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Professional paths of alumni from doctorate programs in health and biological sciences

ABSTRACT

OBJECTIVE: To analyze the career path and professional satisfaction of alumni from the doctorate degree programs in health sector.

METHODS: Exploratory study with 827 alumni of doctoral programs in public health, biological and health sciences at the *Fundação Oswaldo Cruz*, RJ, Southeastern Brazil, from 1984 to 2007. The subjects were grouped in three cross-temporal cohorts according to year. The profiles of the alumni were analyzed, their career paths mapped and information on the perceptions of the education they received and the reasons that led them to choose the institute for their doctoral courses gathered, as well as their evaluations of the courses. The data were collected by means of an online questionnaire.

RESULTS: There are differences between cohorts of alumni related to the periods they followed the courses, their distinct educational backgrounds and labor processes between those from the biological and health sciences areas, and to the specificities of the different areas where the institution offers doctoral courses: public health, biological and health sciences.

CONCLUSIONS: The results allow the academic management of the educational processes to expend its knowledge, thus establishing a baseline for tracking the trajectory of alumni, and may contribute to upgrading the follow up process of Brazilian graduate programs.

DESCRIPTORS: Education, Graduate. Health Postgraduate Programs. Institutional Evaluation.

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INTRODUCTION

Over the last decade, as a consequence of technological innovations, the demand for qualified researchers and the spread of the culture of assessment, evaluate the quality of educational processes at all levels of teaching, notably master's and doctorate courses, and their relationship with the professional world has come to form part of the agenda in education institutions.

Studies in countries which are highly socially and economically developed are concerned with the quality of postgraduate courses¹¹ and trends in the career paths chosen by researchers.^{2,5,9} In Brazil, there are no systematic studies following postgraduate educational processes, whether discussing successful experiences to construct strategies for scientific development, or to support and strengthen postgraduate education. However, continuous development in new professional competencies is part of the agenda in postgraduate educational institutions.¹⁴

At the end of 2010, on its 60th anniversary, the *Coordenação de Aperfeiçoamento de Pessoal de Nível Superior* (Capes – Coordination for the Improvement of Higher Education Personnel) launched the 2011-2020 National Postgraduate Plan,^a containing “new directives, strategies and goals for continuity and progress in proposals for postgraduate and research policy in Brazil”. For the first time, this plan became part of the Ministry of Education's National Education Plan. This meant better coordination and complementarity between the different levels of education. Of the six directives aimed at evaluating the national postgraduate system, no reference is made to following up alumni, something which could form part of initiative by educational institutions. This procedure allows possible efforts in forming the career path of ex-students to be analyzed, provides support in adjusting educational processes and may help curriculum reforms which aim to transform the professional world.

At the beginning of 2013, there were 3,613 postgraduate programs accredited by Capes, in nine areas of knowledge. Of these, 1,772 are master's or doctorate programs. According to a study conducted by the Center for the Study of Strategic Management^b on the education of those with doctorate titles awarded in Brazil between 1998 and 2008 and their employability as of 2008, postgraduate education in Brazil increased and matured with a high standard of quality. The diversity of knowledge areas meant it was able to increase its competitiveness among the emerging countries.

The *Fundação Oswaldo Cruz* (Fiocruz – Oswaldo Cruz Foundation) belongs to the Ministry of Health and is a scientific and technological institution dedicated to research, teaching and developing health technology. It has 18 master's and doctorate programs accredited by Capes in ten evaluation areas, with around 1,200 students enrolled. From an academic and political point of view, this institution occupies a prominent position in professional formation and in formulating directives for scientific and technological development in the health sector. Various ex-students occupy positions in public administration, in lecturing and in producing knowledge. However, the institution does not systematically follow up its alumni's career paths.^{3,8,12}

Fiocruz is establishing regular evaluation mechanisms to assess its educational processes and conducted an exploratory study, the object of this article. Thus, the aim of this study was to analyze career paths and professional satisfaction and evaluations of doctorate courses by alumni.

METHODS

The subjects of the study were 827 alumni who did doctorate courses in Public Health, Biological and Health Sciences between 1984 (four years after the first doctorate courses began at the institution) and 2007. Alumni were contacted by e-mail. The Lattes^c curriculum was used to locate the alumni and contact was made by telephone when e-mail was not available through the Fiocruz Electronic Academic Management System (SIGA). Those who did not respond to the e-mail, or when the e-mail was not delivered, were contacted by telephone.

When drawing up the instruments to collect and analyze the data, the following considerations were used: a) differences between cross-temporal cohorts who may have been affected by restructuring curricular structure and contents, or alterations in the Capes evaluation system; b) differences between alumni from bioscience and health areas, i.e., different paths in education and different work processes; c) peculiarities in the different areas in which the institution offers doctorate courses. An electronic questionnaire to be completed online was developed and then underwent a pilot test to verify intelligibility, relevance and reliability, as well as to control possible bias in filling it out. This procedure was chosen as it did not require much of respondents' time.⁴ The questionnaire was available online between August and December 2008.

^a Ministério da Educação. Coordenação de Aperfeiçoamento de Pessoal de Nível Superior - Plano Nacional de Pós-Graduação – PNPG 2011-2020 /Coordenação de Pessoal de Nível Superior. Brasília (DF): CAPES; 2010. Available from: <http://www.capes.gov.br/sobre-a-capes/plano-nacional-de-pos-graduacao/pnpg-2011-2020>.

^b Centro de Gestão e Estudos Estratégicos. Doutores 2010: estudos da demografia da base técnico-científica brasileira. Brasília (DF); 2010.

^c Conselho Nacional de Desenvolvimento Científico e Tecnológico. Plataforma Lattes. Available from: <http://lattes.cnpq.br>

The questionnaire was composed of five blocks: personal data, professional activity, professional satisfaction, evaluation of the course and follow up program.

Personal data. Record of each alumni (address, contact telephone, e-mail address, sex, date of birth, marital status, academic formation, program followed, year entered and year received title). The undergraduate programs were categorized based on Ministry of Education standards, as: Biological and Health sciences, Physical and Earth Sciences, Human and Social Sciences, Applied Social Sciences, Engineering and Technology. Personal data were included after examining SIGA, in operation since 2004, and completed with data from years before 2004. The responses formed a preliminary database which, to facilitate analysis, underwent readjustments which included the sets of respondents and their responses or lack thereof. Cross-temporal cohorts were defined based on distribution of the year the students received their title in the universe of the study, presenting frequencies of students close to each other to maintain the same interval of years. Three cohorts were constructed: those who received their doctorate between 1984 and 1999, between 2000 and 2003 and 2004 to 2007, and by teaching department in which they completed their doctorate. We were able to maintain the same coverage of years for the two latter cohorts, with frequency of alumni of 277 and 316, respectively. To have a similar frequency (234) in the first cohort, it was necessary to consider a greater interval (1984 to 1998). We sought to identify differences in response patterns, bearing in mind possible changes in the course over the years. The analysis considered possible difference and similarities between the cohorts of alumni.

Professional activity. Closed questions on: professional activity before the doctorate (research teaching, technological development, health care, management, consulting, other); nature and type of institution in which principal professional activity is conducted; type of activity developed; post and function; year entered institution; type of contract; relationship between professional activity and course studied; change of position or function after obtaining the doctorate; and mean monthly income.

Professional satisfaction. Perceptions of professional satisfaction after obtaining the doctorate, as well as closed questions on: remuneration, prestige, work relations, social relevance of work, opportunity to learn new things and to exercise creativity, opportunities for professional development, workload and autonomy. The responses were mutually exclusive and measured using a scale that went from “extremely dissatisfied” to “extremely satisfied”. An index, entitled “degree of satisfaction”, was created: “satisfied” and “extremely satisfied” were grouped together as “satisfied”; “extremely dissatisfied” and “dissatisfied” were

grouped together as “dissatisfied”; another group was formed for the “moderately satisfied”. The proportion of satisfaction was estimated using the equation: number of individuals associated with the “satisfied” grade/total number of individuals who marked one of the options.

Evaluation of the course. Closed questions on: motivation to undertake the doctorate course at the Fiocruz; product(s) of the thesis; level of impact of the course on professional life; level of impact of the course on specific aspects (“low” to “high”); satisfaction with specific aspects of the course (“excellent” to “very poor”). Two sections allowed various responses regarding the motives for doing the doctorate at Fiocruz and products generated by the thesis.

The analyses were conducted by grouping responses of alumni from the three cohorts. Considering that the return of the questionnaire was proportionally different between the different cohorts, the sample was weighted regarding the response rate (32.3%) of the most recent, 2004-2007, cohort (102 respondents). This cohort was attributed the value of 1, that of 1984 to 1999 was given a weight of 2.7 (going from 28 to 76 respondents) and that of 2000 to 2003 weighting of 2.1 (going from 43 to 89 respondents). The sample of respondents was weighted to guarantee representativeness of all three groups in the overall analyses, i.e., those which included all participants. The original number of respondents was maintained, without weighting, for descriptions within the cohorts.

Of the 827 alumni, 20.9% responded to the questionnaire, which corresponds to the expected response rate for internet surveys.⁴ As the number of respondents was higher among alumni from 2000 onwards, especially 2004-2007, it is supposed that poor adherence to the study on the part of alumni from the 1984 to 1999 period was due to difficulties locating them, failure to update e-mail addresses and moving to other states or countries.

The project was approved by the Fiocruz Research Ethics Committee, record 450/08. Agreeing to participate required: accessing the link given in the e-mail or message, entering the first screen and reading the informed consent form, confirming and updating data, if necessary, and accessing the other screens of the questionnaire.

RESULTS

The respondent group did not differ significantly from the universe of the study regarding age, sex, nationality, graduation, type of institution and type of contract before the doctorate (Table 1). The youngest responded less, proportionally, and Brazilian were more helpful than foreigners. The percentage of women was slightly higher than men, although this

Table 1. Demographic profile, area of graduation, nature of institution and employment contract. *Fundação Oswaldo Cruz, 1984 to 2007.*

Variable	Cohort						Total		
	1984 to 1999		2000 to 2003		2004 to 2007		U (N)	R (N)	R(N _{weighted})
	U (%)	R (%)	U (%)	R (%)	U (%)	R (%)			
Age (years)									
< 40	67.5	64.3	68.2	53.5	63.3	54.9	547	120	186
40 to 49	26.9	32.1	25.6	37.2	28.2	32.4	223	43	69
50 and +	5.6	3.6	6.1	9.3	8.5	12.7	57	10	13
Sex									
Male	42.3	50.0	30.3	27.9	32.0	33.3	284	60	97
Female	57.7	50.0	69.7	72.1	68.0	66.7	543	113	171
Nationality									
Brazilian	95.7	96.4	93.9	97.7	95.9	96.1	787	167	259
Foreigner	4.3	3.6	6.1	2.3	4.1	3.9	40	6	9
Graduation									
Bio + Health S	84.2	82.1	85.9	88.4	75.3	78.4	673	141	221
Exact + Earth S	3.4	3.6	1.8	4.7	2.2	3.9	20	7	11
Human + Social S	7.3	7.1	7.9	7.0	15.5	10.8	88	16	23
App Social S	2.1	3.6	1.8	–	5.1	4.9	26	6	8
Eng. + Technol.	3.0	3.6	2.5	–	1.9	2.0	20	3	5
Nature of institution									
Public		89.3		93.0		94.1		161	248
Private		10.7		7.0		5.9		12	20
Employment contract									
RJU		85.7		74.4		59.8		117	193
CLT		7.1		4.7		6.9		11	17
None		3.6		14.0		22.5		30	38
Other		3.6		4.7		6.9		10	14
No response		–		2.3		3.9		5	6

U: Universe; R: Respondents; S: Sciences; RJU: Regime Jurídico Único (Unified Legal System); CLT: Consolidação das Leis do Trabalho (Consolidation of Labor Laws)

was slightly lower in the last cohort. There was a predominance of alumni aged < 40, with a slight percentage decrease in more recent years, i.e., stability in participation of those aged 40-49 and increased share of those aged > 50 years old.

Alumni of Biological and Health Sciences predominated in all cohorts, both in the universe and in the respondents. More than 93.0% were Brazilian for both universe and respondents.

Information on type of institution and employment contract before the doctorate was only available for respondents of the study. They were most commonly connected with public institutions and this increased over time. The lack of any type of link with an institution also increased (3.6% in the first cohort and 22.5%

in the last). Irrespective of the cohort, the Unified Legal System^d was that which presented the highest percentage and mean income varied between 5.8 and 16.6 minimum wages. The highest mean monthly income was found in higher age groups.

The highest levels of satisfaction were found in attributes “social relevance of work”, “opportunity to learn new things and exercise creativity” and “opportunities for professional development” and the lowest for “remuneration” (Table 2). This result was repeated in all three cohorts, but with a trend for the proportion to decrease. The cohorts with more alumni in older age groups had the highest levels of satisfaction in the sections mentioned above. Despite this trend, calculating confidence intervals (95%CI) for the proportions of these attributes showed no significant

^dUnified Legal System - Regime Jurídico Único – is the set of rules governing labor relations of public civil servants direct, independent and public foundation management, defining their rights, responsibilities and duties (Law 5, 247, 26 July 1991).

Table 2. Respondents' degree of satisfaction with different aspects. *Fundação Oswaldo Cruz*, 1987 to 2007.

Aspect	Degree of satisfaction ^a		Proportion of satisfaction
	Dissatisfied	Satisfied	
1987 to 2007			
Remuneration	35	130	0.49
Prestige	9	198	0.74
Work relations	15	199	0.74
Social relevance of work	4	241	0.90
Opportunity to learn new things or exercise creativity	10	235	0.88
Opportunity for professional development	17	228	0.85
Workload	24	175	0.65
Autonomy	10	213	0.79
1987 to 1999			
Remuneration	–	18	0.64
Prestige	–	26	0.93
Work relations	–	23	0.82
Social relevance of work	–	28	1.00
Opportunity to learn new things or exercise creativity	1	27	0.96
Opportunity for professional development	1	27	0.96
Workload	2	18	0.64
Autonomy	–	25	0.89
2000 to 2003			
Remuneration	8	19	0.44
Prestige	2	26	0.60
Work relations	5	30	0.70
Social relevance of work	1	37	0.86
Opportunity to learn new things or exercise creativity	2	37	0.86
Opportunity for professional development	4	34	0.79
Workload	6	27	0.63
Autonomy	3	32	0.74
2004 to 2007			
Remuneration	18	41	0.40
Prestige	5	73	0.72
Work relations	4	74	0.73
Social relevance of work	2	88	0.86
Opportunity to learn new things or exercise creativity	3	84	0.82
Opportunity for professional development	6	84	0.82
Workload	6	70	0.69
Autonomy	4	78	0.76

^a Excluding individuals who stated they were “moderately satisfied”. However, this can be deduced by the difference between the sample for each cohort (1987 to 1999: 28; 2000 to 2003: 43; 2004 to 2007: 102) and the sum of values shown. For the total sample, its value is weighted (from 173 to 268).

differences. “Interest in the lines of research offered” was most common in the second and third cohorts, regarding their motivation for doing a doctorate at Fiocruz. In the first cohort, the highest percentage was for “traditions of the institution”. In all cohorts, “Excellence of the course” was the second most commonly reported item (Table 3).

Of those who declared that their thesis generated products, more than one product per respondent was reported (Table 4). It was noted that there was increase in the number of articles published as a product of thesis in the latter two cohorts, as well as a relative decrease in the number of books and chapters of books. There was a high percentage of alumni who evaluated the impact

Table 3. Respondents' motivation for doing a doctorate referring to specific attributes. *Fundação Oswaldo Cruz, 1984 to 2007.*

Motive	1987 to 1999		2000 to 2003		2004 to 2007	
	n	%	n	%	n	%
Tradition of the institution	16	24.6	20	17.1	41	14.2
Prestige of the institution	12	18.5	19	16.2	54	18.7
Excellence of the course	15	23.1	21	17.9	58	20.1
Interest in the lines of research on offer	11	16.9	27	23.1	72	24.9
High chance of receiving a grant	–	–	3	2.6	7	2.4
Convenience due to the structuring of the course	4	6.2	8	6.8	14	4.8
Interest in a specific advisor	7	10.8	19	16.2	43	14.9

Table 4. Products generated from thesis and degree of impact on respondents' from all doctorate courses. *Fundação Oswaldo Cruz, 1987 to 2007.*

Type of product	1987 to 1999		2000 to 2003		2004 to 2007	
Product of thesis						
Yes						
Article	20		30		67	
Chapter of a book	9		11		16	
Book	7		3		5	
Patent	1		–		7	
Other	3		4		12	
No						
	6		5		29	
Type of product						
	n	%	n	%	n	%
High	23	82.1	36	87.8	81	80.2
Medium	4	14.2	3	7.3	14	13.9
Low	1	3.6	2	4.9	6	5.9

of the doctorate on their professional life as “high”. No significant differences were observed between cohorts with regards these percentages.

Responses evaluating attributes related to the course were grouped as: (a) teaching body and pedagogical practice, (b) infrastructure and (c) academic processes (Table 5). This was dichotomized into excellent (70.0% or more classified this aspect as “excellent” or “good”) and very bad (fewer than 30.0% classified this aspect as “excellent” or “good”). The aspects which were mainly classes as “excellent” or “good” were for the set of disciplines, content, teaching body and thesis guidance, which may confirm the high motivation of alumni to qualify the institution for the “excellence of the course”. The evaluation was negative for “guidance in producing scientific articles”. Ratings of “excellent” or “good” were repeated for aspects of “infrastructure” for facilities, classes and library. There was a trend to give lower ratings to ‘academic processes’, the “selective process” was highlighted as “excellent” and

“very good”; the worst rating went to the “strategy for evaluating lecturers and disciplines”.

DISCUSSION

In Brazil, there have been few studies with alumni of postgraduate courses with the type of coverage of this article. One of the few studies on this topic,¹⁰ showed that the majority who sought to do a postgraduate course were interested in research, were satisfied with their job and assessed their education positively. Around 40.0% had studied abroad. Another study of alumni covered nine areas of knowledge (administration, agronomy, biochemistry, clinical medicine, civil engineering, electrical engineering, physics, chemistry and sociology),⁵ with similar results to this study.

Despite its exploratory nature, the results of this study indicate that the objectives were met, in other words, information was obtained on the alumni's professional activity, their perception of job satisfaction and their evaluation of the course. A study conducted by the Management Center for Strategic Studies showed that women with a doctorate ceased to be the minority from 2004 onwards, although in another study,¹⁰ with alumni of a Brazilian science and technology research institution, male alumni predominated; and this raises the hypothesis that gender difference is marked in areas related to physical sciences and in careers in science and technology, although this trend is decreasing.

A study in the same institution with master's alumni⁸ found that more than 80.0% were aged > 40 and the association of this variable with longer time spent in the institution explains, among other factors, the need for professional improvement in the face of technological innovations. A study in the area of Public Health⁶ identified that more than 60.0% of alumni were aged between 39 and 49 when they defended their thesis.

The mean age of alumni in the area of Biological sciences was lower than that in other areas, which may characterize the acceleration of specializing in research in areas where there are initiative aimed at undergraduate science students. As a consequence, there has been a

Table 5. Evaluation of specific aspects of the doctorate course. *Fundação Oswaldo Cruz, 1987 to 2007.*

Aspect	Degree		
	E/G	R	P/VP
Teaching body and pedagogical practice ^a			
Set of disciplines	75.6	17.7	6.7
Content	78.8	15.8	5.5
Lecturing staff	85.3	10.9	3.8
Pedagogical practices adopted	61.6	29.3	9.1
Opportunity to work in small groups	61.4	30.3	8.3
Learning through team work	58.3	31.8	9.9
Use of problem situations	51.9	34.0	14.1
Strategy to evaluate students	58.6	32.5	8.9
Learning research methods and techniques	73.4	17.1	9.5
Thesis guidance	85.0	7.8	7.2
Academic department services	72.9	21.7	5.4
Guidance on producing scientific articles	53.0	32.2	14.8
Encouraging active search of electronic databases	71.1	19.1	9.9
Infrastructure ^a			
Facilities, services and library	90.3	5.2	4.5
Infrastructure for classes	80.6	13.1	6.3
Infrastructure for group meetings	63.5	27.7	8.8
Infrastructure of laboratories	71.3	22.1	6.6
Academic processes ^a			
Guidance on the market and job opportunities	26.2	40.0	33.8
Developing communication skills	58.6	30.3	11.2
Developing leadership potential	64.7	24.0	11.3
Selective process	78.8	17.2	4.0
Strategy of evaluating lecturers and disciplines	39.7	32.7	27.6
Academic coordinator's relationship with students	69.5	19.5	11.0

E: excellent; G: good; R: regular; P: poor; VP: very poor

^a Non-response percentage < 5%, except for: Thesis guidance (11.0%), Guidance on producing scientific articles (9.2%), Facilities, services and library (8.1%), Lecturing staff (8.1%), learning research methods and techniques (7.5%), Encouraging active search of electronic databases (6.4%), Infrastructure for classes (6.4%), Infrastructure of laboratories (6.4%) and Set of disciplines (5.2%).

rejuvenation in this clientele. A similar situation was identified in England, based on analysis of statistics published in 2007 by the Higher Education Statistics Agency Limited, an official agency for collecting, analyzing and disseminating information on higher education in 2005.⁶ At English universities, female students accounted for 52.8% of total first year students on master's and doctorate courses; 55.6% of women and 49.0% of men were aged between 21 and 24 at the start of the course. This situation can be explained due to the shorter course time agreed by the new European Credit System, in which students on biomedicine courses (except medicine) graduate in three or four years; and in research education starting directly after graduation.⁷

The result regarding remuneration was repeated in all three cohorts, with small variations in the value of the index and constant dissatisfaction with salary levels. This may suggest that there have been no substantial changes in alumni's work over the last 20 years. Despite their dissatisfaction with remuneration, alumni were satisfied with the social relevance of their work and with new opportunities to learn and to exercise creativity.

The motivation for entering the institution changed over time. The first cohort identified the tradition of the institution as their principal motive, whereas the latter two highlighted the "excellence of the course" and "interest in the lines of research". This change may be related to the continued division in scientific

work, in which the specificity of the line of research is essential, as well as growing competition for financing between scientific institutions, which throws excellence into relief. These results, in addition to confirming the relevance of tradition in choosing institutions, may suggest a growing specialization with scientific fields, with focus on lines of research and on competition between institutions.¹

The predominance of professional activity associated with research, teaching and technological development among the alumni may be specific to Fiocruz, with its teaching, research and technological development departments. This is not common in other higher education institutions in the areas of health and S&T institutions.¹⁰

The results of this study are in agreement with the findings regarding the predominance of the public nature of alumni employment. In one of them, on doctorates in the S&T area,¹⁰ more than 80.0% of alumni were working in the public sector. Another study, conducted at the end of the 1980s, covering Master's and Doctorates in various areas of knowledge, showed the more than 70.0% worked in public higher education institutions.¹³

One of the limitations of this study was a loss of respondents, equivalent to around 80.0% of eligible subjects, although there were no significant differences between the two groups. However, it is known that online surveys have poor response rates, but are characterized as an approach that is increasingly used due to its low cost and speed and its broad reach. There is no guarantee that the representativeness of such studies is worse than that of face-to-face studies. Thus, the authors⁴

recommend that comparative studies on the advantages and disadvantages are conducted and to see whether, in fact, they differ in representativeness.

Differences were observed between the cohorts of alumni as a possible consequence of changes in the courses, of different career paths in education, and different work processes specific to the areas of biological and health sciences. The possible differences and similarities between the various courses may be related to peculiarities of the work processes in the areas in which the institution offers doctorate courses: public health, biological and health sciences. It may also reflect current scientific development in the country, which increasingly places Brazil on the international stage as an important actor in global scientific production.

The results of this study enabled students to evaluate their education on Fiocruz doctorate courses, signaling weaknesses and strengths, and allowed us to gain wider knowledge of instances of academic management on educational processes, establishing a base line for accompanying the career paths of alumni. Moreover, it contributes to improving monitoring processes for alumni of Brazilian postgraduate programs.

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