note 1), whether the student changed field of research. However, we do not have any strong hypothesis regarding these three specific factors.

Moreover, we expect to find interactions between gender and other variables suggested above such as discipline, funding and marital status. Also, we postulate that there will be interactions between the discipline and funding. However, exploratory interactions analyses will be conducted between all variables.

Furthermore, we expect higher dropout rates among PhD students who accumulate a greater number of risk factors. Finally, we focused on the time course of doctoral dropout in order to identify the crucial moment of attrition and examine if peak periods of dropouts interact with other key factors such as the source of funding and the type of scholarship. In this context, we postulate that drop-out rates should be higher during the beginning of the thesis and higher among students who do not have funding.

In sum, this study addresses a gap in the current literature by analyzing the associations between the factors of doctoral success and dropout, thus contributing to the debate in this field of research.

2. Method

2.1 Participants

The analyses presented in this paper were conducted on data from cohorts of PhD students spanning 8 years. Indeed, "although funding for doctoral training is generally limited to four years full-time or six years part-time, eight years is considered an adequate period to assess success or failure" (Groenvynck et al., 2013, p. 201). Participants were PhD students who started their doctoral process during the academic year 2005-2006 or 2006-2007.

Objective characteristics of the doctoral students and of their working context were collected from the administrative databases of both universities. These databases contain data collected at the registration of the PhD students, but also information related to changes during the doctoral process (e.g., change of marital status, change of funding). The data were anonymized by the administrative services.

2.2 Dependent Variable

Whether a student had completed his/her PhD or not was recorded for each year of their doctoral studies. We summarize all these information for each student and compute a variable that assigned doctoral students to one of

three categories: (0) probably dropped out, (1) success, and (2) probably still active. Given that dropout is not recorded, students who had not succeeded during a specific academic year and who had not registered the following year were considered as "probably dropped out". Doctoral students who had not succeeded but who were still registered during the last year of the database timeframe were labelled as "probably still active".

2.3 Independent Variables

Based on our literature review, the following characteristics were analyzed as potential determinants of the dependent variable: gender, nationality, marital status, master grade, same university for the undergraduate degree and for the doctoral degree, same field for the undergraduate degree and for the doctoral degree, age at registration, research fields and funding.

Gender. This variable is coded 0 if male and 1 if female.

Nationality. PhD students are grouped in one of three categories: (1) Belgian nationals, (2) nationals from another EU country and (3) non-EU nationals.

Marital status. This variable is coded 0 if married and 1 if unmarried. This information is missing for 8.7% of the PhD students in the sample.

Master grade. The master grade is the grade obtained upon graduating from the masters' program. Information on grades was missing for 35.5% of the PhD students in the sample, partly due to the use of pass/fail grading in some disciplines. The other 64.5% of the participants were assigned to one of four categories: (1) satisfactory (*satis bene*), (2) distinction (*cum laude*), (3) high distinction (*magna cum laude*), (4) the highest distinction (*summa cum laude*).

Changing university. This variable was coded 0 when PhD students were enrolled at the same university as the one which awarded them their Master degree, and 1 otherwise. This information was missing for 2.3% of the PhD students in the sample.

Change in field between the undergraduate and doctoral degree. This variable was coded 1 when PhD student changed field of research between their Master degree and their PhD, and 0 otherwise. This information was missing for 3.5% of the PhD students in the sample.

Age at registration. Age at registration was defined as the age at the time of the first year of registration as a PhD student. PhD students were assigned to one of three categories: (1) less than 26 years old, (2) between 26 and 40 years old and (3) more than 40 years old.

Research field. All research fields were clustered into four disciplines: (1) humanities, (2) social sciences, (3) health sciences, and (4) science and technology.

Funding. All fundings were grouped into four categories: (1) research grants (i.e., students doing their PhD in the framework of a research project that takes them on as researchers, and not necessarily as PhD students), (2) assistantships (i.e., PhD students who spend on average 50% of their time on research and 50% on teaching), (3) competitive fellowships; (4) no-funding or unknown funding.

Finally, given the large number of missing values for some variables, we relied on pairwise deletions of missing data, which partly accounts for discrepancies in *N* across the results section.

3. Results

3.1 Prevalence Analysis

Table 1 presents the number of PhD students depending on whether they succeeded, dropped out or were still active within a period of eight years.

Table 1. Rates of doctoral completion and dropout within a period of 8 years

	Frequency	Percent
Success	820	54.3%
Probably dropped out	572	37.9%
Probably still active	117	7.8%
Total	1509	100%

All the analyses that follow will focus on the explanation of two of these three categories, namely "probably dropped out" and "success". The PhD students who were probably still active were excluded from the subsequent analyses.

3.2 Simple Comparisons

In this first part of our analyses, the factors associated with success and dropout were studied separately using logistic regression analyses with the coded contrasts. Dummy variables were created for all the categorical variables. Table 2 aggregates success rates as a function of each factor.

Table 2. Success rates as a function of factors

	Frequency	Success rate		Frequency	Success rate
Gender			*Marital status*		
Male	779	60.6%	Married	376	67.3%
Female	613	56.8%	Unmarried	946	53.7%
Nationality			*Age*		
Belgian nationals	841	62.5%	Lower than 26 years old	669	65.6%
Nationals from another EU country	255	56.9%	Between 26 and 40 years old	637	55.1%
Non-EU nationals	296	50.3%	Higher than 40 years old	86	34.9%
Master grade			*Research field*		
Summa cum laude	150	81.3%	Sciences and technologies	555	68.6%
Magna cum laude	456	62.1%	Health sciences	278	59.4%
Cum laude	256	49.2%	Social sciences	362	49.4%
Success without honors	26	34.6%	Humanities	197	48.2%
University			*Field*		
Same university	745	62%	Same field	1064	61%
Different university	616	56%	Different field	281	54.8%
Funding					
Fellowship	351	80.1%	Research grant	308	64%
Assistantship	170	67.6%	No- or unknown funding	563	40.3%

3.3 Gender

The relationship between doctoral success/dropout and gender was statistically non significant ($X^2(1) = 2.07$; p > .05). However, from a purely descriptive standpoint, success rates tended to be higher among men than among women (see Table 2).

3.4 Nationality

The relationship between doctoral success/dropout and nationality was significant ($X^2(2) = 14.02$; $p < .01$) (Cramer's $V = .10$; $p < .01$). More specifically, the regression analyses conducted to identify the specific impact of each category show that the contrasts of the category of reference (i.e., Belgian nationals) with the category "Non-EU nationals" is significant ($\beta = -.50$; $SD = .14$; Wald = 13.41; $df = 1$; $p < .001$; OR = .61), but not the one with the category "Nationals from another EU country" ($\beta = -.24$; $SD = .15$; Wald = 2.66; $df = 1$; n.s.; OR = .79). In other words, Belgian nationals have a higher rate of doctoral degree completion as compared to Non-EU nationals (see Table 2).

3.5 Marital Status

The relationship between doctoral success/dropout and marital status was significant ($X^2(1) = 20.34$; $p < .001$; Cramer's $V = .12$) suggesting that the success rate is higher among people who are married (see Table 2).

3.6 Age at Registration

The relationship between doctoral success/dropout and age at registration is significant (X^2(2) = 36.77; p < .001; Cramer's V = .16). More specifically, the regression analyses conducted to identify the specific impact of each category show that the contrasts of the reference category (i.e., lower than 26 years) (1) with the category "between 26 and 40 years old" (β = -.44; SD = .11; Wald = 15.04; df = 1; p < .001; OR = .64) and (2) with the category "more than 40 years old" (β = -1.27; SD = .24; Wald = 27.92; df = 1; p < .001; OR = .28) are significant. In sum, younger PhD students have a higher rate of doctoral degree completion (see Table 2).

3.7 Master Grade

The relationship between doctoral success/dropout and master grade was significant (X^2(3) = 48.73; p < .001; Cramer's V = .23). More specifically, the regression analyses conducted to identify the specific impact of each category show that the contrasts of the category of reference (i.e., high distinction) (1) with the category "satisfactory" (β = -1.13; SD = .42; Wald = 7.10; df = 1; p < .01; OR = .32), (2) with the category "distinction" (β = -.52; SD = .16; Wald = 10.98; df = 1; p < .01; OR = .59) and (3) with the category "very high distinction" (β = .98; SD = .23; Wald = 18.03; df = 1; p < .001; OR = 2.66) are significant. In other words, a higher master grade is associated with a higher rate of doctoral completion.

3.8 Changing University

The relationship between doctoral success/dropout and change in university is significant (X^2(1) = 5.04; p < .05) (Cramer's V = .06; p < .05) suggesting that pursuing a PhD in the same university leads to a higher success rate (see Table 2).

3.9 Changing Field of Research

Results show a marginal significant relationship between doctoral success/dropout and change of field (X^2(1) = 3.54; p = .06), suggesting that pursuing a PhD in the same field might lead to a higher success rate (see Table 2).

3.10 Research Field

The relationship between doctoral success/dropout and research field is significant (X²(3) = 44.45; p < .001) (Cramer's V = .18; p < .001). More specifically, the regression analyses conducted to identify the specific impact of each category show that the contrasts of the reference category (i.e., science and technology) (1) with the category "humanities" (β = -.86; SD = .17; Wald = 25.46; df = 1; p < .001; OR = .43), (2) with the category "social sciences" (β = -.81; SD = .14; Wald = 33.43; df = 1; p < .001; OR = .45) and (3) with the category "health sciences" (β = -.41; SD = .15; Wald = 7.05; df = 1; p < .01; OR = .67) are significant for each field suggesting that the field of research has an effect on the rate of doctoral degree completion (see Table 2). Specifically, PhD students in sciences and technology are more likely to complete their PhD that students from the other disciplines.

3.11 Funding

The relationship between doctoral success/dropout and funding is significant (X^2(3) = 153.83; p < .001) (Cramer's V = .33; p < .001). More specifically, the regression analyses conducted to identify the specific impact of each category show that the contrasts of reference category (i.e., no-funding or unknown funding) (1) with the category "assistant lectureship" (β = 1.13; SD = .19; Wald = 37.26; df = 1; p < .001; OR = 3.10), (2) with the category "fund from outside of university" (β = 1.78; SD = .16; Wald = 125.89; df = 1; p < .001; OR = 5.94) and (3) with the category "research project" (β = .97; SD = .15; Wald = 43.46; df = 1; p < .001; OR = 2.63) are significant suggesting that PhD students with no-funding or unknown funding have the lowest rate of doctoral degree (see Table 2).

3.12 Multivariate Analyses

Based on these univariate analyses, a multiple logistic regression analysis was conducted in an attempt to obtain a model that identifies factors that, when taken together, may tend to predict successful submission. Only the variables found to be significantly linked to the dependent variable in the univariate analyses were entered in the present multivariate analysis. Table 3 presents the results of this multivariate analysis.

Table 3. Prediction of doctoral success/dropout for all variables

Variables	β	Standard Deviation	Wald	Degree of freedom	P value	OR
Nationality ("Belgian nationals" versus "Non-EU nationals")	-.28	.45	.38	1	.54	.76
Marital status	**-1.47**	**.22**	**44.01**	**1**	**.00**	**.23**
Master grade ("high distinction" versus "satisfaction")	-.32	.52	.39	1	.53	.72
Master grade ("high distinction" versus "distinction")	-.22	.20	1.26	1	.26	.80
Master grade ("high distinction" versus "very high distinction")	**.92**	**.26**	**12.31**	**1**	**.00**	**2.50**
Change of university between undergraduate and doctoral degree	-.16	.23	.51	1	.48	.85
Age at registration ("less than 26 years old" versus "between 26 and 40 years old")	.22	.21	1.13	1	.29	1.25
Age at registration ("less than 26 years old" versus "strictly more than 40 years old")	-.80	.48	2.77	1	.10	.45
Research field ("science and technology" versus "humanities")	**-.73**	**.26**	**8.13**	**1**	**.00**	**.48**
Research field ("sciences and technologies" versus "social sciences")	-.20	.22	.78	1	.38	.82
Research field ("science and technology" versus "health sciences")	-.08	.23	.13	1	.72	.92
Funding ("no-funding or unknown funding" versus "assistant lectureship")	**1.09**	**.26**	**17.07**	**1**	**.00**	**2.96**
Funding ("no-funding or unknown funding" versus "non-university funding")	**1.80**	**.26**	**48.24**	**1**	**.00**	**6.06**
Funding ("no-funding or unknown funding" versus "research project")	**.78**	**.24**	**10.49**	**1**	**.00**	**2.19**
Constant	.70	.31	5.09	1	.02	2.01

Note: N = 838. R^2 = .21 (Cox & Snell), .28 (Nagelkerke). Model $\chi^2(14)$ = 195.791, p < .001. Percentage of correct classification = 70.2%. Significant effects are presented in bold.

These results show that four factors (marital status, master grade, research field and funding) are directly associated with dropout rate when all factors are considered together in the same model (Note 2).

3.13 Analysis of Interaction Effects

Several interaction effects were analyzed, either because they were suggested by our literature review or because they combine factors that we consider to be conceptually related (e.g., gender and marital status). First, a significant interaction was found between gender and marital status (β = -.69; SD = .26; Wald = 6.56; df = 1; p = .01; OR = 0.51). When splitting the interaction as a function of gender, regression analyses revealed that marital status predicts success rates among women (β = -.96; SD = .2; Wald = 22.74; df = 1; p < .001; OR = 0.38) but not among men (p > .05). Married women have a higher rate of doctoral degree completion as compared to unmarried women. From a purely descriptive standpoint, the tendency is the same for men but the difference is statistically non significant. Success rates as a function of marital status are presented separately for males and females in Table 4.

Second, when transforming research field (reference category: sciences and technologies) and funding (reference category: no-funding or unknown funding) into dummy variables, we found significant interactions between research grant and social sciences (β = 1.09; SD = .4; Wald = 7.41; df = 1; p = .006; OR = 2.96), on the one hand, and

between research grant and health sciences (β = -1.1; *SD* = .4; Wald = 7.45; *df* = 1; *p* = .006; OR = .33), on the other hand. When breaking down the interaction, regression analyses revealed that for PhD students working on a research grant, the sector of health sciences has an important influence on the drop-out rate (β = -1.15; *SD* = .31; Wald = 14.16; *df* = 1; *p* < .001; OR = .32). Turning to PhD students with no funding, humanities (β = -.8; *SD* = .22; Wald = 12.64; *df* = 1; *p* < .001; OR = .45) and social sciences (β = -.59; *SD* = .25; Wald = 5.47; *df* = 1; *p* = .019; OR = .55) show the highest drop-out rates. Success rates as a function of research field and funding are presented in Table 5.

Third, regression analyses demonstrated an interaction between field of research and nationality (reference category: Belgians) and more precisely, between health sciences and European PhD students (β = -1.5; SD = .43; Wald = 11.97; *df* = 1; *p* = .001; OR = .22) but not with non-European PhD students (*p* > .05). Splitting the sample as a function of nationality, we found that Belgians tend to have lower completion rates in health sciences (β = -.83; *SD* = .21; Wald = 16.85; *df* = 1; *p* < .001; OR = .422) and social sciences (β = -.67; *SD* = .19; Wald = 13.22; *df* = 1; *p* < .001; OR = .51) than in other fields of research (see Table 6). Europeans have significantly lower completion scores in humanities (β = -1.42; *SD* = .42; Wald = 11.27; *df* = 1; *p* = .001; OR = .24), health sciences (β = -1.62; *SD* = .38; Wald = 17.23; *df* = 1; *p* <.001; OR = .2) and social sciences (β = -1.27; *SD* = .36; Wald = 12.37; *df* = 1; *p* < .001; OR = .28) than in science and technology. Finally, Non-Europeans demonstrated the lowest success rate in social sciences (β = -79; *SD* = .28; Wald = 7.72; *df* = 1; *p* = .005; OR = .45).

Fourth, regression analyses showed an interaction between changing university and the category of European PhD students (β = .89; SD = .37; Wald = 5.78; *df* = 1; p = .016; OR = 2.43). Splitting the sample as a function of nationality, we found that changing university predicts greater dropout, but only among European PhD students (β = .66; SD = .32; Wald = 4.25; *df* = 1; p = .039; OR = 1.93) (see Table 7).

Table 4. Relationship between gender * marital status on success rate

		Married		Unmarried
	N	Success rate	N	Success rate
Male	216	64.4%	532	57.5%
Female	160	71.3%	414	48.8%

Table 5. Relationship between research field * funding on success rate

	Assistant lectureship		Fund from outside of university		Research project		No-funding or unknown funding	
	N	Success rate	N	Success rate	N	Success rate	N	Success rate
Humanities	10	90%	42	69%	28	53.6%	117	35.9%
Social sciences	55	60%	31	83.9%	75	76%	201	31.3%
Health sciences	31	74.2%	79	81%	70	42.9%	98	49%
Sciences and technologies	74	67.6%	199	81.4%	135	70.4%	147	50.3%

Table 6. Relationship between research field * nationality on success rate

	Belgians		Europeans (without Belgians)		Non-Europeans	
	N	Success rate	N	Success rate	N	Success rate
Humanities	128	49%	40	48%	29	45%
Social sciences	189	54%	78	51%	95	39%
Health sciences	158	67%	61	43%	59	56%
Sciences and technologies	366	70%	76	79%	113	58%

Table 7. Relationship between change university * nationality on success rate

	Belgians		Europeans (without Belgians)		Non-Europeans	
	N	Success rate	N	Success rate	N	Success rate
Same university	680	64%	50	44%	15	47%
Other university	146	58%	199	60%	271	52%

3.14 Risk Factors Analysis

Each factor that was significantly associated with the outcome in the multiple regression analysis is considered as a risk factor, namely age at registration, nationality, research field, changing university, marital status and the funding (*N* = 1292) (Note 3). Where necessary, each one of these risk factors was recoded so that category 1 corresponds to the category that has a negative impact on doctoral success. A 0 was attributed to the other category(ies). A variable was then created that compute for each PhD student the number of risk factors he/she accumulated. As presented in Figure 1, and in line with our hypotheses, we observed the highest success rate (92%) when there were zero risk factors and the highest drop-out rate (79%) when six risks had been accumulated. More importantly, the results show a linear progression of drop-out rates as a function of risk factors accumulated with an increase until three years plus a peak at three and six risks.
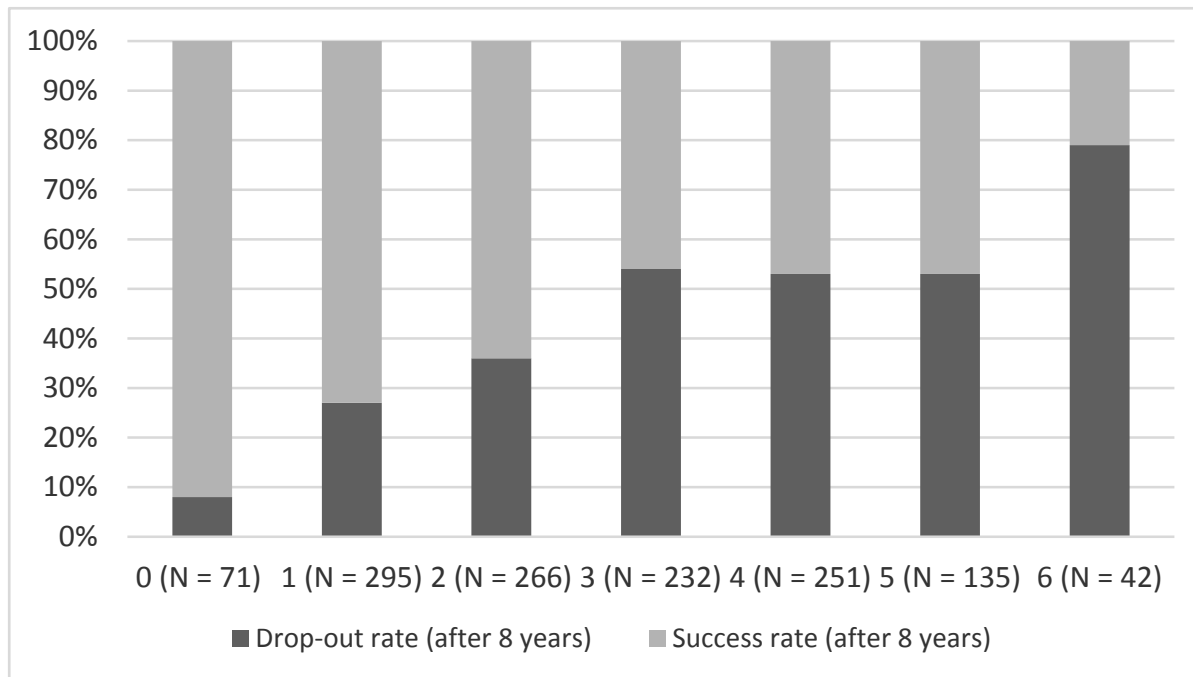

Figure 1. Success and drop-out rates as a function of the number of risk factors accumulated

3.15 Time Course Analysis

We also examined when PhD students drop-out. More specifically, we hypothesized that dropout rates should be higher during the beginning of the thesis and higher among students who do not have funding. As expected, Figure 2 shows that the majority of PhD students leave in the first two years of their doctoral trajectory. Secondly, and in line with our hypotheses, PhD students without funding abandon their doctorate much sooner than funded students (e.g., assistant). Another peak is also observed after five years which is not surprising giving that, in Belgium, the typical grant covers a period of four years. Except the increase at year five, the number of PhD students dropping out decreases across time.
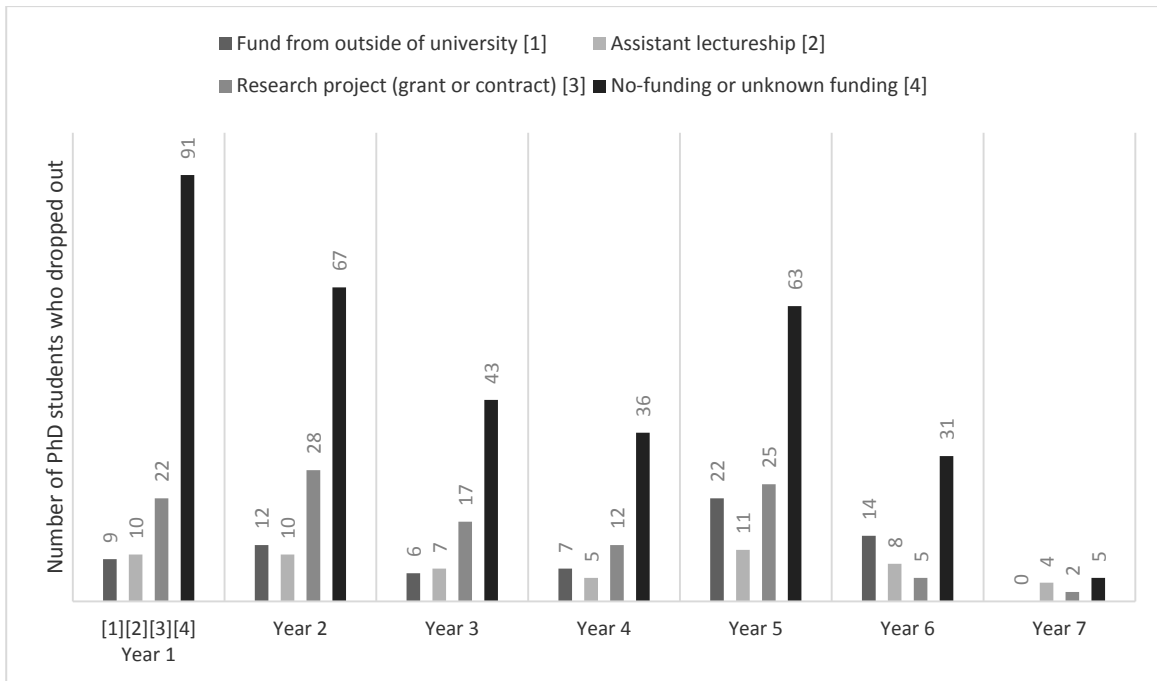
Figure 2. Time course analysis as a function of funding among PhD students who dropped out

4. Discussion

While there is a growing body of research on doctoral-related issues, few studies focus on predictors of doctoral completion in non-U.S. countries, across multiple universities and fields of research. Moreover, there is a gap in the current literature regarding potential interactions between predictors as well as the cumulative effect of risk factors. The present paper aimed to address these limitations and analyzed the population of doctoral students from all disciplines at the two largest universities of the French-speaking Community of Belgium.

Across both universities, approximately 50% of doctoral students obtained a PhD within a period of eight years, a rate quite similar to the ones observed in English-speaking countries (e.g., Golde, 2005). Which factors are associated with this phenomenon? Seven variables are linked to doctoral success/dropout in our sample: nationality, marital status, master grade, age at registration, research field, continuing at the same university, and funding. Among these, four remained significant when all the predictors were introduced together in the same model. These four factors were: marital status, master grade, research field and funding. Before discussing each one in turn, it should be noted that funding and research field also predicted doctoral completion in Groenvynck et al. (2013) and in Wright and Cochrane (2000; see also Van der Haert et al., 2013).

In the present study, marital status is one of the four most important factors of doctoral success and dropout. Our results confirm what Lott, Gardener, and Powers (2009) and Lovitts (2001) have already observed: married students, or more generally students who are in a relationship, are more likely to complete their PhD within 8 years. Second, consistent with the reports of Visser et al. (2007) and Wright and Cochrane (2000), students who graduated with the highest master grades are more likely to complete their PhD within 8 years.

Third, as observed by other authors, students with assistant lectureships are less likely to complete their PhD within 8 years than students who receive research assistantships or doctoral scholarships (Ampaw & Jaeger, 2011; Ehrenberg, Ronald, Panagiotis, & Mavros, 1995; Groenvynck et al., 2013). However, our analyses show that this result depends on the type of funding. Indeed, although students with doctoral scholarships for fundamental or applied research both have higher completion rates than those with assistant lectureships (which is the opposite of what Groenvynck et al. [2013] observed), those with doctoral scholarships from their home university have one of the lowest completion rates. Furthermore, results indicate that funding is associated with the degree of doctoral completion differently based on the field of research.

Finally, a PhD student's research field appears to have an effect on doctoral success/dropout (Espenshade & Rodriguez, 1997; Groenvynck, et al., 2013; Seagram et al., 1998; Van der Haert et al., 2013; Wright & Cochrane, 2000). Consistent with what has been previously observed, the four sectors can be classified as followed (from

lowest to highest completion rate): social sciences, humanities, health sciences, science and technology.

Besides the four most important predictors cited above, three variables predict doctoral success/dropout, but do not remain significant in both university samples when all the factors were introduced together in the model. First, as reported by several authors, the nationality of PhD students is linked to their doctoral success/dropout (Espenshade & Rodriguez, 1997; Groenvynck et al., 2013; Wright & Cochrane, 2000). However, our results contradict the existing literature saying that foreign students outperform their native counterparts. In fact, we found that Belgian students are more likely to complete their PhD within 8 years than foreign students. Additionally, this effect was also heavily influenced by the field of research.

Second, our results confirm that the younger the students are at the start of their doctoral journey, the more likely they are to complete their PhD within 8 years (Groenvynck et al., 2013; Van der Haert et al., 2013; Wright & Cochrane, 2000).

Furthermore, we found that a change in university increases the risk of doctoral failure, which is consistent with what has been observed by Van Ours and Ridder (2003). However, there was an opposite relationship for Europeans PhD students in our sample. Note that it is difficult to draw conclusions from the latter result because we cannot compare dropout rates to that of Europeans who stayed in their own countries.

The two last variables, namely gender and change in field were not stably significant or not significant at all. First, gender does not predict doctoral success/dropout in our sample. Interestingly, and as stated above, married women (but not men) have a higher success rate than unmarried PhD students. In this regard, our results did not confirm the idea that men are more successful than women (Groenvynck et al., 2013; Van Ours & Ridder, 2003; Visser et al., 2007), although no such differences have been found in other studies (e.g., Baker, 1998; Ehrenberg & Mavros, 1995).

One variable that did not have an effect on the drop-out in this study is the change of field between undergraduate and doctoral degree. On the contrary, the conclusions from Van Ours and Ridder (2003) was expanded to all research fields. Indeed, all fields taken together, we observe that students who do not change of field between undergraduate and doctoral degree are more likely to complete their PhD within 8 years but the effect was only marginally significant.

In a second step, we investigated whether these factors of doctoral success and dropout, taken together, may constitute a risk for PhD dropout. To our knowledge, the cumulative effect of risk factors has not yet been studied in the literature. More precisely, and in line with our hypotheses, we observed a linear progression of dropout rates as a function of risk factors accumulated with a peak at three factors suggesting that PhD students who face three or more unfavorable determinants have at least a 50% risk of dropping out.

Furthermore, we examined when the rate of doctoral degree failure is the most important. To do so, a time course analysis revealed that the two first years are crucial as it is when the vast majority of PhD dropouts occurs. Again, this is consistent with our hypothesis. More precisely, the higher dropout rate during the first two years can be explained by the absence of funding or scholarship. Our approach confirms previous findings in the literature (e.g., Ampaw & Jaeger, 2011; Ehrenberg & Mavros, 1995; Van der Haert et al., 2013).

4.1 Limitations

Three limitations to the present study are worth highlighting. First, the effects measured in the regression analysis are statistical effects, and should not be confused with an analysis of causal relationships between dependent and independent variables. This is why this study is only a part of a larger research program that analyzed the effects of a larger number of variables through survey techniques and interviews (Devos et al., 2016; Devos, Boudrenghien, Van der Linden, Frenay, et al., 2016; Devos et al., 2015; Van der Linden et al., 2018).

Second, the present study tries to understand the occurrence of completion within 8 years, but it does not analyze the actual time to completion and time to dropout. However, the "measure of" and the "speed of" the doctoral process appear to be strongly related (Groenvynck et al., 2013). Students who are likely to take a long time to graduate are also more likely to drop out (Van Ours & Ridder, 2003). Moreover, the study of the "speed of" is probably less relevant in countries like Belgium where most of the PhDs are supported by funding that have a defined duration.

Third, we do not have a balanced comparison condition for foreign doctoral students (i.e., we cannot compare them to students in their native country), which can lead to confounds the status of foreign doctoral students being more strongly associated with a change in university.

Fourth, the analyses are limited to sociodemographic variables. It could be interesting to include other variables such as psychosocial factors (motivation, engagement, support, etc.).

4.2 Implications

The issue of considerable dropout rate in doctoral programs is well documented across a large number of countries. The associations found in the present study between enrich the current literature and leads to specific implications for research, policy and practices.

Research. The majority of studies focusing on factors predicting doctoral attrition does not take interactions into account. This study overcomes this limitation and addresses several interactions suggested by the current literature (e.g., gender and marital status, Ampaw & Jaeger, 2011). Interestingly, we found that while some factors have no significant direct effect on doctoral completion (e.g., gender), they strongly moderate the effect of other factors (e.g. marital status). In this regard, we invite scholars to step outside of the typical analysis of main effects made by the current literature and start considering two-way and three-way interactions. Furthermore, we encourage researchers to focus on multiple fields of research, universities and ethnicities in order to enrich the range of population in terms of its socio-demographic characteristics.

Policy. Dropping out can have numerous negative psychological and financial consequences on PhD students and their advisor, as well as for their institutions. However, there is still a disconnection between the reality of the field and politics. Specifically, there is a growing body of research focusing on the predictors associated with doctoral dropout but there is insufficient discussion of these results within the academic environment and politics. In this regard, we invite researchers to spread and convey such findings to students, PhD students, professors, academics and so on. For instance, issues such as the lack of training that researchers are offered when entering academic funding (Halse, 2011; Lee, Dennis & Campbell, 2007) or the degree of fit between supervisory behavior and students' expectation and needs (Pyhältö et al., 2012) should be more widely presented and debated in different kinds of conferences and meetings.

Practices. Within Belgian universities, multiple actions are taking place for advisors and PhD students such as training, mentoring, tutoring, coaching, workshops, guides and brochures. Given the discrepancies in the rate of doctoral dropout among specific population (e.g., ethnicity, age, gender), this study offers the possibility to adapt our knowledge to identify key factors associated with success and dropout among each group specifically thus allowed us to shape our actions to be more effective. It implies that the effectiveness of these actions should be more carefully evaluated.

4.3 Conclusion

To conclude, this study is one of the first that addresses the factors associated with doctoral completion among Non-U.S. countries, multiple universities and fields of research. In fact, this paper focuses on factors associated with doctoral completion from all the disciplines of the two largest universities of the French-speaking Community of Belgium. Moreover, the large number of participants (N = 1509) allowed this research to consider relations between predictors together (e.g., interactions). In addition, we found that accumulation of risk factors leads to a higher dropout rates. Likewise, a time course analyses revealed that the highest dropout rate occurs during the first two years of the PhD process. Finally, we recommend combining qualitative and quantitative approaches in order to find out why some factors such as marital status and funding affect doctoral dropout. More precisely, studying the underlying mechanisms of these effects would bolster the current knowledge in the literature and thus contributing to the debate in this field of research.

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Notes

Note 1. Note that in Belgium, the doctoral stage occurs after two cycles of studies: bachelor (3 years) and master (2 years). In the present paper, we refer to the first two stages as "undergraduate".

Note 2. It has been noted that given the large percentage of missing values for the master grade variable which considerably reduced the number of participants in the multivariate analyses, we conducted the same analysis without this variable. Doing so, results show that one additional factor (age at registration) is associated with dropout rate when all factors are considered together in the same model (N = 1292. R^2= .17 (Cox & Snell), .23 (Nagelkerke). Model $\chi^2(11) = 237.09$, $p < .001$. Percentage of correct classification = 67.8%).

Note 3. It has been noted that given the large percentage of missing values for the master grade variable which considerably reduced the number of participants, we conducted the risk factor analysis without this variable. However, when including the master grade variable as a risk factor, the results show a similar linear progression of drop-out rates as a function of risk factors accumulated. However, the two last bars contain only 6 and 2 participants respectively ($N = 838$).