Job Profiles of Biomedical Informatics Graduates

Results of a Graduate Survey

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Summary

Background: Biomedical informatics programs exist in many countries. Some analyses of the skills needed and of recommendations for curricular content for such programs have been published. However, not much is known of the job profiles and job careers of their graduates.
Objectives: To analyse the job profiles and job careers of 175 graduates of the biomedical informatics bachelor and master program of the Tyrolean university UMIT.
Methods: Survey of all biomedical informatics students who graduated from UMIT between 2001 and 2013.
Results: Information is available for 170 graduates. Eight percent of graduates are male. Of all bachelor graduates, 86% started a master program. Of all master graduates, 36% started a PhD. The job profiles are quite diverse: at the time of the survey, 35% of all master graduates worked in the health IT industry, 24% at research institutions, 9% in hospitals, 9% as medical doctors, 17% as informaticians outside the health care sector, and 6% in other areas. Overall, 68% of the graduates are working as biomedical informaticians. The results of the survey indicate a good job situation for the graduates.
Conclusions: The job opportunities for biomedical informaticians who graduated with a bachelor or master degree from UMIT seem to be quite good. The majority of graduates are working as biomedical informaticians. A larger number of comparable surveys of graduates from other biomedical informatics programs would help to enhance our knowledge about careers in biomedical informatics.

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1. Background and Objectives

Medical informatics has been traditionally defined as the systematic processing of data, information, and knowledge in medicine and health care [1]. These days, it is also often termed "biomedical informatics" [2] or "biomedical and health informatics" [3]. We will use the term "biomedical informatics" throughout this paper, as this is the name of our program at UMIT. For an in-depth discussion of terminology, we refer to recent discussion and recommendation papers [3, 4].

The first university programs appeared already in the 1960s [5]. The field of biomedical informatics typically offers a diversity of job opportunities [6], including jobs at health care institutions, in the hardware and software industry, in the pharmaceutical industry, at consulting companies, or with research institutions.

As biomedical informatics programs started to emerge, the health IT skills needed for different target groups (such as doctors, nurses, and IT professionals) were discussed. For example, health professionals [7] and nurses [8] were surveyed regarding the health IT skills needed for their own professional group. Health IT professionals [9] and health IT employers [10] were asked about the skills needed for the health IT workforce. Also, biomedical informatics programs have been compared regarding the skills they deliver [11–13], and recommendations for core skills within biomedical informatics graduate programs have been proposed [3]. In 2010, the International Medical Informatics Association (IMIA) published its revised recommendations for education in biomedical and health informatics [4], defining a set of skills for health and biomedical informatics.

However, less is known about the actual job profiles of graduates from biomedical informatics programs. The analysis of job profiles helps, among other things, to understand whether the skills that are taught are indeed needed on the employment market, and to understand the various careers that are possible within biomedical informatics. However, graduate surveys seem to be rare. In 1999, the University of Utah published the results of a survey of their 272 medical informatics graduates, showing good job prospects and a wide variety of job positions [14]. Another systematic graduate survey was published in 2003 by the Heidelberg/Heilbronn

program [15]. At that time, 43% of the 446 responding graduates were working in medical informatics; the others were working outside health care. In 2008, a graduate survey of the health informatics program in Aalborg was published [16], also showing a good job situation and diverse job positions.

In 2001, a dedicated full-time bachelor and master program in medical informatics was started at UMIT, the University for Health Sciences, Medical Informatics and Technology in Tyrol [17]. In 2004, the program was renamed to biomedical informatics. By the end of 2013, 175 bachelor and master students had graduated from this program.

The UMIT three-year bachelor program (180 ECTS, ECTS = European Transfer Credit System [18], 1 ECTS representing a student workload of 25 hours) comprises, with some modifications over time, the following modules: medicine and health care organization (21 ECTS), mathematics and physics (30 ECTS), practical informatics (36 ECTS), technical and theoretical informatics (27 ECTS), medical informatics (39 ECTS), bioinformatics (15 ECTS), and a bachelor thesis (12 ECTS). The program takes into account the IMIA recommendations for education in biomedical and health informatics and the content recommended there [17].

The UMIT two-year master program (120 ECTS) comprises modules on medical informatics (57 ECTS), bioinformatics (15 ECTS), biostatistics and biomathematics (18 ECTS), and a master thesis (30 ECTS). The master program was mostly chosen by graduates from technical bachelor studies. Only a few students with a clinical background started the master program.

We were interested to assess whether the skills obtained by the UMIT graduates allowed them to successfully pursue a career in biomedical informatics. We thus conducted a survey of all graduates to determine the job profiles and job careers. In this paper, we will summarize the major results of this survey and discuss the job situation of biomedical informaticians.

2. Methods

All 175 graduates were contacted either in person or per e-mail in spring 2014. They were asked to provide a short summary of their professional career after graduation. If no valid contact or e-mail address was available, information was sought through social networks and the Internet or from other graduates.

All responses were analysed and the following information was extracted in structured form: further studies started at other universities; employer and type of professional activities for the first job; job changes; current employer and type of professional activities; location of work; intention to obtain a PhD; achieved PhD. Where information was unclear, the graduate was asked to verify and complete.

3. Results

One hundred and seventy-five persons graduated from UMIT between 2001 and the end of 2013. Of these, 83 students (47%) obtained a bachelor degree from UMIT, 60 persons (34%) obtained both a bachelor and master degree from UMIT, and 32 persons (18%) obtained only a master degree from UMIT. 140 (80%) graduates are male, 35 (20%) graduates are female.

For 170 graduates (return rate: 97%), detailed information on the job profile could be collected either through personal contact (142, 83%), Internet and social media (23, 14%), or other graduates (5, 3%). The mean time since last graduation from UMIT was 5 years (minimum: 0 years; maximum: 11 years).

Of the 140 graduates with known job profiles who obtained a bachelor degree from UMIT, 69 graduates (49%) started a master program at UMIT, 42 graduates (30%) started a master program at another university, 26 graduates (19%) started working as biomedical informaticians, and three persons started to work outside biomedical informatics immediately after their graduation. Of the 26 graduates who started working as biomedical informaticians, nine persons later started a master program parallel to their job. Thus, by the

end of 2013, a total of 120 bachelor graduates (86%) started a master program.

Of the 89 graduates with known job profiles who obtained a master degree from UMIT, 46 graduates (52%) started working as biomedical informaticians in industry or health care institutions, 32 graduates (36%) started a PhD at a research institution, nine graduates (10%) continued their work as medical doctors, one graduate started to work outside biomedical informatics and health care, and one graduate (already holding a PhD outside of the field of biomedical informatics) started a postdoc position immediately after their graduation.

Overall, of all 170 UMIT graduates, 51 graduates (30%) started a PhD after their master graduation either from UMIT or from other universities. Of these, 44 graduates did so immediately after the master degree. Seven graduates started a PhD only after some time working in industry. Of the 51 PhD students, 21 (41%) have already obtained their PhD. Of these, seven persons are working as postdocs and 14 persons are working in industry.

►Figure 1 shows the job profiles of the master graduates of UMIT in December 2014. Overall, 60 graduates (68%) are working as biomedical informaticians, 15 graduates (17%) are working as informaticians outside health care, eight graduates (9%) are working as medical doctors again, and the other five graduates are working outside informatics or health care or are just searching for a job immediately after graduation.

If we look only at those 75 master graduates working as informaticians, 60 (80%) are working within health care, and 15 graduates (20%) are working outside health care.

Graduates working within biomedical informatics are employed by research institutions, health IT companies, bioinformatics companies, pharmaceutical companies, biotechnological companies, or hospitals.

Of the bachelor graduates, more than half is still living in Tyrol, one-fifth is living in other parts of Austria, and the remaining nearly one-third is living in other countries. Of all master graduates, two-thirds is still living in Tyrol, one-fifth is living in
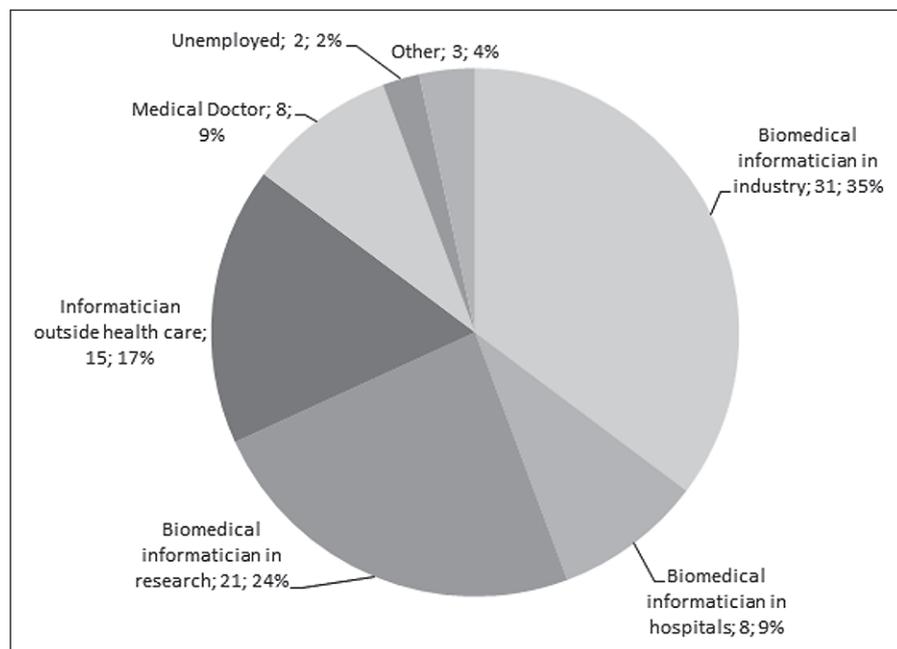
Figure 1 Jobs of UMIT master graduates in January 2014 (n = 88)

other parts of Austria, and the remainder are living in other countries.

The job activities of the graduates working in industry or at health care institutions are quite diverse and include, among other things: system support, user support, software customization, software engineering, software quality management, project management, product management and IT consulting, the first three listed job activities representing typical starting positions for graduates. As this information was not collected on a higher level of detail, a quantitative analysis is not feasible.

Of all 170 UMIT bachelor and master graduates, 54 persons (32%) changed their job at least once: Nine graduates left health care, two graduates entered health care, and the others remained unchanged.

4. Discussion

This survey can only provide some indications of job profiles of UMIT biomedical informatics graduates. The analysis is based on qualitative answers that were inductively analysed and aggregated. A larger standardized survey was not conducted, but instead the personal contact to the graduates was sought. By this, a very large

information completion rate of 97% could be achieved.

Our survey results are influenced by the scope of the UMIT curriculum and the general job situation in Austria. Unfortunately, publications of comparable graduate reviews are rare. Given the limited number of published surveys, the different focus of the available surveys, the specific curriculum at each university, and the different entry requirements of each program, it is difficult to compare or generalize any survey results. Still, where appropriate, we will compare our results to the following three surveys: the 2003 Heidelberg/Heilbronn survey of 446 medical informatics graduates (master level) [15]; the 2008 Aalborg survey of 165 health informatics graduates (master level) [16]; and the 2012 AMC survey where employers of 86 medical informatics graduates (bachelor and master) were surveyed [19].

Our results show a good job situation for our graduates: longer times of unemployment or employment outside the own area of training were rare. Three-fourths of all master graduates are working as informaticians, four-fifths of these within health care and thus within their primary qualification. Most of the others are working as medical doctors again. The fact that

the majority of graduates stayed in Tyrol (a province with 720,000 inhabitants) can be seen as further evidence of good job prospects. Around one-third of all master graduates started a PhD, one-fourth of these at research institutions outside of Austria. All these results reflect the good job situation for biomedical informaticians that is also visible in other countries: "Trained professionals to fill informatics positions are now in high demand" [20]. A good job situation was also confirmed by the 1999 Utah survey, the 2003 Heidelberg/Heilbronn survey, the 2008 Aalborg survey, and the 2012 AMC survey.

It is notable that nearly nine out of ten bachelor graduates started a master study. Individual feedback indicates that they are motivated by better job offers and higher starting salaries with a master degree compared to a bachelor degree. Most of the UMIT master students had a technical bachelor degree; students with clinical background were rare (< 10%). This is due to the fact that the UMIT master program has defined entry requirements for the master program, including the need to show advanced knowledge on mathematical and technical issues.

Another striking result is that only a few – less than one out of ten – graduates are working in health care institutions such as hospitals. While this has been considered an important work field for biomedical informaticians when designing the curriculum, feedback shows that job offers and opportunities for job advancement in this area are considered limited and the salaries too low compared to industry. In the 2003 Heidelberg/Heilbronn survey [15], a higher percentage of 18% of graduates worked in hospitals.

Thirty-five percent of UMIT master graduates are working in the biomedical informatics industry, which is comparable to the 2003 Heidelberg/Heilbronn survey where 41% worked in this area.

In the 2003 Heidelberg/Heilbronn survey [15], only 43% of the 415 graduates worked as biomedical informaticians, and 51% worked as informaticians outside health care. In the 2013 UMIT survey, 68% of the graduates worked as biomedical informaticians, thus a much higher proportion. Whether this is due to an improve-

ment of job opportunities within biomedical informatics in recent years, or due to differences in curricula, cannot be decided based on the available data. In the 2008 Aalborg survey, 80% of the graduates worked within health informatics. This high percentage may be explained by the fact that most Aalborg students (80%) had a clinical or nursing background and several years of professional experience before entering the health informatics master program.

5. Conclusion

The job opportunities for biomedical informaticians who graduated from UMIT seem to be quite good, and most of the graduates are working as biomedical informaticians and thus in their primary qualification. However, comparable surveys from other university programs would be needed for a detailed analysis of typical job profiles of graduates. While each curriculum has specific characteristics and strengths, a cross-university analysis of job profiles of graduates would enhance our knowledge about careers in biomedical informatics and would help to better understand the skills students need to be successful in their professional life.

Acknowledgments

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