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Nøhr, Christian; Sørensen, Marianne

*Publication date:*  
2008

*Document Version*  
Publisher's PDF, also known as Version of record

[Link to publication from Aalborg University](#)

*Citation for published version (APA):*

Nøhr, C., & Sørensen, M. (2008). *The Career Paths for Masters in Health Informatics in Denmark*. Paper presented at IMIA Working Group on Health and Medical Informatics Education Meeting. Building Worldwide Capacity for the Health Informatics Workforce, Buenos Aires, Argentina.  
<http://www.hospitalitaliano.org.ar/imiawged/>

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# The Career Paths for Masters in Health Informatics in Denmark

Christian Nøhr <sup>a,b</sup>, Marianne Sørensen <sup>a</sup>

<sup>a</sup> *Virtual Centre for Health Informatics, Aalborg University, Denmark*

<sup>b</sup> *Department of Development and Planning, Aalborg University, Denmark*

## Abstract

*The master program in health informatics at Aalborg University in Denmark has existed in more than 14 years and more than 285 students have graduated from the program. A questionnaire survey was conducted to get an overview of the student's motives for entering the program, and to get their opinion about being a student in the program, what subjects they felt contributed to their further career. The survey also formed a basis for drawing job profiles. The majority of the graduates changed job once or more after graduation, but they stayed within health informatics. In general they were very satisfied with the program. The survey has contributed substantially to the revision of the curriculum.*

## Keywords

Medical informatics, education, employment, career mobility.

## Introduction

The ageing population in the western countries and the fewer hands left to care for the population together with the intentions to limit errors in healthcare and improve quality have stimulated the development and implementation of information technologies. The workforce necessary to sustain the systems to achieve their vision must possess qualifications on a high academic level. The IT systems that are being developed will be implemented in a highly professional area which is characterized by a diversity and complexity not superseded by any other sector. It is not possible to transfer e.g. office automation systems from other well-known areas to a health care environment. The development and implementation require knowledge and experience from the health professions combined with a comprehensive insight in the IT domain. The combination of knowledge about informatics – the intersection of people, information and technology – and the experience from a health domain constitute the health informatics professional.

There are several university graduate programs in health informatics – a number of them are mentioned in the IMIA database on health and medical informatics education [1]. The database was established to

provide up-to-date information about programs and courses in Health and Medical Informatics worldwide.

Several of the curriculums in health informatics and bioinformatics or biomedical informatics have been described in recent papers [2-5]

It is however more complicated to get information about what job functions the candidates perform after they graduate. Tony Eardley has surveyed the health informatics workforce in the NHS in England [14] where he finds that that the 25.000 full time equivalents are distributed between a number of main categories: Senior managers (7%), Health Record staff (26%), Knowledge Management staff (9%), ICT staff (37%), Information Management staff (18%), and clinical Informatics Staff (3%). Although the survey is not specifically addressing the workforce with graduate degrees, it does give information about the distribution of the most important work functions in health informatics.

There have been few studies where university programs have surveyed their graduate student's job functions. In 2003, Petra Knaub et.al. reported a survey of the graduates from the program at the University of Heidelberg and the University of Applied Sciences Heilbronn [3]. The objectives of their study were to assess the job situation of the graduates and to evaluate the curriculum from their viewpoint. They used a structured questionnaire to survey the 1024 students who finished their studies before March 31 in 2001 of which they obtained a response rate of 45.5%. It showed that about one third of the graduates are working in software/hardware companies and 43% are working within health informatics and 51.4% are working outside of medical informatics, but within informatics. The respondents regarded software engineering, database and information systems to be the most important parts of the education. Most of the graduates are satisfied with their education and their personal career. They concluded that the variety of jobs, the job profiles and the high satisfaction with their education indicate the relevance of a specialized informatics program.

The health informatics master's program at Aalborg University was started in 1994 and the first masters earned their degree in 1998. The curriculum of the

program was developed in time with the European project "Eductra" [6-8] and has been further described in [9-12].

The main goal of the program at Aalborg University is to provide the students with capabilities that enable them to bridge the gap between health professionals and IT professionals. The specific aims of the program are:

- To give the student a basic theoretical, analytic, methodological and practical insight in health care informatics.
- To enable the student critically to appraise and assess the possibilities and limitations for application of information technology in health care.
- To qualify the student to take active part in the planning, development, and implementation of information systems, and to organize the division of labor in relation to daily practice.
- To qualify the student to analyze and handle information in health care based on theories and methods from biomedical engineering, computer science, organization, communication and cognition.

After three years of study in the program the student has earned 90 ECTS (European Credit Transfer System; 1 ECTS = 28 hours of study), and will receive a Master's Degree in Health Informatics.

To be admitted in the program the student must hold a master's degree or a B.Sc. in a health science i.e. nursing, midwifery, physiotherapy, or radiography; and have at least two years of work experience from health care. Students are recruited from Greenland, Iceland and the Scandinavian Countries (Norway, Sweden, and Denmark) the majority from Denmark.

The program consists of 26 ECTS of traditional coursework and 64 ECTS of problem-oriented project work - a student research guided by a faculty member. The project-work is organized as teamwork or as an individual activity, and is documented in a report, which is the basis for the exam (final test).

The subjects in the courses are organized in four tracks: 1. Database theory, network theory and decision support. 2. System and context, demand/system specifications, user interaction. 3. Project management, assessment/evaluation, and organizational change. 4. Methodologies for data acquisition, quantitative/qualitative analysis.

The students are gathered four times a year at weekend workshops for intensive lectures, laboratory exercises and oral discussions. The rest of the time the backbone of communication is a conference system, which runs on a server at the university. Through the network the faculty hands out study plans, gives as-

signments and communicates feedback to the individual student.

In order to evaluate how the students contribute to the health informatics capacity, and to monitor how the program is able to prepare the students for their future job we have investigated the student's job situation after graduation. A first part of the study was done in 2004 when 147 students had graduated from the program. The second part of the study was done using the same questionnaire in spring 2008.

### Objectives

The aim of this investigation was to get an overview of which motives the students had for applying for admission, at what time in their career they found it suitable to pursue further education. Furthermore it was the aim to survey their opinion about being a student in the program, what subjects they felt contributed to their further career and what subjects had been of minor value. Finally the survey could be the basis for drawing job profiles for the graduates of the program. The final goal was to get input for revising the curriculum.

### Method

A questionnaire containing 45 questions grouped in 4 sections: Demographics, studies undertaken, present job, and the master program in relation to your present.

The questionnaire was tested on a sample of 10 students and revised in accordance with the feedback. The 10 students also made an estimate of the time it took to fill in the questionnaire; they spend 10-25 minutes. The questionnaire was web based and a letter was sent to the 285 students who had graduated from the program asking them to go to the web page and fill in the questionnaire. The questionnaires were analyzed anonymously. Descriptive statistics were applied to the standardized answers. There were very few free text answers, which were summarized by the authors.

### Results

Of the 285 letters send out, 10 letters were returned with "address unknown", hence 275 have had the opportunity to answer the questions. 165 returned their answers, which give a response rate of 60%.

75% of the graduates were female and the overall majority (57%) of the students came with Bachelor Degree in Nursing Science, 9% held a Bachelor Degree in Medical Laboratory Technology, and 11% had a Master Degree in Medicine. Only a few percent had a bachelor degree in physiotherapy (5%) or a background as medical secretary (5%). The rest

(13%) had a background from radiography, chiropractic, engineering and law/administration. Most of the students were between 30 and 50 years when they started in the program, only 5 were under 30 years and 6 were more than 50 years.

76% of the students had more than 10 years of work experience when they entered the program. 69% of the students indicated that one of the reasons for entering the program was a desire for personal development. 59% further indicated that they wanted to achieve a new job profile and 38% saw an opportunity to advance their career. 53% also indicated that they wanted to gain insight in the use of IT systems. Only 18% indicated that higher salary was a driving factor for starting in the program.

80% of the graduates are working within health informatics. 6% are working with IT outside the health area, mainly IT- or pharmaceutical industry. 13% do not work with IT at all, the majority is either working in clinical positions (nurse or physician) or in managerial positions within the hospital.

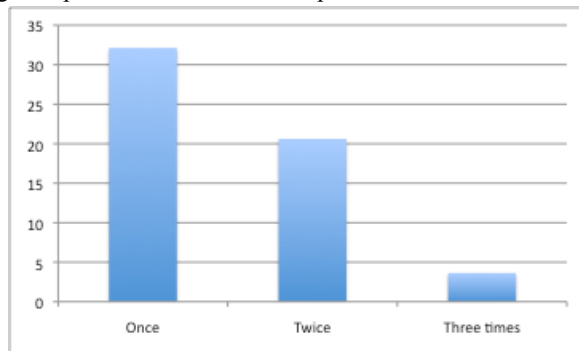


Figure 1 – Job change of graduates in % (n=165)

Half of the students change job after graduation. Figure 1 shows how many students have changed their job once, twice or three times since they graduated.

Employment	Before	After	Migration
Regional institution/administration	9	22	13
Hardware/software industry	4	14	10
University or research institution	5	11	6
Hospital IT-department	16	18	2
Ministry or government admin.	3	5	2
Consultancy	1	3	2
Other	9	10	1
Municipal institution	6	7	1
Pharmaceutical industry	0	1	1
Nursing School	11	11	0
Other public institution	4	4	0
Own company	1	1	0
Not on the labour market	3	1	-2
Hospital administration	19	16	-3
Homecare	9	4	-5
Hospital - clinic/laboratory	62	25	-37
Missing	3	12	9

Table 1. Employment before and after graduation (n=165)

The students were also asked where they were employed before they entered the program and where they were employed three month or more after graduation. The result is shown in table 1.

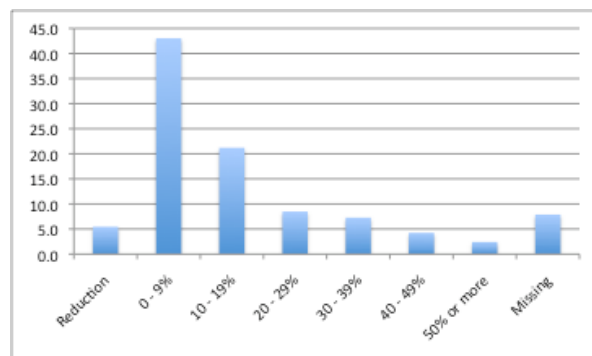
There are many different work tasks fulfilled by the masters, and the majority fulfills more than one task in their job. The masters were asked to check as many as necessary to describe their current work function on which they spend more than 10% of their time, and the result is shown in table 2.

Work function	Number	%
Implementation of it-systems	96	58
Project management	82	50
Education/teaching	74	45
Quality assurance	70	42
Consultancy	62	38
* for hospitals	59	36
Management/organisation	45	27
* for primary care	36	22
General administrative tasks	29	18
Decision support	25	15
Multimedia, internet, intranet	23	14
Research/innovation	20	12
Telemedicine	14	8
Pervasive computing	8	5
Medical image analysis	7	4
* for public health	6	4
Other	5	3
Bioinformatics	2	1
* for private company	1	1

Table 2 Work function after graduation (n=165)

\* = Development/purchase of systems for ...

All the masters were employed or had set up their own business at the time of the survey, and the raise in income after the job they had during their studies

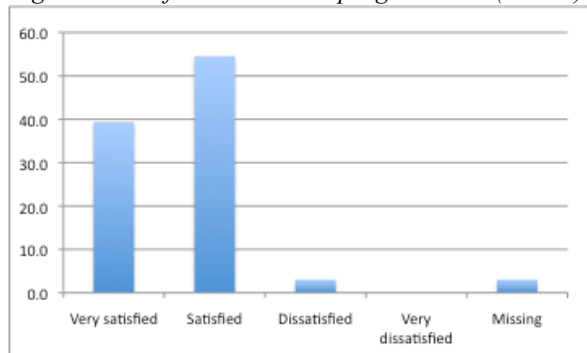


is shown in figure 2.

Figure 2. Raise in income for students after graduation in % (n=165)

The masters have rated their general satisfaction with the program on a four point scale from very satisfied, to very dissatisfied. The result is shown in figure 3.

Figure 3. Satisfaction with the program in % (n=165)



At the question: "If you were in the situation today when you entered the program would you then choose to study health informatics in this program again?" 77% responded yes, 7% says no and 16% were not quite settled in their view.

## Discussion

Much has been written about various university graduate programs in health informatics, but only little has been written about the outcomes for the graduates of the programs. In the US the University of Utah has reported their experience in 1999 [5], and from Europe the University of Heidelberg has repeatedly surveyed their graduated in great detail the latest in 2003 [3]. The present paper characterizes those who graduated from the master program in health informatics at Aalborg University in Denmark.

The response rate of the survey was 60%, which we consider quite satisfactory, compared to similar surveys. The weekend workshops are functioning as networking activities where the students socialize in a friendly atmosphere around professional activities. This creates a very positive attitude to the learning environment and has turned out to be more productive in terms of cooperative projects than expected. This might also have influenced the response rate and the very positive attitude to the program in general.

The students entering the program all have a professional background and several years of professional experience from health care. The age of the students are relatively high compared to the other programs at the Aalborg University, and gives rise to special challenges for the faculty. The students are highly motivated, but they also carry a load of knowledge predominantly founded in health science methodology

that has to be altered into an interdisciplinary science with a multi method approach, which is characterizing the health informatics profession.

The dominant motivation for entering the program was the desire to achieve personal development. It is naturally very difficult to evaluate such an outcome, but comparing the very high satisfaction with the program in general, we assume that the graduates have achieved this goal. The second most common motivation was to achieve a new job profile. 59% of the graduates indicated this, and as 50 % had changed job one, two or three times since they graduated it is very likely that they achieved new job profiles. This is supported by the results regarding job migration. The most remarkable exodus happened from the clinical or para-clinical departments at hospitals where the 38% of the graduates were working before they entered the program were reduced to 15% after graduation. We have not traced the individual pathways, but the regional administration which is in charge of the development, purchase and implementation of the current most important health informatics issue – the electronic health record – has received the majority of new masters together with soft/hardware industry and research institutions.

In the contrary to the programs at Heidelberg University and University of Utah the majority (80%) of the graduates from Aalborg University work with health informatics after graduation and 94% remain within the health care sector. An immediate explanation is that nearly all the students at the point of entering the program already have a job in health care.

At Heidelberg University more than half of the graduates worked outside of medical informatics, which in their opinion underlined the quality of the informatics oriented part of education, because the medical informatics graduate can compete with those from less application oriented disciplines. In our case we find it rather supporting for the quality of our program that the graduates are able to find jobs within health informatics – the area in which they are specialized to function in and that they can contribute with high-level knowledge about very complex problems. In addition we may mention that none of the graduates have been unemployed in any period after graduation. Of course the general level of unemployment in Denmark is historically low these years, and especially among people with higher education – hence the competition to get a job is rather limited. It should also be noted that the health informatics area has experienced an increase in the hospitals IT-investments from 1,3 % of the turnaround in 2001 to 3,12 % in 2005 [13]. This increase in spending has resulted in many new jobs in health care institutions.

Denmark is one of the countries that have a national strategy for the IT in health care for several years, and in the current situation implementation activities are the main issue in all the hospitals. Therefore it is natural that most of the graduates are engaged in implementation work functions. It was however surprising to experience that 45% of the graduates were working as project managers. The curriculum did not sufficiently cover project management as a professional area. This has now been adjusted in a revised curriculum.

The survey of the graduates job profile and work functions have been essential to the continuous revision of the curriculum at Aalborg University.

### Conclusion

The majority of the graduates from the master program in health informatics at Aalborg University participated in the survey of their background and motivation for entering the program, and which activities had contributed to their further career.

The majority of the students enter the program with a Bachelor degree in Nursing or Medical Laboratory Technology. They change their job once or more after graduation, they migrate from employment in clinical settings to job in the administration, universities or research institutions and industry. None are unemployed, and they stay within health informatics working with implementation of IT systems, education, and project management. They were practically all very satisfied or satisfied with their education, and they would choose the same program if they were in that situation today.

The survey has been essential to the revision of the curriculum.

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