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## **Future Doctors**

Mental Distress during Medical Education:  
Cross-sectional and Longitudinal Studies

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## ABSTRACT

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Medical education is long and stressful and medical students may suffer from mental distress. The aims of this dissertation are threefold; to investigate levels of distress in medical students at one Swedish medical school, to examine gender differences in such distress and to study individual and environmental determinants of distress. Major outcome measures were self-rated depression, burnout and interviewer-rated psychiatric morbidity. The thesis consists of two cross-sectional (I, II) and two longitudinal (III, IV) studies of medical students at Karolinska Institutet, examined by questionnaires (all) and interviews (III). A study stress inventory (HESI) is also introduced.

Study I showed that women students were more often depressed and reported higher levels on several aspects of study stress than men did. Medical students were also more often depressed than general population controls. Study stress factors *Worries about future endurance/capacity*, *Workload*, *Low commitment* and *Insufficient feedback* were associated with depression. Suicidal ideation and reported suicide attempts were not more common than usually reported in this age group. In Study II, an association was found between performance-based self-esteem and each of the two burnout dimensions exhaustion and disengagement. Exhaustion among medical students was also found to be associated with poorer self-rated health. Study III followed one cohort from 1<sup>st</sup> to 3<sup>rd</sup> year of medical school. A cluster analysis identified students with high/low burnout at 3<sup>rd</sup> year. High burnout was predicted by impulsivity personality trait and associated with concurrent workload (HESI). This cohort, affected by restrictions of the student financial aid system, had increased levels of financial concerns, which were also associated with high burnout. By interviews at 3<sup>rd</sup> year, 27% were assessed as having a psychiatric condition. This was predicted by depressive symptoms at first year. A history of depression was reported by 42%. Study IV followed two cohorts from their final year of medical school into their first postgraduate year and examined determinants of exhaustion in the postgraduates. Women students were more exhausted at both points of observation and also increased their scores. Exhaustion before graduation and *Worries about future endurance/capacity* (HESI) predicted exhaustion in the junior physicians. Concurrent job strain had a positive association with exhaustion whereas a good climate for learning in the clinic had a negative impact. The gender effect was mediated by worries about the future, which was more pronounced in women.

Mental distress was common among medical students, especially women, but mild to moderate forms predominated. Individual and environmental factors contributed to distress.

Key words: Medical students, stress, depression, burnout, gender, suicidal ideation, personality

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- III. **Marie E Dahlin**, Bo Runeson. Burnout and psychiatric morbidity among medical students entering clinical training. *BMC Medical Education*, 2007, 7:6.
- IV. Jenny Fjell, **Marie Dahlin**, Bo Runeson. Exhaustion among physicians during the first postgraduate year – a prospective study on dispositional and organisational determinants. Submitted to *Medical Teacher*, March 2007.

The publications listed above will be referred to as Studies I-IV in the text.

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## LIST OF ABBREVIATIONS

ANOVA	Analysis of Variance
AT	Allmäntjänstgöring (internship, pre-registration training)
BDI	Beck's Depression Inventory
CIS-R	Clinical Interview Schedule – Revised
DCQ	Demands-Control (-Social Support) Questionnaire
GAD	Generalised Anxiety Disorder
GHQ-12, 28	General Health Questionnaire - 12, 28 item version
HAM –D, -A	Hamilton Rating Scale for Depression, Anxiety
HESI	Higher Education Stress Inventory
HP5-i	Health-relevant personality traits from a five factor perspective
JSS	Job Satisfaction Scale
MINI	Mini International Neuropsychiatric Interview
MADRS	Montgomery Åsberg Depression Rating Scale
MANOVA	Multivariate Analysis of Variance
MBI	Maslach Burnout Inventory
MDI	Major Depression Inventory
OLBI	Oldenburg Burnout Inventory
PBSE	Performance-based Self-Esteem
PMSS	Perceived Medical School Stress
SCAN	Schedules of Clinical Assessment in Neuropsychiatry
SCID	The Structured Clinical Interview for DSM-IV
ST	Specialisttjänstgöring (Specialty training, resident)
SRH-5	Self-rated health (Five step response mode)
WFEC	Worries about future endurance/capacity

# 1 SOME PERSONAL NOTES

I am a psychiatrist, and as a physician I have never really considered any other specialty. I am interested in people's minds and their actions and reactions, who they are and what they experience. My encounter with medical school was not very positive, though. Coming from academic studies in the humanities, I found myself unable to think more than one step ahead after my first years as a medical student. Any attempt to engage in elaborate reflection or critical thinking faced a solid wall of silence; an experience I attributed to the amount of literature that had to be swallowed, but not really expected to be digested or critically valued. Instead of developing a critical and intellectual relationship with medical knowledge and knowledge-building, medical school seemed to foster people that would just accept as true what any lecturer chose to share with them. The road into this exciting, dynamic and challenging profession seemed counterproductive and I began to wonder what medical school does to medical students.

I have known two fellow students who committed suicide; there were others with severe alcohol abuse. I also had friends, who although having the motivation and the formal prerequisites, chose not to study medicine with reference to a psychological vulnerability.

Some years later, my first position as a licensed physician in the mid-nineties was at a psychiatric clinic profiled towards health-care personnel. I had the opportunity to care for colleagues with various psychiatric ailments and was intrigued by the special aspects of being a doctor for doctors as well as the characteristic obstacles involved when physicians become patients. At this time, the concept of burnout became the word of the day and many of the physicians we saw and treated were definitely affected by the nature of their work.

Since a few years, besides research, I have the great pleasure of teaching and working closely with medical students in psychiatry. I see a definite need for medical students to find help for mental problems, and in a broader sense to find forums for reflection over how to navigate between positions such as health and ill-health, what it is to be doctors or to be patients. Medical school and medical community teach future doctors to think that only the first line of these dichotomies can be theirs. I believe that if such an attitude becomes a tacit conviction, it may leave them with serious problems as one day they find themselves on the other side of that line; a predicament most of us will meet, sooner or later, in one form or another. After all, medical education is not an immunisation against disease.

## 2 INTRODUCTION

### 2.1 A HEALTHY COMMUNITY?

Personal motives are necessary, but not sufficient reason to engage in research. Why study medical students, and why focus on distress instead of well-being? Medical students are privileged as a group, positively selected with regard to several health-relevant factors such as socioeconomic status, educational level and healthy habits. Physicians are, at least when it comes to somatic disorders, healthier than the general population (Frank et al., 2000, Toyry et al., 2000). One of the reasons for taking up this study was that sick-leave rates suddenly rose to the double among physicians during the 90's in Sweden (Lutz and Lindquist, 2004). Thus, a change seemed to be at hand. Although rates were still low in absolute numbers as compared to the increase in the general population at this time, the proportion of sick-leave due to mental distress among physicians was high. In the years 2001-2003, 47.7% of sick-leave among women, and 37.9% among men physicians was due to mental diagnoses (AFA Försäkring, 2005). So why was this happening, and why just then? Had there previously been an "optimal" match between vulnerability and demands vs. the resources of physicians' working situation that suddenly did not match up?

There has been evidence that doctors are more prone to develop depressive disorders as compared to the general population (Firth-Cozens, 1989). This may be due to specific properties of the job, e.g. confronting death and suffering, or it may be due to personal characteristics in the selected population choosing such a job. Some studies have shown differences between specialities, indicating that e.g. psychiatrists are at greater risk (Olkinuora et al., 1990). The physician role has also changed dramatically during the last decades, with the information revolution and an ever faster growing corpus of medical knowledge. Often, new findings reach patients in bits and pieces from media and the Internet even before it has become accessible and workable knowledge to the profession. Thus demands from patients, politicians and the professional community as such have increased, as status has decreased (Arnetz, 2001).

A decline in physician health in Sweden was thus at hand, although it did not match that of the general population in Sweden during the same period. However, physicians' health and dissatisfaction is not restricted to Sweden, and it has been studied and debated internationally (Theorell et al., 1988a, Caplan, 1994, Williams, 1997, Elovainio and Kivimaki, 1998, Grassi and Magnani, 2000, Smith, 2001, Aasland et al., 2001, Tyssen and Vaglum, 2002, Firth-Cozens, 2003). Physicians' ill health may also affect the quality of care they provide to their patients (Firth-Cozens and Greenhalgh, 1997). Psychiatric disorders were the most common cause of premature retirement among UK doctors (Pattani et al., 2001).

Medical education is long and costly. It is in the interest of the individual and of society alike to have doctors that last, are healthy, stay on track and while doing so, perform their best. The health of medical students is also a predictor of later distress in the physician, according to a Norwegian study (Tyssen et al., 2001a). To collect data on health relevant factors in a defined occupational group from early on in their development is thus of value for the identification of predictors for later distress or as baseline data for the detection of possible future patterns of change.

There has been a trend within occupational stress research during later years to change focus from distress towards well-being from stressors to salutogenic factors. This is noted both in the choices of outcome measures such as well-being and life-satisfaction (Stecker, 2004, Kjeldstadli et al., 2006), and in the increasing interest in engagement as the antithesis of burnout (Maslach et al., 2001) or in job engagement as a determinant with more positive effects than job involvement (Hallberg and Schaufeli, 2006). While this may reflect a more positive and constructive approach towards occupational health, the people who are troubled still deserve to be studied.

## **2.2 MEDICAL EDUCATION IN SWEDEN**

Today, there are about 29 000 active physicians in Sweden, of whom 80% hold positions in the public sector. About 900 medical students are admitted to medical school each year, and almost 1000 become registered (Läkarförbundet, 2007).

There are presently six medical schools in Sweden; Karolinska Institutet in Stockholm, University of Uppsala, University of Göteborg, University of Linköping, University of Lund (Malmö) and University of Umeå. The undergraduate education comprises eleven semesters at all sites, but curricula and pedagogical profiles differ. During medical school, no grades are given; students pass or fail courses. Application for medical school is centralised and there is a quota system; the majority of Swedish medical students are selected on their grades from upper secondary school (gymnasium) or results of the Swedish Scholastic Assessment Test (SweSAT). The latter aims at measuring students' aptitude for studies, and is used as a general admission test for academic studies. However, at Karolinska Institutet a growing proportion is admitted since 1992 through a local procedure with tests and interviews; at present 60-70% enter medical education by this procedure. Upon graduation, 18-21 months of mandatory rotations in internal medicine, surgery, psychiatry and family medicine follows before registration (AT, i.e. internship or pre-registration training). This training is under the supervision of the National Board of Health and Welfare, not the universities. Subsequently the registered physician selects a speciality, which requires another five years of training as a resident (ST).

While the undergraduate medical education is formally provided by the universities, all clinical training is given within the health care system of the county councils. The latter being a completely different organisation, and with changes and reorganisations that may not always result in a priority of the task of education.

Medical school is free of charge, as is all university education in Sweden. Most medical students, just as other university students, support themselves by student aid; loans provided by the national authority for study loans and grants. The number of semesters that study aid can be lifted is limited to 12. Since many medical students have taken loans for other studies before and medical school covers eleven semesters, quite a few encounter problems supporting themselves. It was previously possible to apply for funding for additional semesters (up to a total of 15), a possibility that was removed in June 2001.

The studies in this thesis have been conducted at Karolinska Institutet, the one medical school in the Swedish capital, Stockholm, and one of Europe's largest medical universities. In the two first cross-sectional studies we investigated how study

conditions (or study stress) and individual features were associated with mental distress, operationalised in these studies as depressiveness and burnout. The two following longitudinal studies attempt to find individual and environmental determinants of burnout and clinically significant psychiatric morbidity at the entering of clinical studies on the one hand, and of the burnout dimension exhaustion in the postgraduate on the other. A short review of the literature follows below.

## **2.3 LITERARY REVIEW: MENTAL DISTRESS IN MEDICAL STUDENTS AND PHYSICIANS**

### **2.3.1 Medical students**

Although there are studies on medical students distress since the 1960's (Nichols and Spielberger, 1967, Gunn, 1968, Pasnau and Bayley, 1971), due to major changes in medical education and profession that have occurred over time (e.g. the change in gender distribution in the profession; pedagogic changes; an immense increase in medical knowledge that has affected curricula, etc.), I will concentrate on the last 20-25 years. Mental distress among medical students has been reported during the last decades. Early studies were predominantly North-American (Vitaliano et al., 1984, Zoccolillo et al., 1986) and British (Firth, 1986), and so it remains, although the issue is widely addressed. In the nineties a nationwide longitudinal study was initiated in Norway from which several influential papers have been published (Aasland et al., 1997, Tyssen et al., 1998, Vaglum and Falkum, 1999). In later years, there has been a growing body of studies from different regions such as Turkey (Aktekin et al., 2001, Sarikaya et al., 2006), South-America (Peterlini et al., 2002), Asia (Stewart et al., 1995, Saipanish, 2003, Wong et al., 2005) and Africa (Omigbodun et al., 2006, Ovuga et al., 2006). The international population of medical students may be highly heterogenous, and in the absence of international comparisons, we do not know if it is adequate to generalise from one medical student population to another. Differences are likely to be at hand, for at least three possible reasons: 1) Different educational systems and curricula, resulting in different strain on the individuals, 2) different selections of populations, due to different cultures and different admittance systems 3) cultural and socioeconomic differences between countries and, not to mention, continents.

While many studies claim that medical students are stressed, or experience distress, quite few of them actually put the question into context, by comparisons with other students or other control populations. Although there are factors that are particularly stressful and that medical students are exclusively exposed to, such as the coming responsibility of patients, encounters with disease, suffering and death, the very demands of higher education may not necessarily be more pronounced for medical students than students of other disciplines. However, medical school may contain more bullying and harassment than other educations (Rautio et al., 2005, Frank et al., 2006). Where comparisons have been done regarding distress in different educational settings, results are conflicting. In a Canadian study, medical students were not more depressed than law or graduate students (Helmers et al., 1997) and UK medical students did not have higher health anxiety than other university students (Singh et al., 2004), whereas other studies have shown that medical students were more distressed than other university students (Bramness et al., 1991, Aktekin et al., 2001, Wong et al., 2005, Facundes and Ludermit, 2005, Jonsson and Ojehagen, 2006, Niemi and Vainiomaki, 2006).

Most studies are cross-sectional, which limits conclusions that can be made regarding causal relationships between distress as outcome and its possible determinants. Many longitudinal studies have a rather short span between observations, maybe covering one curricular year or semester (Vitaliano et al., 1989a, Vitaliano et al., 1989b, Stewart et al., 1997), while some have followed students over several years during medical school (Zoccolillo, 1988, Rosal et al., 1997, Guthrie et al., 1998, Gude et al., 2005, Kjeldstadli et al., 2006, Niemi and Vainiomaki, 2006). Finally, there are longitudinal studies with observational times covering not only medical school, but also postgraduates and the subsequently specialized physicians (Firth-Cozens, 1997, Firth-Cozens, 1998, Tyssen et al., 2001a, McManus et al., 2004, Tyssen et al., 2005).

### *2.3.1.1 Depression, Anxiety, Distress*

Stress and mental distress has often been addressed as outcome measures. In a recent review of North-American studies, Dyrbye et al used different wordings of depression and burnout as well as anxiety, mental health, and distress as search terms (Dyrbye et al., 2006c). These capture the field quite well, but as the authors found, studies of burnout in student populations are scarce.

Depression and anxiety disorders are among the most prevalent mental disorders in the general population, where the cumulative probability of developing a depression is 31% for women and 22% for men, according to a recent Swedish study (Mattisson et al., 2005). Recent 1-year prevalence numbers in the USA were 10% in ages 18-29 years and 7% in ages 30-44 years (Compton et al., 2006). Depression is described as common among medical students, and reported prevalence rates varies between e.g. 6% one-year prevalence in an interview study (Zoccolillo et al., 1986) and around 25% by self-reports (Clark and Zeldow, 1988, Givens and Tjia, 2002), although different measures and definitions have been used. In a sample of 113 last-year medical students in the UK, students were interviewed and 16% identified as cases of psychiatric morbidity by the CIS-R (Guthrie et al., 1998). A Turkish study showed larger increase in depressive symptoms and percentage above cut-off for caseness in medical students from first (18%) to second (48%) year, than in economy students (Aktekin et al., 2001). Thus indications of distress as well as estimates of caseness according to some definition of clinical disorders have been assessed in different studies.

An early study of Swedish university students reported that 1/3 had either had a psychiatric consultation or were assessed by themselves or the investigator to be in need of one. Mental health problems did not, however, have a significant influence on study results (Sundqvist, 1973, p 123).

Individual and environmental risk factors for mental distress in medical students have been discussed, as well as their interplay. In a US sample, from an initial resemblance with those of the general population, depression scores increased in subsequent follow-ups during the course of medical school, as did gender effects with higher levels for women (Rosal et al., 1997). By contrast, a Canadian study favoured the idea that individual factors explained elevated depression levels in some students, in the absence of association with measured medical school stressors (Helmert et al., 1997). A more recent cross-sectional study from the UK, mentioned above, showed that medical students worried less and had less health anxiety than other university students, which might suggest that individual factors are less important (Singh et al., 2004).

Worries about the future were associated with higher scores on General Health Questionnaire-12 (GHQ-12) and Beck's Depression Inventory (BDI) in Turkish students (Aktekin et al., 2001). Vitaliano and co-workers showed that Type A behaviour and the coping strategies "wishful thinking" and "avoidance" were associated with high scores on the Perceived Medical School Stress scale (PMSS) (Vitaliano et al., 1989a) and that such study stress was associated with depression and anxiety (Vitaliano et al., 1984). Norwegian medical students who sustained high life satisfaction over the course of medical school reported less interference of studies on their personal and social life, and had less wishful thinking (Kjeldstadli et al., 2006).

The different approaches to estimating distress levels in these populations may sometimes rather seem to blur the picture. It is quite unclear if e.g. trait anxiety, personality and high scoring on a stress or depression scale are distinguishable from each other in self-report studies, as is the extent to which they reflect "true" or "heavier" psychiatric disorders.

### *2.3.1.2 Suicide*

Suicide-rates among medical students are not very well known, but a US survey of 101 medical schools reported 15 suicides between 1989 and 1994, yielding yearly rates of 0-11.7/100 000, well below American national levels (14,9-15,2/100 000) in the same age-groups (Hays et al., 1996). However, a Brazilian study reported an approximately four-fold rate in medical students compared to the general population of the same age (Millan et al., 1990).

In a Swedish study of university students in Uppsala 15 suicides were found during 1962-1966, but rates were not reported on. The same study showed higher rates of suicide attempts among university students than in the general population during 1962-1972, where medical students' rates were similar to those of students of other faculties (Norrman, 1974). In a recent study 34% of first year medical students at Karolinska Institutet reported suicidal ideas some time during their life, vs. 44% among last year students (Wallin and Runeson, 2003). Similar levels were reported from Norwegian final year students, where 1.4% reported at least one suicide attempt in life (Tyssen et al., 2001b). In a Swedish study of the general population, 2.7% reported having attempted to commit suicide during their life-time (Renberg, 2001).

Physician suicide rates are more often studied, and they are higher than in other academic populations (Arnetz et al., 1987, Stefansson and Wicks, 1991, Aasland et al., 2001, Hem et al., 2005). Women physicians have been reported to have particularly high rates (Arnetz et al., 1987). In later years, trends seem to point to decreased rates as well as decreased gender differences, although they still exist (Stefansson and Wicks, 1991, Hem et al., 2005). A retrospective study of physician suicides where information from medical school was available, suggested that physician suicides were predicted by signs of psychopathology in the subjects as medical students (Epstein et al., 1973).

### *2.3.1.3 Alcohol and drugs*

This thesis will not focus on alcohol or drug abuse, but since these are closely connected to mental disorders and also a well known problem within the physician community (O'Connor and Spickard, 1997), a few words on the subject will be said. Among British medical students alcohol habits were above levels of non-hazardous

amounts and alcohol intake increased over time during medical school (Newbury-Birch et al., 2000). In a Swedish study, medical students had lower alcohol consumption than other university students, but 12% of the men and 4% of women students were considered at risk for alcohol problems (Borschos et al., 1999). In a Norwegian sample, hazardous use was seen in 24% of men and 6% of women and 10.5% of the students, regardless of gender, used alcohol to cope with tension (Tyssen et al., 1998).

#### 2.3.1.4 *Burnout*

As mentioned above, there are few studies on students and burnout, although studies on young physicians are abundant. Since burnout develops over extended time, a full burnout syndrome might not be expected to be frequent among medical students, being in the very beginning of their professional path. In a longitudinal study of British medical students, a slightly modified version of the Maslach Burnout Inventory, adapted for studies in medicine, was administered to first, fourth and fifth year medical undergraduates. By cut-off values taken from US data, prevalence of high-scorers was 5.2-12.9% on the Emotional exhaustion subscale, 3.8-7.1% on the Depersonalisation scale and 14-16% on the Personal accomplishment scale (Guthrie et al., 1998). A cross-sectional study on three German dental schools showed mainly high scorings on Emotional Exhaustion scale of the German version of the MBI (Pohlmann et al., 2005). High scorers were defined as values exceeding the 75<sup>th</sup> percentile.

As many as 45% of medical students in a multi-centre study in Canada and USA were assessed as positive for burnout, defined as above cut points on any of the MBI subscales, (see below; operationalisations of burnout are discussed briefly in section 3.4.3), where life events was the major explanatory factor (Dyrbye et al., 2006b).

### 2.3.2 **Postgraduates**

The first postgraduate year has been appointed as a peak of distress (Clark et al., 1984, Hsu and Marshall, 1987, Firth-Cozens, 2001, Tyssen and Vaglum, 2002, Tyssen et al., 2005). In many countries, the first years in the profession as physician are also very demanding in terms of working hours; US interns and British pre-registration house officers may well work for 80-100 hours a week (Oransky, 2003, Firth-Cozens, 2001). Working hours are, however, not necessarily associated with distress or burnout (Clark et al., 1984, Firth-Cozens, 1987, Tyssen et al., 2005), though burnout levels did decrease among US interns when work hour limits were introduced (Goitein et al., 2005). Even though weekly working hours in Scandinavia are substantially lower, around 40-48, the first postgraduate year seems to be particularly stressful (Tyssen et al., 2005). The newly graduated students meet the full personal responsibility in the profession and are now exposed to “real-life” situations where their knowledge and skills are challenged. Some suggested determinants of mental distress at this stage are personality, sleep deprivation, being single, previous mental distress and job stress (Firth-Cozens, 1987, Tyssen et al., 2000, Tyssen et al., 2001b). According to a recent qualitative study on well-being among interns, the informants viewed internship as a time of “temporary imbalance” (Ratanawongsa et al., 2007).

The authors of a British study, who followed medical students for twelve years, claim that personality explains later work stress. They found that personality determined learning styles during medical school, which in turn predicted attitudes to work as well as stress and burnout at follow-up (McManus et al., 2004).

### **2.3.3 Help-seeking**

Help-seeking for mental and somatic problems have often been reported to be low in physicians, who rather self-prescribe or make informal consultations with colleagues and friends (Toyry et al., 2000, Rosvold and Bjertness, 2002, Davidson and Schattner, 2003). While it may relieve the health care system, it is not viewed as a desirable behaviour, for several reasons. It may result in poor or incomplete treatments and investigations, where no one takes a formal responsibility. Self prescription may also be a road to abusive behaviour (Hughes et al., 1992). A similar pattern has been ascribed to medical students, who tend to by-pass their GPs, and use informal contacts instead (Hooper et al., 2005, Brimstone et al., 2007). As far as mental ailments are concerned, the problem with a shortage of available contacts that are perceived as safe regarding secrecy makes health professionals especially vulnerable.

### **2.3.4 Gender**

Depression is more common in women than in men in the general population, thus gender differences would be expected also among medical students and physicians. The latter has often been found; with higher rates of distress and depressive symptoms among women doctors than among their men counterparts (Hsu and Marshall, 1987, Wall et al., 1997) but also higher than women of other occupations (Wall et al., 1997). Among medical students, results are ambiguous. While many studies actually fail to show gender difference in distress during medical school (Richman and Flaherty, 1986, Firth, 1986, Guthrie et al., 1998, Tyssen et al., 2001b, Tyssen et al., 2001a), some do (Lloyd and Gartrell, 1981, Vitaliano et al., 1984, Lloyd and Gartrell, 1984, Toews et al., 1997, Rosal et al., 1997, Helmers et al., 1997, Jonsson and Ojehagen, 2006). The lack of gender difference in several studies, considering the pattern in the general population, is interesting and may also deserve attention. A suggestion could be that preconceptions about the role of the physician as a male dominated career path may influence the selection of women choosing this career, or being admitted, leading to no or smaller gender differences (Richman and Flaherty, 1986).

However, although women make up a growing part of the corpus of medical students in most parts of the world (Kilminster et al., 2007), there may still be a shortage of women role models and the educational environment may be dominated by men (Firth-Cozens, 1990). This may result in lack of mentoring relationships provided to the women students and may exert a pressure on those women who enter medical school that is different from that experienced by men students.

Working conditions and staff relationships may be different for men and women in the medical profession. From the historical norm of the doctor as a man, the different role of the woman physician in relating to women nurses may induce a complication for the doctor (Gjerberg and Kjolsrod, 2001). It may, however, also be the case that women, being more sensitive to the protective effects of social support (Theorell, 1996, p 74), also as doctors benefit from the relationship with nurses, if it is positive and constructive.

Even when no gender differences have been found during medical school, they may occur in the postgraduate stage, where a suggested explanation has been that the

women become more stressed as they encounter conflicts between family and career (Firth-Cozens, 1987).

## **2.4 OUTCOME VARIABLES: MENTAL DISTRESS**

It has been pointed out, that in studies of physicians' strain a more psychiatrically oriented approach is usually applied compared to when other professional groups are studied (Firth-Cozens, 1989). This may have led to a systematic "pathologising" of the perception of strain in this population. The reasons may be disputable; a more clinical view would perhaps seem more natural to investigators as well as the physicians studied, and maybe there actually is a specific interest inherent in the pathology of those who are set to care for the people's ailments.

In this thesis, outcome measures are of both kinds; depression and burnout. In addition, study stress is applied both as outcome and stressor. Further, in Study III diagnostic interviews were held, yielding clinically significant psychiatric morbidity as outcome. Below, these and some related concepts as well as ways to assess them are discussed briefly, followed by a section on the explanatory factors, where study stress is dealt with.

Most studies on mental distress in medical students rely on self-reports and different measures of depression, anxiety or caseness defined as above threshold scorings on the instruments applied. The use of different measures and different cut points sometimes make comparisons difficult.

### **2.4.1 Stress**

The concept of stress suffers from denoting several different phenomena, be it in colloquial or scientific language. In a scientific context, its connotations vary between (a) the external factors inducing (b) the physiological reaction resulting in (c) an emotional/cognitive/affective response in the individual. The external factors (a) may be referred to as stressors, which may be e.g. work overload, time-pressure or role-conflicts; or in an evolutionary perspective, e.g. being attacked by a predator. The physiological reaction would be e.g. the activation of the fast working sympatho-adrenal system and the slower cortisol response, and further biological systems such as immunological responses.

In this study, however, no biological parameters are measured; I consider primarily the stressors (a) and the emotional/ cognitive/affective responses (c). When study stress is measured by the Higher Education Stress Inventory (see below, p 20), the demarcation line between (a) and (c) above is not entirely clear, only partly due to that the use of a self-report instrument does not allow a clear-cut differentiation between what is described and the appreciation of the same (see also p 34).

### **2.4.2 Psychiatric conditions and suicidal ideation**

An obvious feature of mental distress would be fully developed mental, or psychiatric, disorders. Alternatively, a considerable level or load of psychiatric symptoms would be an approximation of distress. The presence of mental disorders in a population can be determined through the use of diagnostic self-report instruments, interviews or studies

on the use of health care. All methods have their advantages and drawbacks. The use of self-reports make possible larger samples for the same cost, but may lack in validity and reliability, depending on e.g. the instruments used and the population assessed. Interviews are expensive, and may be performed by laymen or professionals, and the reliability and validity also depends on the instrument used, e.g. the SCID, SCAN, MINI (First et al., 1995, WHO (World Health Organisation), 1999, Sheehan et al., 1997). If interview manuals designed for patient populations are used, the reliability in a general population sample may not be as high.

#### *2.4.2.1 Depression*

The psychiatric disorder Major Depression is a state defined by criteria according to either the DSM-IV or the ICD-10. According to the DSM-IV (which is descriptive, criteria-based and does not consider any etiological aspects) it is characterised by either depressed mood or loss of interest or pleasure (anhedonia) most of the time and at least five criteria from these two and the following: significant weight loss or weight gain, insomnia or hypersomnia, psychomotor agitation or retardation, fatigue, feelings of worthlessness or guilt, diminished ability to concentrate or make decisions, recurrent thoughts of death or death wish or suicidal thoughts, over a time of at least two weeks. It shall result in significant clinical suffering or loss of social or global function. Further it shall be distinguished from uncomplicated grief and not be a physiological effect of substances or somatic disease. Depressive episodes may differ in gravity and it may, when severe, go with psychotic symptoms. The ICD-10 classification requires the same clinical features, but does not explicitly consider duration, and it is graded according to number of symptoms. Historically, different approaches towards depression or melancholy have been launched. The expression “endogenous depressions”, for example, has been used to differentiate the apparently spontaneous, often severe depressive episodes from “exogenous”, where a reason for the depressed mood, such as a negative life event, could be identified, and where positive experiences may have a relieving effect. Today, depression is usually perceived as a state of multiple causes, where individual vulnerability, including heredity, as well as external stressors are considered relevant. The status or the correct definition of the depressive entity is by no means settled, however (Shorter, 2007). The bipolar syndromes also belong to the affective disorders, where, in addition to depressive states, hypomanic or manic episodes occur.

A diagnosis is set by clinical examination, with regard to a classification system, sometimes with the aid of rating scales that may be diagnostic or used to measure the gravity of the depressive episode. In epidemiological contexts, self-rating scales are often used as an approximation. BDI, MDI, MADRS, HAM-D are all commonly used scales with different properties. (Beck et al., 1961, Bech et al., 2001, Olsen et al., 2003, Montgomery and Asberg, 1979, Hamilton, 1960, Hamilton, 1967).

Suicidal ideation is thus one possible criterion for depression, and the majority of fulfilled suicides do occur under the influence of some psychiatric disorder. The individual history of suicidal ideation or behaviour is also of interest, since it constitutes an increased risk of future suicidal acts. When assessing suicidal ideation in surveys, many self-report scales are available. What is often of interest is to capture thoughts of death or suicide as well as suicidal acts within some defined time span or during the entire life-span. Results from different studies are not always readily comparable, due to the different measures used. Epidemiological studies often use

register data to estimate suicide rates within a certain population or time frame. Large populations or fairly long observational time is usually necessary, since incidence is low, which may partly explain the scarceness of studies on medical students.

#### 2.4.2.2 *Psychiatric morbidity*

The variable psychiatric morbidity used in this thesis is a composite variable of affective disorders; i.e. depression and bipolar disorder (defined here as a history of at least one hypomanic or manic episode), anxiety disorder, eating disorder and alcohol abuse or dependence according to the MINI. Thus drug abuse, psychotic disorders and personality disorders were not assessed. The MINI 5.0.0 yields diagnoses according to DSM-IV and ICD-10. The variable *Psychiatric morbidity* may not be readily comparable with those measured in other studies of relevant populations. Fairly close may be the caseness derived from the CIS-R, used in a British study (Guthrie et al., 1998), which captures “minor psychiatric morbidity”, understood as non-psychotic disorders (Lewis et al., 1992). This instrument does not, however, include alcohol abuse or dependency. The General Health Questionnaire (GHQ) is an often used self-report measure that also indicates psychiatric caseness (Goldberg et al., 1997).

### 2.4.3 **Burnout**

In this thesis, I view burnout as a measure or approximation of distress and assess it by the Oldenburg Burnout Inventory, see below. The distress perspective is far from self-evident. In Sweden, as in the Netherlands, this clinical view on burnout has prevailed, in contrast to the motivational perspective, that is held e.g. in the North American tradition of burnout research (Hallberg, 2005, pp 3-5), where burnout is understood as a specific and negative set of attitudes towards work.

The concept of burnout was initially developed in the late 1970's, then thought to appear exclusively in human-service work, e.g. among health care workers, social workers and teachers. Over the years this perspective has been abandoned and burnout is now usually perceived as a process (or state) that may occur in any professional setting. The most widely used measure of burnout is the MBI (Maslach Burnout Inventory), available in different versions, comprising the dimensions *Emotional exhaustion*, *Depersonalisation* (or *Cynicism*) and *Diminished personal accomplishment* (Maslach, 1979). A known psychometric problem with the MBI is that *Emotional exhaustion* and *Depersonalisation* are both negatively worded throughout the scales, whereas *Diminished personal accomplishment* is positively worded (Lee and Ashforth, 1990).

The exhaustion dimension is considered the core feature of burnout, while different theoretical interpretations of the “*depersonalisation/disengagement/cynicism*” factor have been suggested. Demerouti et al. define the concept of burnout as a state that may appear regardless of profession and have designed a two-dimensional scale, the Oldenburg Burnout Inventory, OLBI, measuring *Exhaustion* and *Disengagement*, corresponding to the MBI dimensions *Emotional exhaustion* and *Depersonalisation* (Demerouti et al., 2001b).

According to the theoretical underpinning of the OLBI, *Exhaustion* is thought to be related to job demands, whereas *Disengagement* is associated with (lack of) job resources (Demerouti et al., 2001a). In a study on Greek nurses, these associations were

confirmed, as well as an impact by burnout on life satisfaction (Demerouti et al., 2000). The OLBI has been validated against the MBI *Emotional Exhaustion* and *Depersonalisation* sub-scales (Demerouti et al., 2003).

Burnout can be conceived as either a continuous process or as a state (Cox et al., 2005), and the choice of perspective will affect the analysis of the measure used (Brenninkmeijer and Van Yperen, 2003). The “process view” favours the presentation of continuous scores, while the “state view” implies the introduction of a dichotomous variable, defining presence or absence of burnout, which is of course attractive to the clinical perspective. Although burnout may be understood as a set of attitudes towards work (the motivational perspective), the question of suffering or loss of function of the individual is important from the clinical perspective. Lowered quality of work performance, absenteeism and drop-out may follow high burnout levels.

Burnout seems to present differently in different settings – vocational as well as geographical – and the development of local criteria through clinical validation has been suggested to determine burnout cut-off levels for the scales used (Shaufeli W, 1998, pp 63-65). This should be kept in mind when interpreting prevalence estimates in studies where cut points are “imported”.

There are no established Swedish criteria as yet, for the OLBI or for the MDI, and since there is no clinically established diagnosis associated with burnout, as e.g. in the Netherlands, the association between the theoretical burnout complex and clinical suffering or loss of function is unknown. In 2003, the Swedish National Board of Health and Welfare published an expert report, proposing diagnostic criteria for Exhaustion syndrome (Socialstyrelsen, 2003). The major symptoms are physical and psychological exhaustion, determined as a number of specified symptoms with a duration exceeding two weeks. Further, identifiable stressors present for at least six months, and a considerable lack of mental energy is required as well as significant clinical suffering or loss of social or global function. However, the Exhaustion syndrome does not take into account any aspect of disengagement, cynicism or emotional detachment, thus being a construct quite distant from the motivational perspective on burnout.

Apart from the job-related determinants for burnout, individual characteristics predisposing for the development have also been suggested. Personality characteristics that have been shown to correlate with burnout are neuroticism or negative affectivity, external control orientation, extraversion and Type A behavioural pattern (Shaufeli W, 1998, p 75, Hallberg, 2005), see also below, p 13. Further, the concept of Performance-based self-esteem has been proposed by Hallsten, to be an essential part of the burnout construct (see below, p 13).

## **2.5 EXPLANATORY VARIABLES: PROTECTORS, VULNERABILITIES AND STRESSORS**

### **2.5.1 Personality**

Personality is something that characterises a person and that is supposed to be fairly stable over time. Everybody has a personality. The personality colours ones perceptions, actions, reactions and is not to be perceived as a sign of morbidity of any kind, as opposed to a personality disorder. There are several different approaches to the

concept, however. Usually some kind of multidimensional model is used, where any given person has more or less of the different traits or aspects that may be assessed by the use of some rating scale. In addition to several approaches to the concept of personality, there are also many different measures to assess it available, often compiling over 100 items and measuring different facets of each factor. It may be difficult to enclose such inventories in an otherwise comprehensive questionnaire, if response rates are to be sufficiently high. A frequently employed framework is the five factor model (McCrae and John, 1992). The five factors are Neuroticism, Agreeableness, Conscientiousness, Openness and Extraversion.

The personality measure used in this thesis, HP5-i (Health Relevant, Personality, Five-factor, inventory) is short, consists of 20 items, and intends to measure facets of relevance for health of each of the five factors. We have used two of these factors. *Negative Affectivity* (positive facet of Neuroticism), which marks “proneness to nervous tension and distress”, found to correspond to individual differences in susceptibility to distress and poor outcomes and *Impulsivity* (negative facet of Conscientiousness) related to substance abuse and unhealthy behaviours. The impulsive person “...takes life easy, and the day as it comes, and does not make plans” (Gustavsson et al., 2003).

However, *Impulsivity* may also indicate impatience, which is part of a different construct, namely Type A pattern of behaviour. The concept of Type A behaviour, was introduced in the 1950's, as an aspect of stressful behaviour, being a risk factor of coronary heart disease. It was described as “characterized by an excessive competitive drive, a persistent desire for recognition and advancement, a persistent involvement in multiple functions subject to ‘deadlines’ and a habitual propensity to accelerate the pace of living...” (Rahe et al., 1978). Type A behaviour has been found to be associated with stress among medical students (Vitaliano et al., 1989b) and burnout (Shaufeli W, 1998, p 75). However, in a recent Swedish thesis, a longitudinal relationship with burnout could not be supported (Hallberg, 2005, p 23).

Three facets of the HP5-i were not used in this thesis, due to low internal consistency in the studied population; *Alexithymia* (negative facet of Openness), *Antagonism* (negative facet of Agreeableness) and *Hedonic Capacity* (positive facet of Extraversion).

## **2.5.2 Performance-based self-esteem**

According to the Swedish burnout researcher Hallsten, performance-based self-esteem (PBSE) is a prerequisite for the process of burnout. PBSE is conceptualised as a contingent self-esteem, based on the sense that you have to accomplish in order to be valued, as opposed to “global” self-esteem. PBSE is thus thought to build on accomplishments and “doing”, rather than “being” or “having” (Hallsten et al., 2005, p 5), and drives the individual to engage heavily in work. The high motivation that follows a high performance-based self-esteem might then under negative working conditions contribute to the burnout process.

Hallsten views burnout as a process that is not necessarily work-dependent, but can develop in unemployed persons or as a consequence of domestic or family burdens. PBSE measured in large Swedish samples of the general population has proven to be higher in young people and among academics and has shown moderate correlations with general and somatic health in previous research (Hallsten et al., 2002, pp 25-27).

Further, Hallsten differentiates between “burnout” as a combination of high scores on traditional burnout scales and high PBSE, and “wornout”, where high burnout scores are combined with low PBSE, see Fig 1.

**Fig 1.** Hallsten’s schedule for burnout and performance-based self-esteem.

		PBSE	
		+	-
Burnout	+	”Burnout”	”Wornout”
	-	”Challenged”	”Relaxed”

Adapted from Hallsten (Hallsten et al., 2005, p 4).

### 2.5.3 Study stress/study conditions

The Perceived Medical School Stress scale (PMSS) was introduced in the early 1980’s and has been used in several studies world wide (Vitaliano et al., 1984, Richman and Flaherty, 1990), sometimes with modifications (Bramness et al., 1991, Stewart et al., 1995, Tyssen et al., 2001a). It contains 11 or 13 items, and has usually been analysed as a sum score (Richman and Flaherty, 1990, Bramness et al., 1991). Factors have also been identified, although usually not used as variables (Vitaliano et al., 1984, Stewart et al., 1995, Tyssen et al., 2001a). There is no formal theoretical framework for the factors that are results of factor analyses in each different study where the measure is employed. Factors have been described as, e.g. “medical school curriculum and environment”, “personal competence/endurance”, “social/recreational life”, “finances” (Vitaliano et al., 1989a) or “academic worries” and ”social and personal renunciations” (Kjeldstadli et al., 2006).

We found some of the PMSS items difficult to respond to or not quite adequate for a Swedish medical student; e.g. statements regarding electives or the appreciation of the administration and faculty, which seemed abstract and unclear in a Swedish medical school context. We also wanted to take additional aspects into account and further saw a need for comparisons with other student populations, and have thus designed a new inventory the Higher Education Stress Inventory (HESI), which is described below in the methods section.

### 2.5.4 Working conditions and attitudes

#### 2.5.4.1 Demand- control- social support

One theoretical frame for studying working conditions that have an impact on health is the Demand-Control model of Karasek, see Fig 2. High demands and low control (“high strain”) is the most stressful combination and increases the risk of cardiovascular disease. The low control impedes the possibility to actively adjust to the demands; theoretically resulting in sympathoadrenal arousal as well as decreased anabolism and restorative capacity of the body (Theorell, 1996, p 71).

**Fig 2.** Karasek's demand-control model of work

		Demands	
		+	-
Control	+	Active	Low strain
	-	High strain	Passive

The model has been elaborated by adding the concept of social support, which in women and white collar workers has been shown to be of importance when combined with high demands (Theorell, 1996, p 74).

A recent Swedish study showed lower levels of morning saliva cortisol in women with low job strain compared to women with active, passive or high strain jobs, but no differences were detected between different strain levels in men (Alderling et al., 2006). Job strain is commonly assessed by the self-report inventory DCQ (Demands Control Questionnaire) that also comes with a social support module (Theorell et al., 1988b, Theorell, 1996). Supposedly, the effect of job strain as psychological distress is not direct or obvious, since the subjective perception may differ with coping strategies or personality traits (Landsbergis et al., 2000).

#### 2.5.4.2 *Climate for learning*

In a profession with such knowledge density as that of the physician, the first year as a professional, although medical school is over, is highly characterised by learning and determining the border between what is known or mastered and the lack of knowledge and experience. The attitude towards the newly graduated in the clinic where he or she works may be of importance for the acquisition of knowledge, as well as for well-being. A context that is supportive and also acknowledges the limited experience of the intern or junior house officer, one that provides supervision and feedback, is thought to favour the growth and well-being of the physician. To assess these aspects of the working environment, we used an instrument developed for the Norwegian nationwide study (Tyssen et al., 2000), that intends to reflect attitudes and learning conditions on the ward. In a study of Norwegian junior house officers, concurrent mental health did not depend on the climate for learning, when personality, medical school factors and job stress were controlled for (Tyssen et al., 2000). However, in a study of the same sample, job stress was negatively associated with a good learning climate, even in an adjusted analysis, where e.g. personality was controlled for (Tyssen et al., 2005).

### 3 GENERAL AIMS

This thesis builds on four papers from a longitudinal study of three cohorts of medical students. According to some areas of controversy and conflicting knowledge, namely a) whether medical students suffer more from distress than other populations, b) whether women medical students fare worse than their male counterparts, c) whether distress comes from the individuals or from the environment they inhabit, the general aims are the following:

- To study levels of mental distress in medical students and
  - compare with those of the general population
  - investigate gender differences in its levels or expressions
- To investigate environmental and individual correlates and causes of such distress

**Study I:** To compare study stress between different stages of medical school and prevalence rates of self-rated depression between medical students and the general population.

**Study II:** To study associations between performance-based self-esteem and burnout and their relationships with medical students' perceived health.

**Study III:** To study changes in study stress and burnout from 1<sup>st</sup> to 3<sup>rd</sup> curricular year, presence of psychiatric morbidity, and predictors of psychiatric morbidity and burnout at 3<sup>rd</sup> year.

**Study IV:** To examine individual and environmental predictors and correlates of exhaustion in the first postgraduate year.

## 4 METHODS

### 4.1 DESIGN AND PROCEDURES

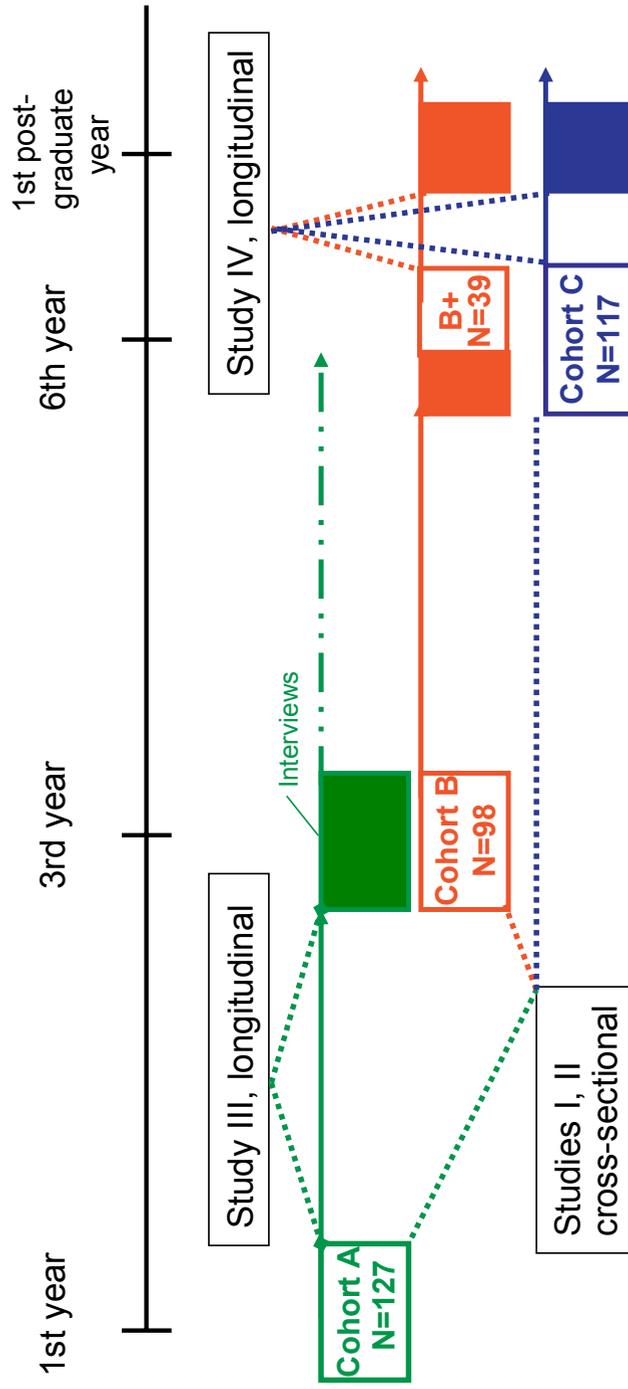
A longitudinal study of three cohorts (A, B, C) of medical students at Karolinska Institutet was initiated in 2001. Our purpose was to investigate students at the beginning and end of medical school and while entering their very first clinical assignments, first as students (3<sup>rd</sup> year), then as young physicians (first postgraduate year). At baseline, all registered students of the first curricular semester (1<sup>st</sup> year) in the autumn of 2001, and the 6<sup>th</sup> (3<sup>rd</sup> year) and 11<sup>th</sup> (6<sup>th</sup> year) curricular semesters in the autumn of 2002 were approached. Each cohort was then followed up as they passed the third year, sixth year and the first postgraduate year (Fig 3).

Addresses and telephone numbers were initially retrieved from the Karolinska Institutet Students services registers. In addition, personal identification numbers were held, in order to secure longitudinal follow-ups. The latter were stored separately, with a key for matching the unique study ID of each student. This key was broken twice a year by administrators, to search for included study participants at the decided stages of education.

Data was collected by postal questionnaires, labelled with each participant's unique study ID. There were two reminders by mail and one by telephone. Students were guaranteed confidentiality and the study was approved by the Ethics Committee at the Karolinska Institutet. Responders received a cinema voucher for their participation.

At the 3<sup>rd</sup> year follow-up of cohort A (see Fig 3), all responders were invited to participate in an interview. The interviews were held during workdays at the hospitals where students attended their clinical rotations. Three physicians with training in psychiatry performed the interviews, which took between 20-90 minutes. Thorough discussions on the interview manual were held prior to the interviewing period and at regular meetings during the period, but no formal common rating sessions were arranged. A second cinema voucher was given to students who took part in the interviews.

**Fig 3. Flow chart over cohorts (A, B, B+, C) and studies (I-IV)**



## 4.2 CURRICULUM

Medical school at Karolinska Institutet comprises 2 years of preclinical studies, followed by 3.5 years of clinical courses. The first semester is dominated by a course on cell biology. At third year, students enter their clinical rotations during the internal medicine course, of 30 weeks. The final year consists of a compilation of short courses of 1-4 weeks including oncology, geriatric medicine, family medicine, public health, emergency medicine, and an eight week elective.

After graduation, Swedish medical students start working as physicians. In the Swedish system, a mandatory rotation (internship) of 18-21 months of clinical training (composed of training in internal medicine, surgery, psychiatry and general practice) must be completed before obtaining a medical licence. While some students begin their rotation directly after medical school, others take temporary positions as junior physicians to gain credits to increase their chance of being admitted to their first-choice internship rotation.

## 4.3 PARTICIPANTS

Data was collected between 2001 and 2006. Initially, 342 students were included; in each cohort 127 (A), 98 (B) and 117 (C). At the sixth year follow-up of cohort B, another 39 students were included (B+), who attended the same course and semester at the time of data collection; see Fig 3 and Table 1. The overall gender distribution was 58% women and 42% men. Response rates are given in Table 1. Of the responders (Studies I and II, n=309), 9% (27) were born outside Sweden and 20% (61) had at least one parent that had immigrated to Sweden.

Studies I and II are cross-sectional from the original baseline data-collection, including cohorts A, B and C with an overall response rate of 90 %. In Study I, we also included controls from the general population, two for each medical student, matched for gender and age, but not for educational level. These controls came from a study on mental disorders in the general population, with a response rate of 49% (Dahlberg et al., 2007).

Study III is longitudinal, following cohort A from baseline (1<sup>st</sup> year) to 3<sup>rd</sup> year (n= 98, response rate 77%), including diagnostic interviews with 81 of the responding students at 3<sup>rd</sup> year. From the original cohort, six students had left medical school and four had moved to continue their education at another medical school.

Study IV is likewise longitudinal, following cohorts B, B+ and C (N=253, n= 186, response rate 73.5%) from their 6<sup>th</sup> undergraduate year to the first postgraduate year. Since all subjects from cohort B had not reached their final semester during the study period, only 81 of the original 98 students in this cohort were eligible for inclusion (see Table 1).

Table 1. Cohorts, response rates

Cohort	N	Women	Baseline 2001/2002		3 <sup>rd</sup> year follow-up 2004-5	6 <sup>th</sup> year follow-up 2005-6	Postgraduate 2003/2006
			Curr. year				
A	127	58%	1 <sup>st</sup> year	113 (89%)	102 (80%)*	-	-
B	98	59%	3 <sup>rd</sup> year	95 (97%)	-	81 (83%) <sup>†</sup>	66 (67%) <sup>†</sup>
B+	39	59%	6 <sup>th</sup> year <sup>‡</sup>	-	-	33 (85%)	30 (77%)
C	117	58%	6 <sup>th</sup> year	101 (86%)	-	-	97 (82.9%)

\* Responding on both occasions, 1<sup>st</sup> and 3<sup>rd</sup> years: 98, 77%.

† Data collection not completed, 81 had received the postgraduate questionnaire; "true", pending response rate 81.5%

‡ Baseline data collection performed in 2005

#### 4.4 QUESTIONNAIRES

Participants were asked to indicate their gender (woman=female, man=male) and age. We also had register information on gender and age from the personal identification numbers, which were used to compute the distributions among non-responders. Below, the instruments used in the thesis are presented. See Table 2 scale range, Cronbach's  $\alpha$  and information on the studies in which each instrument was used. All scales are of Likert type.

##### 4.4.1 Study stress/conditions (HESI)

HESI: The Higher Education Stress Inventory was designed for this study. It was inspired by the Perceived Medical School Stress scale, PMSS (Vitaliano et al., 1989a), but is more comprehensive and also applicable in other higher educational settings than medical school, in order to enable comparative studies between students of different disciplines.

Seven items were borrowed from the PMSS scale, three of them in slightly modified versions. To identify additional issues of importance, we performed semi-structured interviews with nine fifth-year students, who were asked to describe and report on stressful aspects that they had encountered in medical school. They were explicitly asked to reflect on the different stages of medical school they had passed through and to consider various aspects of strain. Experiences from preclinical and clinical courses were considered in all interviews. Aspects indicated as stressful by the students were difficulties with role-modelling, value conflicts, limited possibilities to influence curriculum and schedule, issues of discrimination, concerns regarding the future profession and unsatisfied needs for feedback. We composed statements based on these themes, which were presented to another group of 18 medical students on the ninth semester, who also commented on the clarity and relevance of the statements. After this, some items were reformulated.

The resulting instrument, Higher Education Stress Inventory, comprises 33 statements and is neutral to discipline or educational programme. It was distributed again to groups of students of nursing, physiotherapy, social science and medicine and was found relevant and unambiguous to fill in. Some psychometric information is given in Study I and the inventory itself is found in the Appendix. The 33 statements indicate presence or absence of stressful aspects, responses are rated on a four-point Likert scale (values

1-4); “does not apply at all”, “does not apply very well”, “applies fairly well”, “applies perfectly”; with reversed order for items describing absence of stressors, so high scores are always less favourable. In the item-wise presentation in Study I, responses were dichotomised between 2 and 3, i.e. according to confirmation or rejection of the statement, and prevalence of high-scorers are presented. See the appendix for the Swedish and English versions of the HESI with scoring information.

In a factor analysis, seven factors have been extracted, with 22 items loading, which are further presented in Study I, see also Appendix II. Mean scores for each factor are computed. Some of the factors showed somewhat different internal consistencies in the three studies (I, III, IV), which indicates a lack of stability. Thus, some factors were left out in Study III and IV, where the Cronbach’s alphas were low.

#### **4.4.2 Depression, suicidal ideation, self-rated health and burnout**

MDI: The Major Depression Inventory was applied to measure Depressive symptom load and self-rated depression, respectively. The latter was computed by fulfilment of depressive criteria according to DSM-IV. It is a validated instrument that can be used for screening and diagnostics. Since we had access to comparative data from the general population, a four response alternatives version that had been used in that study (Dahlberg et al., 2007) was employed instead of the original scale’s six response alternatives (Bech et al., 2001, Olsen et al., 2003).

Suicidal thoughts and acts were assessed by Meehan’s six questions on life-time and last year presence of suicidal ideation or suicide attempts. If the respondent reports a suicide attempt, questions are asked on psychological consultation or hospitalisation in connection with the attempt, which gives an indication of the severity of the reported incident. This set of questions has been elaborated to suite a young population (Meehan et al., 1992).

OLBI (Oldenburg Burnout Inventory): A two-dimensional burnout inventory, applicable for any vocation (Demerouti et al., 2001b). The dimensions Exhaustion and Disengagement comprise 8 items each. The OLBI was translated into Swedish by our group and a version adapted for students (by permission of the authors) was also applied. The students’ and the worker version were both used. In Study II the dimensions Exhaustion and Disengagement are presented separately; in Study III, a high-burnout and a low-burnout group among students were defined by cluster analysis; and finally in Study IV, Exhaustion alone was used as outcome variable. The Swedish worker version has been used to study burnout in psychotherapists in a recent thesis, but with reversed coding (Perseius, 2006).

SRH-5: Self-rated health, five response alternatives: Very good, Quite good, Neither good nor poor, Quite poor, Poor. A validated one-item question (Eriksson et al., 2001). Response alternatives were dichotomised between “Quite good” and “Neither good nor poor” in Study II as dependent variable in a logistic regression.

### 4.4.3 Personality and related measures

HP5-I (Health Relevant Personality from a 5 factor perspective) (Gustavsson et al., 2003): A short inventory of personality facets thought to be relevant for health. Each facet corresponds, negatively or positively, to one of the five main factors. Impulsivity (- Conscientiousness) and Negative affectivity (+ Neuroticism) were used in this thesis, while the facets antagonism (- Agreeableness), hedonic capacity (+ Extraversion) and alexithymia (- Openness) were not used, partly due to low internal consistencies (0.47-0.58).

PBSE-scale (Performance-based self-esteem): Context-free version, measures performance-based self-esteem, in four items on a five point rating scale. The scale has been used in large Swedish population studies, total N=17 177 (Hallsten et al., 2005).

Table 2. Measures used, their pertaining factors, scale ranges, Cronbach's alphas and study.

Measure	Factor/variable	Scale range	$\alpha$	Study
HESI	Worries about future endurance/capacity (WFEC)	1-4	0.72-0.80	I, III, IV
	Non-supportive climate	1-4	0.71	I, IV
	Faculty shortcomings	1-4	0.69	I, IV
	Workload	1-4	0.62	I, III
	Insufficient feedback	1-4	0.65-0.67	I, IV
	Low commitment	1-4	0.62-0.68	I, IV
	Financial concerns	1-4	0.59-0.65	I, III
OLBI	Exhaustion	1-4	0.79-0.83	II, III, IV
	Disengagement	1-4	0.60-0.76	II, III, IV
MDI	Depression score	0-30	0.87	III, IV
	Self-rated depression	0/1	-	I
	Suicidal ideation and acts*	0/1	-	I
	SRH-5*	1-5	-	II
HP5-i	Impulsivity	1-4	0.73-0.81	III, IV
	Negative affectivity	1-4	0.62-0.69	III, IV
PBSS	Performance-based self-esteem	1-5	0.72-0.79	II, III, IV
	Demands	5-20	0.80	IV
DCQ	Decision latitude (control)	6-24	0.61	IV
	Job strain (Demands/Control)	-	-	IV
	Climate for learning	10-50	0.79	IV

\* Single items, no compound scales.

### 4.4.4 Working conditions and attitudes

DCQ (Demand-Control Questionnaire): The demand-control ratio; job strain was used (Theorell, 1996, Landsbergis et al., 2000). The internal consistency of the demands scale was higher than that of the control scale, see Table 2, which is consistent with previous findings in homogenous samples (Theorell, 1996, p 76).

Climate for Learning: Measures the degree of support and adaptation to the newly graduated physician at the clinic. It has been used in the Norwegian nationwide study of medical students and physicians, and consists of ten items rated on a five point scale, which are added to a sum score (Tyssen et al., 2000).

## 4.5 INTERVIEWS

MINI (Mini International Neuropsychiatric Interview): A structured interview, recommended for epidemiological studies and yields DSM-IV and ICD-10 diagnoses. In Study III, mental disorders were assessed by the Swedish version of the MINI 5.0.0 (Sheehan et al., 1998). The interviews were held by three physicians, having a minimum of one year's training in psychiatry. We did not include the modules of psychotic disorders, drug abuse or antisocial personality disorder. The outcome variable psychiatric morbidity (caseness) was defined as having a diagnosis of any of the following: Major Depression, Dysthymia, a history of Hypomania and/or Mania, Social phobia, Generalised anxiety disorder, Alcohol abuse, Alcohol dependency or Bulimia nervosa.

## 4.6 STATISTICAL METHODS

A large variety of statistical methods were used. Predominantly, parametric methods were used in spite of the ordinal quality of data. The use of methods is shown in Table 3.

Study I	Factor analysis, ANOVA, t-tests (HESI), Chi <sup>2</sup> -tests (HESI, MDI) Logistic regression (MDI, HESI)
Study II	MANOVA (OLBI, Exhaustion and Disengagement) ANOVA (PBSE) Kendall's tau-b and Spearman's Rho correlations (SRH-5; PBSE, OLBI) Logistic Regression (SRH-5, PBSE, OLBI)
Study III	Cluster analyses (OLBI), t-tests, intra-class corr. (OLBI, HESI, AUDIT, MDI, HP5-I, PBSE) Chi <sup>2</sup> -tests (M.I.N.I) Logistic regressions (OLBI, HESI, HP5-i, MDI, M.I.N.I)
Study IV	Chi <sup>2</sup> tests (demogr), t-tests (OLBI, HESI, MDI, HP5-I, PBSE, DCQ, Climate for Learning). Multiple linear regression (Exhaustion, HESI, PBSE, Hp5-I, Job Strain, Climate for Learning)

In Study I, a multiple logistic regression was carried out with self-rated depression as dependent variable and HESI-factors as independent with backward elimination. Then another bivariate regression with only gender as independent was run, not to risk that a gender effect would be masked by study stress. A use of forced entry of gender in a multiple regression would have avoided this, while still controlling the HESI effects for gender. In Study II, a MANOVA was chosen to detect differences in Exhaustion and Disengagement levels between stages of medical school, since the two dimensions were highly inter-correlated. While this choice was methodologically correct, it may have rendered the results less straightforward to the reader than would have separate ANOVAS.

## 5 RESULTS

### 5.1 STUDY I. STRESS AND DEPRESSION AMONG MEDICAL STUDENTS: A CROSS-SECTIONAL STUDY.

This is a descriptive study of study stress and depression among 342 medical students (cohorts A,B,C). Questionnaire data were used, the response rate was 90.4%. Study stress was examined by the Higher Education Stress Inventory, which was introduced in this paper. Prevalence of self-rated depression and suicide ideation/attempts were compared with controls matched by age and sex from the general population.

Fig 4a. Study stress by stage of medical school

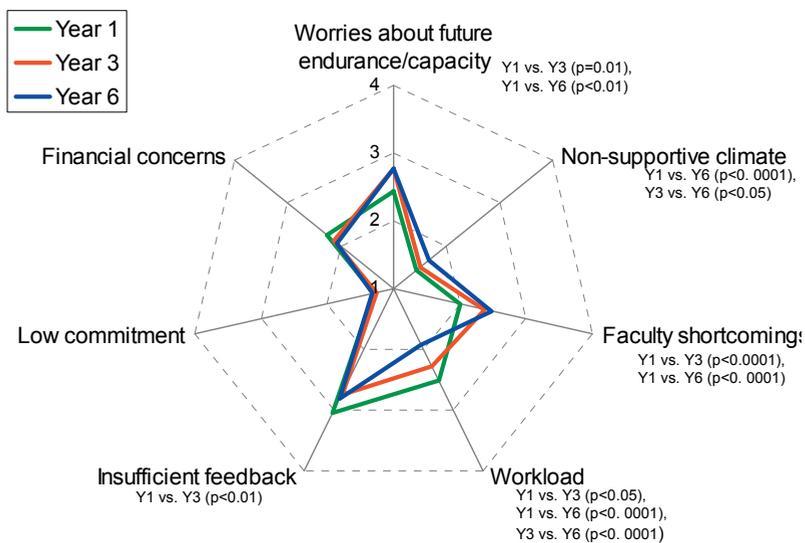
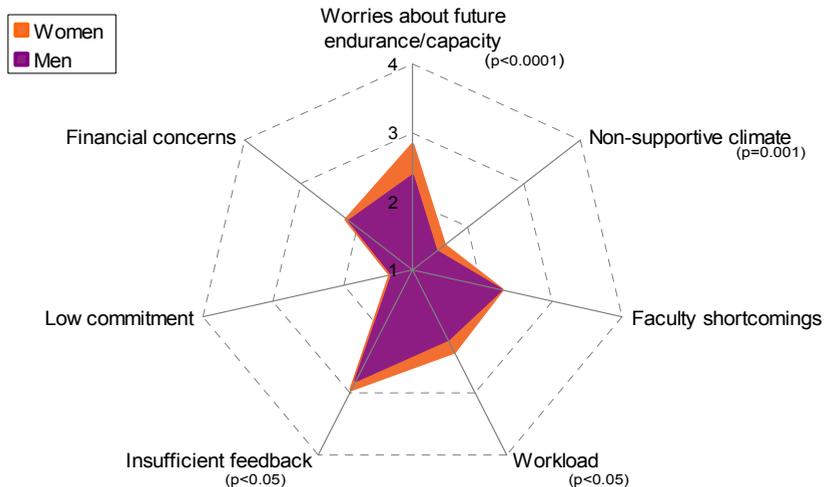


Fig 4b. Study stress by gender



An explorative factor analysis of the HESI resulted in a ten factor solution, of which seven factors were used (Fig 4). These seven factors explained 48.7% of the variance and had 24 of the 33 items loading in them.

Women students rated higher on factors *Worries about future endurance/competence* (WFEC), *Non-supportive climate*, *Workload* and *Insufficient feedback*. WFEC, *Non-supportive climate* and *Faculty shortcomings* were higher in the clinical stages, feedback complaints were highest at 1<sup>st</sup> year and Workload decreased with time.

Self-rated depression was significantly ( $p < 0.05$ ) more common among medical students (12.9%) than in the general population controls (7.8%). A greater proportion of women medical students (16.1%) than men (8.1%) fulfilled criteria; the women had 2.4 times higher a risk than men of having a self-rated depression. High levels of HESI factors *Lack of commitment*, *Insufficient feedback*, *Workload* and WFEC were all associated with increased risk of fulfilling criteria for self-rated depression.

Suicidal ideation at some time in life was reported by 28.8% and in the preceding year by 5.4%. Among the students 2.7% reported ever having made a suicide attempt, compared to 4.2% of the general population controls (not significant).

## 5.2 STUDY II. PERFORMANCE-BASED SELF-ESTEEM AND BURNOUT IN A CROSS - SECTIONAL STUDY OF MEDICAL STUDENTS.

This study is cross-sectional (cohorts A,B,C), with the objective of investigating the associations between *performance-based self-esteem* and *burnout* (measured as *exhaustion* and *disengagement*) in medical students, and how they relate to self-rated health. Questionnaire data were used, N=342, and the response rate was 90.4%.

*Performance-based self-esteem (PBSE)* levels were high among medical students, compared to other populations according to the literature and did not differ between men and women or by stage of education.

Women were more exhausted than men, but *Exhaustion* levels did not vary significantly by stage, while *Disengagement* had higher levels in later stages, without significant gender difference.

PBSE was positively associated with *Exhaustion* and *Disengagement*. *Exhaustion* (but not *Disengagement*) was associated with an increased risk of having poor self-rated health, which in turn did not differ according to gender.

*Burnout* was not associated with previous academic studies, having a physician parent, or having paid employment outside studies, but had weak significant correlations with having a history of psychological counselling.

### 5.3 STUDY III. BURNOUT AND PSYCHIATRIC MORBIDITY AMONG MEDICAL STUDENTS ENTERING CLINICAL TRAINING.

A longitudinal study of 127 medical students (cohort A), with description of changes in study stress and burnout from first year to the entering of clinical training (response rate 77%) as well as of psychiatric morbidity among third year medical students, assessed by interviews (participation rate 63%). Further, possible predictors of high burnout and psychiatric morbidity at 3<sup>rd</sup> year of medical school are studied.

A cluster analysis identified two groups; High and Low burnout, based on 3<sup>rd</sup> year scores on the Exhaustion and Disengagement scales. High burnout at third year was predicted by *Impulsive personality* and *Financial concerns* at first year and was also associated with third year *Workload*. *Performance-based self-esteem* measured at 1<sup>st</sup> year did not predict high burnout at third year.

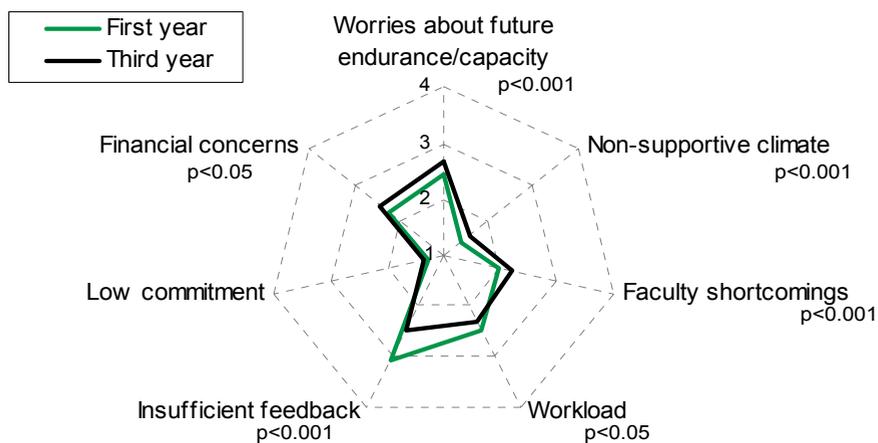
The point prevalence of psychiatric disorders was assessed, and 27% of the students received a diagnosis according to the MINI. A current psychiatric condition was not more common among high burnout individuals, but a history of depression was. *Psychiatric morbidity* at third year was univariately predicted by PBSE, depressive symptoms and *Disengagement* at first year, but in the multivariable analysis only depressive symptoms remained significant.

#### 5.3.1 Additional preliminary data on cohort A

##### 5.3.1.1 Longitudinal changes of burnout and study stress

Only three HESI factors (*WFEC*, *Workload* and *Financial concerns*) were included in the analyses in paper III, the others were excluded due to low Cronbach's alphas at first year. For a fuller description and to enable comparisons with cross-sectional data from Study I, the changes in all HESI factor's scores from first to third year are displayed in Fig 5. The changes in study stressors replicated the pattern seen between stages in Study I, except on *Financial concerns*, which increased over time in this cohort (paired samples t-test).

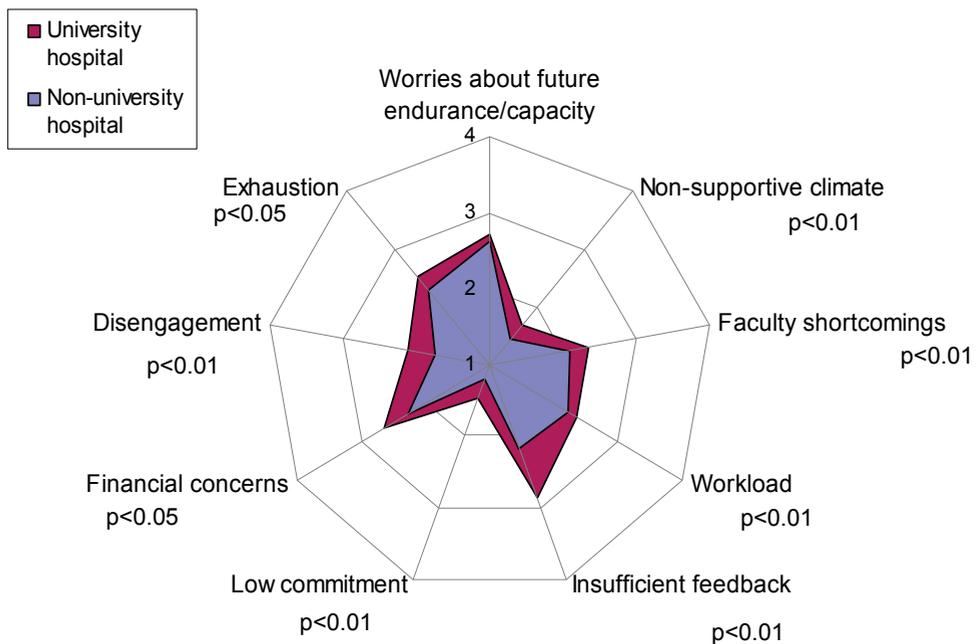
Fig 5. Burnout and study stress from 1<sup>st</sup> to 3<sup>rd</sup> year



### 5.3.1.2 Third year burnout and study stress by type of hospital rotation

Additional analyses on cohort A were performed on the levels of study stress and burnout by type of clinical rotations at third year of medical school. Scores of students doing their rotations at the two university clinics (n=41) were compared with those placed at two non-university clinics (n=53), by Independent samples t-test. The results in Fig 6, shows that students at the university hospitals were more exhausted and disengaged and also scored higher on *Non-supportive climate*, *Faculty shortcomings*, *Workload*, *Insufficient feedback* and *Low commitment* to profession than those at non-university rotations. The students attending the two to hospital types did not differ in gender distribution, personality (HP5-i), first year distress (MDI, OLBI) or first year HESI ratings.

Fig 6. Burnout and study stress at 3<sup>rd</sup> year by type of rotation



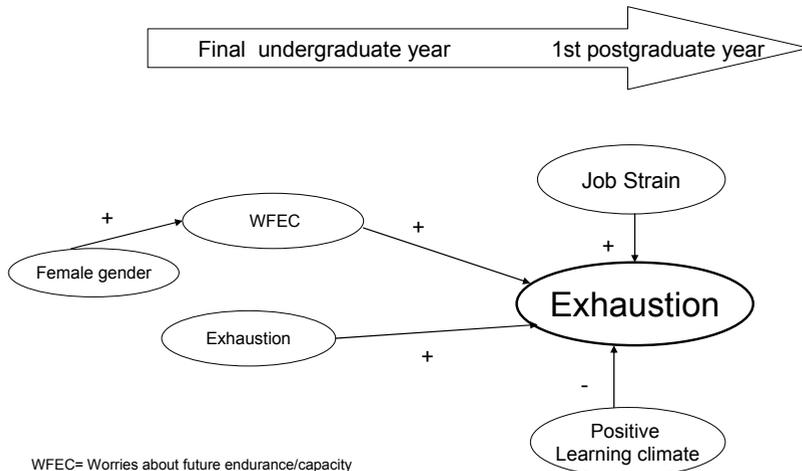
#### 5.4 STUDY IV. EXHAUSTION AMONG PHYSICIANS DURING THE FIRST POSTGRADUATE YEAR – A PROSPECTIVE STUDY ON DISPOSITIONAL AND ORGANISATIONAL DETERMINANTS

A longitudinal study of 253 final year medical students (cohorts B, B+, C), with the objective of finding a model to explain *Exhaustion* in first year postgraduates, when holding their first positions as physicians. Response rate 73.5%.

*Exhaustion* was higher in women both as students and postgraduates and it also increased among women but not among men. Further, women had higher scores than men on *Negative affectivity*, *Non-supportive climate* and *Worries about future endurance/capacity (WFEC)*, and men had higher *Disengagement* scores at final year. There was no significant gender difference in working conditions among postgraduates.

By linear regressions the following model was suggested. *WFEC* and *Exhaustion* at final year predicted *Exhaustion* among postgraduates. When adding concurrent working conditions, high *Job strain* was positively associated with *Exhaustion*, whereas a positive *Climate for learning* had a negative association. The effect of gender on *Exhaustion* was not direct, but mediated through *WFEC* (Fig 7).

Fig 7. Model of determinants of Exhaustion in the first postgraduate year.



## 6 GENERAL DISCUSSION

### 6.1 LEVELS OF DISTRESS

#### 6.1.1 Self-rated depression

Study I showed that medical students had a higher prevalence of self-rated depression than the general population, which was especially pronounced among women. These results accord with the repeatedly shown overrepresentation of depressiveness in medical students and doctors (Firth-Cozens, 2001, Wall et al., 1997). Since the controls were not matched for educational level, it is still possible that medical students are not worse off than other university students, as sometimes reported (Helmers et al., 1997, Singh et al., 2004). University students may have higher rates of distress than working people in the same age-group, which has been shown in Sweden recently as well as some 35 years ago (Sundqvist, 1973, Vaez et al., 2006).

In Study I, self-rated depression was determined by an algorithm yielding diagnosis according to the DSM-IV. Self-rated depression is not, however, equivalent with a clinically diagnosed depression. Although the MDI has shown good validity and reliability, a recent Swedish population-based study showed low accordance with interview-based diagnoses by the SCAN (Forsell, 2005). We did not perform any analyses of this kind in Study III, since cases were few and the sample limited. Furthermore, the intervals between responses of the questionnaire and the interviews were in some cases too distant for convergence analyses to seem relevant.

Suicidal behaviour was considered only in Study I, showing low levels of previous suicide attempts, as among Norwegian students (Tyssen et al., 2001b). Suicidal ideation previously in life or during the preceding year was at the same level as in the general population (Study I) (Renberg, 2001). The reported higher suicide rates among physicians (Arnetz et al., 1987, Stefansson and Wicks, 1991, Hem et al., 2005) could thus not be traced as elevated levels of suicidal ideation or suicide attempts in medical students. Physicians do not have higher rates of suicide attempts than other occupational groups of the general population (Hem et al., 2000). Rather, it is often suggested that the higher rate of complete suicides is due to the access to the means, i.e. drugs, and knowledge about how to succeed (Stefansson and Wicks, 1991, Hem et al., 2005), intoxication by drugs being the most employed method in physicians' suicide (Aasland et al., 2001).

#### 6.1.2 Psychiatric morbidity

The rate of psychiatric morbidity of 27% detected in Study III is indeed high, and interpreting the figure requires caution. It is of no benefit to anyone to overestimate morbidity, and there are anecdotal reports that medical students feel that they are fed with negativistic information such as on the high suicide risks within the profession.

The recorded figures exceed those from the few studies with interview data of medical students (Guthrie et al., 1998, Zoccolillo et al., 1986), while in a 20-year-old study of US interns, 27 % developed a depressive syndrome over the first six months of internship (Clark et al., 1984). The instruments used in these studies do not cover alcohol dependency and abuse which the variable *psychiatric morbidity* of Study III

includes. If the cases of alcohol-related disorders are excluded from it, the proportion of students with a psychiatric condition would be lower; 21%. Although we present proportions for each specific disorder that may approximate a point-prevalence estimate, the sample is too small to rule out random effects. Further, the participation rate was only 67%, which although acceptable in a follow-up interview study, still leaves too wide a space for uncertainty.

#### *6.1.2.1 Severity*

As either impaired function or significant suffering is required for diagnosis, any of these must have been present in those individuals who were assessed to fulfil criteria for a diagnosis. We know that all the interviewed students were fully active in their studies. There may have been a relative decline in the functional level of those receiving a diagnosis, but it is not likely that function was seriously impaired. We may thus assume that those depressions found were not too severe and states of social anxiety not too disabling. While the MINI is recommended for epidemiological purposes, one must still consider the possibility of over-diagnosing in a sample that is unselected as compared to e.g. patients at a primary care setting or psychiatric outpatient clinic. Further, the MINI may give false positive cases of manic disorder (Amorim et al., 1998).

### **6.1.3 Burnout**

Burnout can be apprehended as a pathologic dimension, as reflected in the diagnostic proposal of Exhaustion syndrome by the Swedish National Board of Health and Welfare (Socialstyrelsen (National Board of Health and Welfare), 2003), or as a motivational phenomenon of the individual with respect to work (Hallberg, 2005). Exhaustion was associated with poorer self-rated health, suggesting that the burnout levels recorded may be considered as aspects of distress (Study II). The fact that higher burnout was not associated with psychiatric morbidity in Study III may reflect that burnout groups were not defined according to any absolute levels or ideas of clinical relevance but only with regard to the dispersion of scores within the sample.

Burnout and exhaustion were outcome variables in studies II, III and IV. In the absence of validated cut points of the OLBI, prevalence numbers could not be determined. As mentioned above, the “high burnout” group in Study III reflects but a distribution within the sample studied and does not allow comparisons with prevalence reports from other studies. Thus, the 47% classified as “high burnout”, does not compare to the 45% reported from a North American study, where the MBI with established cut points for each subscale was used (Dyrbye et al., 2006a).

Exhaustion levels did not differ between stages of medical school (Studies II and III). There was a consistent gender effect, where women, in addition to being more exhausted than men (II, IV), also increased their levels of exhaustion in the transition to internship.

Disengagement showed increasingly higher levels by stage of education in the cross-sectional evaluation (Study II). Previous studies have shown increased cynicism and lowered engagement as students progress along medical school (Kopelman, 1983, Coulehan and Williams, 2001, Dyrbye et al., 2005).

## 6.2 DETERMINANTS OF DISTRESS

Several medical school stress factors were associated with a depressive state; most strongly *Low commitment*, *Insufficient feedback*, *Workload* and *WFEC* (*Worries about future endurance/capacity*). Determinants of later *Depression* has not been investigated, but in Study III, *Workload* at first year predicted burnout at third year, and in Study IV *Exhaustion* and *WFEC* at final year of medical school predicted *Exhaustion* in the first postgraduate year.

### 6.2.1 Vulnerability/individual factors

The relationship between *WFEC* and distress was found in studies I, III and IV. Worries about the future also predicted stress in a Turkish study, and low academic worries (PMSS) was suggested to predict stable life-satisfaction in Norwegian students (Aktekin et al., 2001, Kjeldstadli et al., 2006). There has been a growing research on worrying in later years, in general as well as clinically defined populations. Worries and ruminations as cognitive aspects are associated with GAD (Generalised Anxiety Disorder) and depression (Gladstone and Parker, 2003, Robichaud et al., 2003). In Study I, concurrent *WFEC* was associated with concurrent self-rated depression, but it did not predict later *psychiatric morbidity* in Study III.

This population had considerably higher *Performance-based self-esteem* scores (3.38, sd 0.92) than has been reported from large population-based studies. In the Swedish general population, 20-29-year-olds have a *PBSE* mean of 3.04, students of 3.17 (Hallsten et al., 2002) and from an unpublished study of employees of the public sector, physicians were the highest scoring professionals with mean 2.90 (sd 1.10, n=269) (Hallsten, 2005). *PBSE* might thus be an interesting variable to target when it comes to explaining characteristics that are specific to medical students. *Performance-based self-esteem* was cross-sectionally associated with both burnout dimensions (Study II), but did not predict high burnout at third year in the longitudinal evaluation (Study III). The effect on exhaustion in postgraduates was weak and not significant when concurrent working conditions were controlled for (Study IV). In paper III it is argued that long-term effects of *PBSE* may not be reliable, or that it just lacks predictive properties. In previous studies, intervals between measurements have not exceeded one year (Hallsten et al., 2005). The way *PBSE* was used in the studies of this thesis does also differ from the model suggested by Hallsten, which is derived from dichotomised burnout and *PBSE* characteristics; see Fig 1, page 14 (Hallsten et al., 2005). As stated in Study III and above, since high and low burnout was defined by cluster analysis, they lack clinically valid discriminative features. Further analyses of the 3<sup>rd</sup> year students showed that high *PBSE* (>3.5) (Hallsten et al., 2002) was not more common in the high burnout group. Following Hallsten's terminology, 20.6% of the students would have been labelled wornout, and 14.4% burnout. However, the studies in this thesis were not designed to test Hallsten's model, and will neither strengthen nor weaken the theoretical model of burnout as driven by contingent self-esteem.

While burnout has been associated with personality traits such as neuroticism or negative affectivity, we did not find support for that. A bivariate association was seen with Exhaustion in postgraduates in Study IV, though. The recorded relationship between burnout and Impulsivity did not seem evident at first, but the trait caught by this facet may be equivalent with such aspects as impatience and irritability that are compounds of the Type A behavioural pattern. The variable Impulsivity is constructed

as a negatively correlated facet of Conscientiousness. The impulsive individual may be less capable of strategic planning and goal-directedness. Conscientiousness, in turn, has been shown to correlate negatively with burnout and a surface-oriented approach to work in physicians (McManus et al., 2004). However, in Study IV we saw no correspondence at all between Impulsivity and exhaustion in postgraduates. This discrepancy may indicate that it is rather the disengagement dimension of burnout that is affected by Impulsivity. Alternatively, exhaustion may come about in different ways in medical school and in clinical work; this seems less plausible, though, considering that Exhaustion at final year of medical school was strongly predictive.

### **6.2.2 Organisational factors**

*Job Strain* in the postgraduates was associated with burnout or exhaustion as expected, but, in accordance with other studies, *working hours* was not (Firth-Cozens, 2001, Tyssen et al., 2005). The directions of the associations noted are undetermined, so that in the model in Fig 6, the arrows directed towards exhaustion from *Job Strain* and *Climate for Learning* may actually be reciprocal or even turned in the opposite direction. The most exhausted may perceive the strain as higher and the climate as worse.

The negative association with *Climate for Learning* supports the results from a study of job stress in Norwegian 1<sup>st</sup> year postgraduates (Tyssen et al., 2005), suggesting that there is room for improvement and support in cases where the newly graduated experience stress. As internship is a learning position, it is important that the intern is provided with supervision and that the system acknowledges that he/she is not yet to be considered a fully autonomous professional.

### **6.3 GENDER**

We found that more women students than men were affected with depression. While being consistent with conditions in the general population, a number of studies have failed to show gender differences among medical students. We also found that women medical students were more depressed than women in the general population, a difference not seen among men. The recorded higher overall prevalence among medical students in our sample can thus be largely attributed to the women. This was actually quite the opposite from Norwegian findings, where male medical students had more nervous symptoms compared to the general population than female students had (Bramness et al., 1991).

Behind the diverse findings may be e.g. national/cultural differences, or effects of different universities/ pedagogical styles, or of different admittance systems. We do not know if Swedish medical students differ from other nationalities in some relevant respects, and if so, why. Relatively similar results in this respect could have been expected in Norway and Sweden. An often cited Swedish study showed markedly higher suicide rates in women physicians, compared to other academics and to men doctors (Arnetz et al., 1987), whereas US women physicians had lower suicide rates than women in the general population (Frank and Dingle, 1999). However, later Swedish studies have shown that the suicide rate among women physicians had a tremendous peak during the 1960's, and has then decreased, as has the gender difference among physicians, while still existing (Stefansson and Wicks, 1991). In

Norway, though, there seems to be a gender effect as well as an age effect, with the highest rates among men physicians aged above 60 (Hem et al., 2005).

Women were not only more depressed but also rated higher on several study stress factors and exhaustion. Still, they did not rate their overall health lower than did their men peers (Study II). May it be that the women in our study do acknowledge and report symptoms to a greater extent than men, though they do not recognise these symptoms as health-related? If so, this could reflect gender specific response styles rather than differences in perceived health. Or, the concept of self-rated health was perceived by the responders in a strictly somatic mode and psychological suffering was not considered when responding to the question.

In studies II and IV the levels of exhaustion were higher in women students, and the findings from Study IV suggest that the effect of gender on exhaustion is mediated through *WFEC*, that is, a tendency to worry about the future. The propensity for worrying was higher among women in studies I, III and IV. This is well in line with previous research in the field of worrying and has been associated with the gender differences in rates of GAD. Further, women particularly tend to report worry concerning lack of self-confidence (Robichaud et al., 2003). In a study of identification with the role of doctor, women medical students' level of identification was lower than men's, and in women, identification depended on their confidence in own knowledge and fear of encountering demanding situations. For men, though, medical school factors were of greater importance (Gude et al., 2005). The gender-specific effects from worrying may be a fruitful path to investigate further, especially regarding long-term effects.

## **6.4 HESI AS A TOOL TO DETERMINE STUDY STRESS**

### **6.4.1 Stressors and/or stress**

The PMSS, that served as a source of inspiration for developing the Higher Education Stress Inventory, is a measure of *perceived* stress; thus as a reaction to assumed stressors. While working with the HESI, however, some of its factors seem rather to tap study conditions, or environmental aspects, such as *Non-supportive climate*, *Insufficient feedback* or *Workload*. Accordingly, we used the HESI to map different stressors in medical school. However, the factors *WFEC* and *Low commitment* may rather reflect individual traits or states, than effects of the education.

The general question about the extent to which a self-report measure captures external factors or rather states or traits of the respondent, should be kept in mind. Does then HESI measure environmental factors or does it measure the individual aspects of the respondent? The question may not be possible to answer in a straightforward way; any self-assessment of the surrounding conditions will be coloured by the respondent's personality or current mood, especially if those conditions are described in a normative way, as are many of the HESI items.

A proneness to worrisome thinking has been suggested to act not only as a stressor in itself, but also as mediating the effects of psychosocial stressors (Brosschot et al., 2006). It is shown in repeated studies that worrying, rumination and anticipatory stress have physiological effects and also effects on health. The theory is that perseverative worrying prolongs the activation of the organism. This constant alertness, acting as a chronic stress, may then have effects on metabolism, cortisol levels, heart rate

variability, the immunological system and other stress-related parameters. *Worries about future endurance/capacity* (WFEC) can hardly be claimed to denote any easily identifiable aspect of the school environment, but it may well tap the tendency to engage in anticipatory stressful thinking. It is unclear whether it reflects a state or trait phenomenon. The positive association with depression (Study I) and change over time may well indicate a state while the high intra-class correlation (Study III) may suggest that it is a trait-like dimension. Further, *WFEC* did not differ between hospital types (Fig 6, p 28) although several other factors did, thus indicating that temporal environmental features do not affect the tendency to worry. As some studies that used the PMSS have performed factor analyses and actually found one factor resembling *WFEC*, comparisons would have been interesting (Vitaliano et al., 1984, Tyssen et al., 2001a, Tyssen et al., 2005, Kjeldstadli et al., 2006). However, the factor was used per se only in one of these, where low academic worries univariately predicted stable life satisfaction, but not in an adjusted model (Kjeldstadli et al., 2006).

*Low commitment* includes two statements on whether the respondent is proud of and happy with their choice of career, both reversed. This may rather capture an attitude, or maybe a state. The variability was very small, and levels were consistently low in the present studies.

The factors *Non-supportive climate*, *Faculty shortcomings*, *Workload* and *Financial concerns*, seem to be more attributable to environmental aspects. The idea that actual features of medical school are captured is supported by the changes over time (Fig 5, p 27), which confirms the cross-sectional findings of Study I. Similarly, a study of students at 1<sup>st</sup>, 3<sup>rd</sup> and 6<sup>th</sup> years at Lund University Medical school (Jonsson and Ojehagen, 2006), having a curricular structure similar to Karolinska Institutet, showed almost identical results as those of Study I. Further, the differences between university hospitals and non-university hospitals (Fig 6, p 28) indicate that individual traits would not explain the variability in ratings.

#### **6.4.2 Stability**

The overall internal consistency 0.81 of the HESI was good, but not exceptional considering the number of items (33). Since the factor analyses performed in Study I identified several factors, a total score or one-factor solution was abandoned. The factor analysis was explorative and we have not performed confirmatory factor analyses. The inventory was not constructed from any theoretical basis, but rather with a phenomenological approach to whatever students claimed being stressful. Some of the factors did not have acceptable reliability in some subsets, especially in the first year measurements of Study III, indicating that they are somewhat instable, primarily in the non-clinical setting. A possible explanation for this may be a systematic “error”: The students that were interviewed regarding stressful aspects of medical education for the construction of the inventory were at their ninth semester (see p 20), and recall bias may have influenced the eventual inventory. Since the inventory is designed for use in different higher educational settings, further studies will be needed to examine their reliability in non-clinical settings. The HESI is quite extensive and may benefit from being shortened. On the other hand, it might be perceived as a collection of questions that may be used for different purposes, depending on the educational setting being studied.

### 6.4.3 Study stress and study conditions among medical students

The perceived lack of feedback was high at all stages of the education, however most pronounced among first year students (Study I, III). This is in accordance with recent results from a British study, where students entering medical school rated their expectations on the educational environment and then rated their opinions of the same at the end of the first year. Their actual perceived feedback from teachers was markedly lower than expected (Miles and Leinster, 2007). Feedback on skills and performance is a crucial part of educating people in medicine. Medical education has two equally important fundaments; theoretical knowledge and practical skills, each one indispensable. Medical students need feedback on both, to become competent and autonomous physicians, and teachers' interest in students' learning is a critical factor for learning (Lundberg et al., 2000). The higher scores on lack of feedback in university clinics are disturbing (Fig 6, p 28). A possible explanation may be that the two university hospitals were engaged in a major merging process at the time of the third year follow-up survey of cohort A, which may have affected the overall working climate. Further, the different rotation alternatives are not equally popular, and students' preconceptions may have had an impact on the results. Lack of feedback was associated with depression (Study I). "Encouragement and personal attention" from teachers (as one of the pertaining items concerned), may well be of importance for the psychological well-being of students, as well as their achievements (Niemi and Vainiomaki, 1999).

*Faculty shortcomings* and *Non-supportive climate* both increased along the course of studies (Study I and III), which may indicate a growing dissatisfaction over time that may in turn be associated with the elevated levels in *Disengagement*, seen in the later stages in Study II. This was not, however, explicitly studied.

*Financial concerns* deserve some special attention. As previously shown (Ross et al., 2006), it was associated with distress, at least in cohort A (Study III). As freshmen cohort A had high Financial concerns' scores in study I and their levels had increased further by third year. The three cohorts were subjected to somewhat different financial circumstances. Cohort A, who started their medical education in 2001, were the first of the studied cohorts to be subjected to the stricter rules of the study financial aid system, introduced in June 2001 (see p 3). Among them, many knew from their first semester that they would not be entitled to study aid for the entirety of medical school. As a group, they had higher levels of financial concerns than the other students which also seemed to affect their well-being.

In most Western studies where academic stressors are considered, demands, examinations, lack of support or feedback are studied. However, in a global perspective, there may be a different panorama. A Nigerian study reported that major stressor for medical students were faculty strikes and overcrowding. Financial concerns were also associated with psychological morbidity, especially in men (Omigbodun et al., 2006).

## 6.5 INDIVIDUAL AND/OR ENVIRONMENT

Is distress in medical students and interns to be attributed to the vulnerable individual, or should medical school be held responsible? It has been argued that personality is the major factor behind distress in physicians and also behind job attitudes (McManus et al., 2004); while for interventional purposes, environmental factors are the most

interesting. A pragmatic view, considering both aspects relevant (Firth-Cozens, 1989, Firth-Cozens, 1998, Tyssen et al., 2005), is supported by our results. The prospective studies III and IV are best suited to shed light on the question, however, the role of these studies in settling the “controversy” is limited.

While individual explanations, such as Impulsivity, worrisome thinking (WFEC) and gender prove relevant for distress, the importance of performance-based self-esteem was ambiguous. However, although they were statistically significant determinants in the explanatory models, the explained variance by personality or supposed trait variables was limited in the longitudinal analyses. This may partially be due to the fact that time lag itself in longitudinal studies will lead to lower correlations between the dependent variable and prospectively measured determinants compared to the simultaneously measured explanatory variables.

All risk factors may not be unequivocal. High academic performance is desirable and definitely expected from medical students. A certain degree of Performance-based self-esteem may well be beneficial and keep up motivation during a longstanding education. Maybe there is an optimal level, or an optimal balance towards e.g. worrying. The ambitious student may also need a certain degree of reward to enhance performance instead of increasing performance anxiety, which again highlights the need for feedback and recognition from teachers.

## **6.6 THE QUESTION OF HELP-SEEKING**

The problem with self-prescribing and patient’s delay among physicians is widely acknowledged and often reported on (Toyry et al., 2000, Rosvold and Bjertness, 2001). It is also perceived as a problem among medical students (Chew-Graham et al., 2003, Hooper et al., 2005). All in all, 17 (17.3%) of the students in Study III had consulted a professional because of mental problems at some time since they started medical school. However, just as many reported having had such a contact already in the first year investigation (see table 1 in Study II). Among those with psychiatric morbidity at third year 14.4% had a contact, thus the rate of help-seeking was not higher among those with clinically significant distress than among the “healthy”. For comparison, two older studies reported that among Swedish university students in 1968, 14% had sought help for mental disorders during their life-time (Sundqvist, 1973), and as many as 40% in a study of US interns in the early 1980’s (Clark et al., 1984).

## **6.7 LIMITATIONS**

There are limitations to this thesis, some of which I have mentioned in the discussion. A few more notes on this are added here.

First, almost invariably factors related to medical school were used as environmental determinants or explanatory variables of distress. Life events or extra-educational aspects may of course play an important role in explaining distress (Dyrbye et al., 2006a). Some were addressed; such as parent’s profession and previous university studies, but no stressors were asked for.

While in Study I a control population was used, matching for educational level was not possible. Since results are conflicting in the literature in this regard, it is possible that differences would be less or non-existing, had the controls been other university

students. The response rate was also lower in the study from which the controls were collected. This may have resulted in a false difference, if the non-responders of the population from which the controls were drawn had a higher depression rate than the responders.

In Study III, interviews were held, but no joint ratings were performed and we have no measure of the inter-rater reliability. Furthermore, non-responders at follow-up had higher burnout and workload scores at baseline than those who participated, which may have lead to underestimation of the levels of psychiatric morbidity and burnout.

Two of the instruments most heavily relied on in this thesis need further validation. The HESI is a new inventory, where further use in different student populations and further psychometric evaluation is needed. The Swedish versions of the OLBI have not been validated, although it is used in several ongoing studies, and more data will come forth.

Student's ethnicity was not addressed in any of the studies. Students who were born outside Sweden or had at least one parent born outside Sweden had no different levels of depression or burnout. The same was true for all study stress factors except low feedback, where students who were not born in Sweden had significantly higher levels.

## **6.8 CONCLUSIONS**

Women medical students were more depressed, more exhausted and more affected by study stress than their men peers. They were also more depressed than women of the same age in the general population. At least for postgraduate exhaustion, worries about the future mediated the gender effect. It is important to address these issues and provide support within the educational system to help students recognise their abilities in an adequate way. The lack of feedback may be especially detrimental to students for whom worrying induces or precipitates feelings of insufficiency or inadequacy. Also for pedagogical reasons the lack of feedback should be seriously addressed. Further, as previous studies have also shown, financial concerns did have an impact on distress. It also seems that those students who have received study aid since the latest restriction on maximum length of loan reception were more burdened.

These studies will not serve to tell whether burnout in medical students is common, but that increased burnout levels were associated with concurrent demands from studies or work, as expected, and further predicted by the personality trait Impulsivity and Worrisome thinking. Exhaustion was higher in women, but disengagement had no significant gender pattern. The efforts to combine the two dimensions into a single burnout entity by cluster analysis thus rendered burnout a gender neutral status.

Psychiatric morbidity was common, although probably of less severe character in most cases. Supporting the latter interpretation, the rates of suicidal ideation or suicide attempts were not higher than in the general population. However, help-seeking among those identified as cases was low, and it is well known that medical students as well as physicians do have specific obstacles to finding well-functioning health-care for themselves. This is probably specifically difficult when psychological problems are dominating. The Student Health Services at the universities primarily assist students with study-related problems or may provide short term support in a critical life situation. Students with mental disorders such as depression, bipolar disorder or alcohol dependency have to go the public facilities, where they may encounter their fellow

students or their teachers as care-givers. That is a situation that most students would want to avoid. The same is actually true for physicians.

Medical students had high levels of performance-based self-esteem, but while its relationship with concurrent burnout was clear, long-term effects were not confirmed. Rather, a long-term association with psychiatric morbidity was noted. Further research on how it relates to other traits, cognitive styles and coping strategies may be clarifying.

Finally, the commitment to the chosen career among these medical students was indeed high, and even if negative attitudes towards the education seemed to increase over time, it did not seem to spill over on the sense of having made the right choice.

## **6.9 FUTURE RESEARCH IMPLICATIONS**

Some areas to address in future research in this field are longitudinal studies to examine long-term effects of individual aspects or environmental factors such as pedagogical varieties, admitting procedures and training hospital. Further are studies with larger cohorts wanted, to gain knowledge about outcomes with low prevalence such as suicide rates. There is also some shortage of context building. Comparative studies on mental health and stressors with student populations of other disciplines and medical students of different nationalities would be valuable. Further testing of validity and reliability of the HESI in larger and more differentiated student populations would also clarify its value.

### **6.9.1 Ongoing and planned activities**

Our group has just completed data collection from a comparative cross-sectional study of 500 medical students and 500 economy students in Stockholm. Preliminary results suggests that economy students had higher levels of depressive symptoms and higher scores on *Negative climate*, *Low feedback*, *Low commitment* and *Disengagement*, but lower scores on *Financial concerns*.

The HESI has been interpreted into English and Spanish, and a Korean translation is under development. Researchers from the UK, Sri Lanka, Pakistan and Korea have requested it. Furthermore, our group has collected data from students at an Argentinean medical school of the same stages as the cross-sectional sample of studies I and II, for a comparative study.

Further follow-ups of the cohorts studied in this thesis are planned, one presently going on (cohort A's 6<sup>th</sup> year's investigation).

Students come to medical school by different routes. The interview-based admitting system at Karolinska Institutet has been operating for about 15 years. A long term evaluation on the possible effects on health and well-being with regard to the different admittance routes is planned.

In the autumn semester of 2007, a new curriculum of the medical programme will be implemented at Karolinska Institutet. The effect of this on the mental health of the students should be followed up, whereby the present study can serve as a baseline measure.

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## 9 APPENDIX I – HESI (SWEDISH AND ENGLISH)

### HESI (Higher Education Stress Inventory) Swedish version

	Stämmer inte alls	Stämmer inte särskilt bra	Stämmer ganska bra	Stämmer precis
1. Studierna präglar min tillvaro och lämnar för lite tid över för andra aktiviteter	1	2	3	4
2. Jag känner mig respektfullt behandlad av mina lärare	4	3	2	1
3. Jag är orolig för att inte kunna tillgodogöra mig all den kunskap som krävs i mitt yrke	1	2	3	4
4. Utbildningen skapar anonymitet och isolering mellan de studerande	1	2	3	4
5. Lärarna brister ofta i att klargöra utbildningsmålen	1	2	3	4
6. Studierna stimulerar min personliga utveckling	4	3	2	1
7. Yrkesrollen som förmedlas genom utbildningen strider mot mina personliga värderingar	1	2	3	4
8. Man får uppmuntran och personlig uppmärksamhet av lärarna	4	3	2	1
9. Relationen mellan de studerande präglas av konkurrens	1	2	3	4
10. Jag är nöjd med mitt yrkesval	4	3	2	1
11. Jag tycker att utbildningen bidrar till att skapa en kall och opersonlig attityd hos de studerande	1	2	3	4
12. Min ekonomi under utbildningen är en källa till oro	1	2	3	4
13. Mina kurskamrater ställer upp för mig	4	3	2	1
14. Jag oroar mig för långa arbetspass och stort ansvar i mitt framtida yrke	1	2	3	4
15. Utbildningen präglas av en atmosfär där ens svagheter och brister inte accepteras	1	2	3	4
16. Som studerande förväntas man ofta närvara i sammanhang där ens roll och funktion är oklar	1	2	3	4
17. Jag är stolt över mitt framtida yrke	4	3	2	1
18. Jag tycker att jag på grund av min könstillhörighet blir sämre behandlad under utbildningen	1	2	3	4
19. Jag har möjlighet att påverka studiernas uppläggning	4	3	2	1
20. De inblickar jag fått i mitt framtida yrke har gjort mig orolig inför den höga stressnivån	1	2	3	4
21. Studierna består till alltför stor del av passiv faktainläring och alltför lite av aktivt kunskapssökande och egen reflektion	1	2	3	4
22. Förväntningar från min familj har haft alltför stor betydelse för mitt val av yrkesutbildning	1	2	3	4
23. Min bostadssituation oroar mig	1	2	3	4
24. Jag tycker att jag på grund av min etniska bakgrund blir sämre behandlad under utbildningen	1	2	3	4
25. Jag ser många färdigutbildade inom mitt yrke förmedla uppgivenhet eller missnöje i sitt arbetsliv	1	2	3	4
26. Jag upplever att utbildningen förbereder mig väl för den yrkesroll jag går in i	4	3	2	1
27. Kåraktiviteterna stärker gemenskapen och bidrar till ett bättre studieklimat	4	3	2	1
28. Jag känner oro över min framtida ekonomi och mina möjligheter att klara studieskulderna	1	2	3	4
29. Undervisningen präglas i hög grad av gruppaktiviteter med oklara mål där alltför stort ansvar vilar på den studerande	1	2	3	4
30. Kurslitteraturen är alltför svår och omfattande	1	2	3	4
31. Studietempot är alltför högt	1	2	3	4
32. Under utbildningen förväntas jag delta i moment som är etiskt stötande för mig	1	2	3	4
33. Man får ofta feedback av lärarna på sina kunskaper och färdigheter	4	3	2	1

### HESI (Higher Education Stress Inventory) English version

	Totally disagree	Somewhat disagree	Somewhat agree	Totally agree
1. Studies control my life and I have little time for other activities	1	2	3	4
2. I feel that my teachers treat me with respect	4	3	2	1
3. I am worried that I will not acquire all the knowledge needed for my future profession	1	2	3	4
4. The studies have created anonymity and isolation among students	1	2	3	4
5. The teachers often fail to clarify the aims of the studies	1	2	3	4
6. The studies stimulate my personal development	4	3	2	1
7. The professional role presented in the training conflicts with my personal views	1	2	3	4
8. The teachers give encouragement and personal attention	4	3	2	1
9. There is a competitive attitude among students	1	2	3	4
10. I am satisfied with my choice of career	4	3	2	1
11. I feel that the studies have played a role in creating a cold and impersonal attitude among students	1	2	3	4
12. As a student, my financial situation is a worry	1	2	3	4
13. My fellow students support me	4	3	2	1
14. I worry about long working hours and responsibilities in my future career	1	2	3	4
15. The training is characterised by an atmosphere where weakness and personal shortcomings are not accepted	1	2	3	4
16. As a student you are often expected to participate in situations where your role and function is unclear	1	2	3	4
17. I am proud of my future profession	4	3	2	1
18. I feel that I am less well treated because of my sex	1	2	3	4
19. I am able to influence the studies	4	3	2	1
20. The insight I have had into my future profession has made me worried about the stressful workload	1	2	3	4
21. There is too much focus on passive learning of facts and too little on active seeking of knowledge and time for reflection	1	2	3	4
22. Expectations from my family have influenced my choice of career too much	1	2	3	4
23. I am worried about accommodation	1	2	3	4
24. I feel that I am less well treated because of my ethnic background	1	2	3	4
25. I meet many future colleagues that seem dejected or dissatisfied in their profession	1	2	3	4
26. I feel that the training is preparing me well for my future profession	4	3	2	1
27. Student union activities promote a sense of community and contribute to a better working environment for students	4	3	2	1
28. I am worried about my future economy and my ability to repay student loans	1	2	3	4
29. The education is highly characterised by group activities with unclear goals and with too much responsibility placed on the student	1	2	3	4
30. The literature is too difficult and extensive	1	2	3	4
31. The pace of studies is too high	1	2	3	4
32. The training demands that I join in situations that I find unethical	1	2	3	4
33. The teachers often give feedback on the students' knowledge and skills	4	3	2	1

## 10 APPENDIX II – HESI FACTORS

HESI factors	Pertaining items
Worries about future endurance/capacity (WFEC)	3. I am worried that I will not acquire all the knowledge needed for my future profession 14. I worry about long working hours and responsibilities in my future career 20. The insight I have had into my future profession has made me worried about the stressful workload
Non-supportive climate	4. The studies have created anonymity and isolation among students 7. The professional role presented in the training conflicts with my personal views 9. There is a competitive attitude among students 11. I feel that the studies have played a role in creating a cold and impersonal attitude among students 18. I feel that I am less well treated because of my sex
Faculty shortcomings	2. I feel that my teachers treat me with respect (rev) 5. The teachers often fail to clarify the aims of the studies 6. The studies stimulate my personal development (rev) 16. As a student you are often expected to participate in situations where your role and function is unclear 19. I am able to influence the studies (rev) 21. There is too much focus on passive learning of facts and too little on active seeking of knowledge and time for reflection 26. I feel that the training is preparing me well for my future profession (rev)
Workload	1. Studies control my life and I have little time for other activities 30. The literature is too difficult and extensive 31. The pace of studies is too high
Insufficient feedback	8. The teachers give encouragement and personal attention (rev) 33. The teachers often give feedback on the students' knowledge and skills (rev)
Low commitment	10. I am satisfied with my choice of career (rev) 17. I am proud of my future profession (rev)
Financial concerns	12. As a student, my financial situation is a worry 28. I am worried about my future economy and my ability to repay student loans