ORIGINAL RESEARCH

Millennials Medical Students Generation at the Crosswalks: Motivations and Attitudes Towards Study and Future Career – A Mixed-Method Study

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Video Abstract

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Background and Objectives: The aim of this study was to investigate in the millennium medical student generation the influence of the curriculum (problem-based curriculum [PBC] vs science-based curriculum [SBC]), gender and semester level on medical students' motives to study medicine, their attitudes toward their career and in this regard their view about their study condition in university.

Methods: Semi-structured qualitative interviews with 28 medical students were performed and analyzed using Mayring's content analysis. Based on these results, a quantitative questionnaire for a nationwide survey was developed using a mixed-method-approach and send to most medical faculties in Germany. Data from n=1053 students entered statistical analysis.

Results: Humanistic ideals prevailed in the choice to enter medical school and to become a physician. PBC students were found to be significantly (p<0.001) more idealistic and patient oriented, and they regard their curriculum more competitive than SBC-students (p<0.001). A balanced work and family life is essential for all students but particularly important for the PBC – group, male and undergraduate students. The majority of students wanted to work with patients and omitted patient-distant line of work. Undergraduate SBC-students saw their studies as old-fashioned citing lack of patient contact (p<0.001 compared to PBC), which eased in the graduate study part.

Conclusion: This study found major differences in student's perceptions depending on curriculum type. PBC-students were more idealistic, and humanistic ideals prevailed in comparison to SBC. For both, close patient contact is essential in their training. Particularly for female students, lifestyle factors and a balanced work-life-integration outweigh career ambitiousness. This study offers an important insight to policy makers and educators to understand the motivation and perceptions of the millennial student generation regarding their studies and future career plans, which should be considered in educational policies.

Keywords: medical students, career expectations, perceptions

Introduction

Medical professionalism including professional behavior towards patients have been increasingly emphasized in medical school curricula. Good interpersonal skills, knowledge and empathy of healthcare professionals toward patients ultimately lead a positive impact on patient satisfaction, compliance to treatment and care outcomes.[1–3] Besides humanistic reasoning and empathy, motivation is a determining factor to affect these professional skills, once it guides and sustains such goal-oriented activities.[4,5] The Self-Determination Theory, distinguishes between the intrinsic motivation, when activities are based on genuine interest, and controlled motivation, when external factors are the main driving motivational force.[6] Intrinsic motivated students have more deep study strategy, more self-study hours, better academic

performance and lower exhaustion from studies.[7] As an independent variable, motivation affects the choice of medicine and the specialty within medicine and intention to excel in medical study, and it can be manipulated by medical educators.[8] Externally generated motives were associated with less favorable learning behaviors. Lower motivation leads more often to burnout, lower quality of live, self-efficacy and inferior test scores.[9] Motivators for a career in health care are humanitarian ideals, societal views (job opportunities, prestige, job security), medical background of family members and scientific reasons (curiosity in scientific and medical knowledge, academia, specific medical subspecialities).[10–12] Students' motivation is based on the pursuit of different levels of needs following the Maslow's hierarchy.[13] Levels of student's motivation has been investigated at different phases of medical education finding highest motivation scores in early semesters.[14,15] Although education environment like educational contexts and teachers' autonomy-support influence motivation levels, studies to compare students' motivation in association with their curriculum type are rare and motivational processes are substantially undervalued in curriculum development.[16–18] A Brazilian study comparing motivation of students from a traditional with those studying a reformed curriculum found significant higher motivation levels in the latter, which persisted over the whole study period.[17] The switch away from the traditional curriculum reduced the medical students' levels of anxiety, improved students' metacognitive processing capacity and self-regulated learning skills.[19,20] Knowing the different determinants and effects of motivation, educators can initiate interventions that motivate students to engage more successfully in their studies, resulting in more to positive outcomes not only profiting themselves but also their patients.[16]

For centuries, students in Germany were taught a traditional science-based curriculum (SBC), starting in the first 2 (undergraduate = preclinical part) years with courses such as physics, chemistry and anatomy, lacking direct patient contact. The notion for this diachronic founded approach is, that formal analytic reasoning which is integral to the natural sciences, should hold pride of place in the intellectual training of physicians.[21] During the next (graduate = clinical part) 4 years patient contact intensifies stepwise. In the 80s, the private University Witten-Herdecke introduced a problem-based constructivist model instructional curriculum (PBC), which was around 2000s adapted also by some state universities.[22] In there, medical students are introduced to early patient contact already in the undergraduate part of their study, learning communication skills and clinical examination in the pre-clinical years with the purpose of gaining early clinical experience in combination with basic medical knowledge. This gives the unique opportunity to build a comprehensive structural model for personal identity of the millennial medical student generation by identifying various compounding factors, which also includes the curriculum type how their motivation regarding aspects of medical professionalism is evolved. With this body of knowledge, a desirable professional identity in these students can be formulated.

Aim and Research Questions

This study investigated millennial medical students of all 12 semesters – beginning with the first year (undergraduate) to the final (6th) year (graduate) – perceptions on professionalism, their motives to study medicine and their career plans. The primary aim of this study was twice:

(a) The motives to study medicine and their view about their study condition in university.
(b) The individual conceptualizations as well as the expectations towards their studies in university and how they pursue their professional career in medicine.

The secondary aim of this study was to verify whether there are significant confounders, such as gender, study curriculum and semester levels respectively. Based on the existing literature, we expected to find differences in attitudes regarding gender and semester level.[23–25]

Methods

This study uses an exploratory sequential mixed-method design, in which the information collected in the first qualitative phase (phase A) was then integrated into the second phase (phase B) consisting of a quantitative internet-based survey to affirm or dismiss the results from the qualitative part quantitatively.[26–28]

Phase A

A thorough literature search was carried out to collect themes students relate to medical professionalism with the focus on students' motives to study medicine, their motivations in medical studies and perceptions to become a medical doctor. We used the definition of medical professionalism as described elsewhere.[29,30] The following themes were extracted:

- The motive to become a physician, specifics of their studies while being at their respective university,
- Learning habits as an undergraduate and graduate student,
- Their career expectations and future challenges,
- Their personal anticipation being an intern, and
- How to balance their private life with the intended career path.

Two focused think-aloud discussions among the authors were performed a) until an agreement regarding the extracted themes from the literature, and b) in order to test and adjust the interview guide appropriately. Ill-defined questions and redundancies were clarified, and the guide revised accordingly. Based on this consent procedure, a semi-structured interview template with four themes including six subcategories was constructed:

1. Personal expectations regarding a) their time as a student and b) becoming a physician.
2. Learning habits and challenges.
3. Medical aspects (individual thoughts, error management).
4. Digital medicine (individual notion, friend or foe in patient care).

Each category/subcategory consisted of one major questions given to the interviewees. Depending on the category up to seven adjunct questions were asked as a stimulus, if needed. The questions stimulated the respondents to talk freely. This safeguarded a systematic and comprehensive assessment of attitudes, apprehensions and expectations regarding the medical training. Although the interview touches broader issues, only aspects relevant for the above outlined research questions were included in this analysis. Using this methodological approach the semi-structured interview form for a thematic analysis was chosen, as described earlier.[31]

The first author conducted the semi-structured interviews between November 2019 and March 2020. The interviews took place face-to-face (n=9) at the University Witten-Herdecke and at the Kreiskliniken Reutlingen – Ermstalklinik, Germany, or over the phone (n=19). All interviews, which lasted about 30 minutes, were electronically audio recorded and transcribed verbatim (Table 1). All the quotations in this paper were translated into English language and were double-checked by back translation as described earlier.[32] Reporting complied the consolidated criteria for reporting qualitative studies 32-item checklist (COREQ).[33] Participants were students of various semesters in German medical faculties of private or state universities. The participants were selected consecutively by chance using in part snowball until theoretical saturation of the answers had been reached. The authors approached most participants by email, some personally by the authors, and some by phone.

The only inclusion criterion was, that students must be actively study medicine in one of the German universities. They studied in the German universities of Aachen, Bonn, Heidelberg, Rostock or Witten-Herdecke; 27 were Germans, one from Austria. The age of the interviewees was between 19 and 34 years (24.6±3.1).

Phase B

Mixed methods analytical techniques with a sequential exploratory strategy were used to collect qualitative data to identify key concepts subsequently measured in an online survey.[34,35]

Development of the Quantitative Survey Instrument

Every item that was mentioned in more than twice in the qualitative interviews of part A, was translated into a question. All questions were reviewed by the authors for content validity.[36,37] This is seen as an objective judgment about the

Table 1 Baseline Data of Interviewees. All Professions and Activities Lasted ≥6 Months. Direct Transition Means = No Time Lost Between High School Exam and Entering University

Parameter	Specifics (Quantitative Study)	Specifics (Qualitative Study)
Students	n=28	n=1053
Age (years)	24.8±3.05	23.7±3.9
Gender distribution	♀ n = 17 (60.7%) ♂ n = 11 (39.3%)	♀ n = 779 (74.0%) ♂ n = 274 (26.0%)

Semester
  (1–4) = Undergraduate
  (5–12) = Graduate
	n=10 (35.7%)
	n=18 (64.3%)
		n =438 (41.6%)
		n = 615 (58.4%)

Interview time (minutes/ interviewee)	29.5±2.6	25–30

PBC-students
  Gender
  Age
	n=13
	♀ n= 5 (38.5%), ♂ n= 8 (61.5%)
	26,9±4,1
		n = 490
		♂ n= 153 (31.2%), ♀ n= 337 (68.8%)
		23,8±4,0

SBC-students
  Gender
  Age
	n=15
	♀ = 12 (80.0%), ♂ = 3 (20.0%)
	22,60±2,03
		n = 563
		♂ = 121 (21.5%), ♀ = 442 (78.5%)
		23,7±3.8

construct of an instrument, which indicates the instrument's relevance to the study's aim, how to express phrases, the wording of questions, and understanding the researcher's intended concept.[38,39] The items were then refined through another author's group discussion, and the outcome was tested through a pilot study with 4 students from preclinical and clinical settings to understand how they perceive the subject of interest to finalize the list of items. Comments and suggestions were added, overlaps were avoided, resulting in the final construct of questions.

Response to the Qualitative Survey

The online survey was sent to all medical faculties in Germany from which most forwarded the survey invitation by email to about 80000 medical students. Each contained an invitation letter and an information sheet. As an incentive, we offered 280 Amazon vouchers each 25€ per completed survey which were distributed by way of a lottery.

Data Analysis

In Phase A, the quotations were first identified as expressions of a particular factor and further categorized into the sub-themes. To increase inter- and intra-coder reliability, the authors performed the analysis of the transcribed interviews independently. An inductive content analysis was performed using Mayring's principles as also exploited by others.[40,41] From the research question, a theoretical based definition of the aspects of analysis, main categories including sub categories were formulated, which leads to coding rules of those categories. The categories were collected in an open coding agenda using the software Quirkos (www.quirkos.com), and eventually revised and formative checked for reliability within the coding process in repetitive discussions until consensus was reached (investigator triangulation). Thus, individual phases and passages summarized into one code. The final working through the texts were again checked for reliability. Prototypical text passages, categorical definitions, and rules to discern the categories were formulated. The material was completed systematically step by step and revised within the process of analysis. Using this methodological approach, the authors followed quantitative inquiry approaches, which is also the cornerstone of grounded theory.[42] However, instead of generating a formal theory, the intention of this qualitative content analysis was to use the results to develop a protocol, which was incorporated into a questionnaire of a quantitative inquiry (Phase B).

The authors developed a quotation tree during the transcription of the interviews, consisting of three main categories (Figure 1 Supplement):

- Students' choice.
- Career options.
- Study related statements.

Likert scale questions (ranging from 0=decline/do not know to 7=completely agree), questions with a percent scale from 0 to 100 and questions with the option of three answers (do not know, false, fully agree) were used. An item was considered a "firm perception" when the mean response was within one-third of the lowest/highest possible answer scores. Statistical analysis was performed in the quantitative study part using SPSS (V27). Only complete data sets were analyzed. Data sets being prematurely terminated by the students were omitted. Descriptive statistics were used to summarize student demographic data. Cronbach's alpha was calculated to assess internal consistency of categories of professional behavior in the students' choice paragraph (Table 2). Mann–Whitney-*U*-Tests were used to compare the responses relating to perceptions. Group comparators were curriculum type, gender and semester levels. Pearson correlation coefficient was calculated to compare students' socio-humanistic attitudes towards their intention to a career in medicine. For the determination of work schedule preferences between student groups, the Chi-Square test was used. A p-value of less than 0.05 was considered statistically significant.

Ethics

Informed consent confirmed voluntarily participation of each individual participant at the beginning of the survey. All participants of the qualitative study part agreed to the audio recording, either verbally or in written form. By designating each student a code through a computerized assignment system, anonymity, confidentiality and data security was guaranteed. Prior to the first interview ethical approval for the study from the University Faculty of Medicine and Dentistry Committee for Ethics at the University Witten-Herdecke (#137/2919), Germany were obtained.

Results

For phase A 17 women and 11 men were recruited. Thirteen students came from a university with a problem-based curriculum (PBC) and 15 were taught with a science-based focus (SBC). In phase B 1053 questionnaires were analyzed. The response proportion was ca. 1.3%. In both study phases women prevailed which roughly represents the gender distribution in German medical schools (2020/2021: male 36.8%, female 63.2%, https://de.statista.com, July 02, 2022). Table 1 summarizes the baseline characteristics of all participants.

Student's Choice

In the qualitative study part, social and humanistic reasoning prevailed as the major motive to study medicine, like wishing to help patients, to heal diseases, compassionateness besides the fascination of understanding the scientific foundation of underlying diseases. All of the students gave statements like.

"It is fascinating to work with humans, share their grief, and to deal with their emotions".

Some patients expressed socio-economic centered motives like job security and broad professional job opportunities, or they were unable to give a concrete reason, had simply luck in the state-run distribution system or – in one case and due to an indecisiveness – medicine was chosen because "a close friend suggested it".

On average 80% of students in the quantitative study part made their decision to become a physician goal oriented before applying for a place at a medical college (Table 2). 86.6±21.7% of PBC-students vs 80.8±21.3% of SBC-students (p<0.001) decided to study medicine in a goal-oriented manner. Although all students favor a humanistic reasons over economic motivations for becoming a physician, clearly PBC-students dominate in this reasoning over SBC-students (73.8±23.2% vs 65.6±25.7%, p<0.001, Table 2). For PBC-students medical profession is more an active duty for humanity than a scholastic occupation compared to the SBC-group (43.2±21.8 to 42.3±23.7, p<0.001, Table 2). We found no gender differences. When asked whether they perceived the medical profession primarily as a service for humans or as a somewhat detached scholarly activity, students had a quite balanced view although tending to the first. Pearson correlation coefficient revealed that goal-oriented modus operandi to apply for a place in medical college correlated significantly (although with a low correlation coefficient) with social and humanistic attitudes towards the

Table 2 Incentive to Study Medicine and Vision

Questions	PBC (n=490)	SBC (n=563)	Male (n=274)	Female (n=779)	Total sum (n= 1053)	Cronbachs α
How did you decide to study medicine ? By chance (0) vs goal-oriented (100)	86.6±21.7	80.8±2.3	86.6±21.7	80.8±25.3	83.5±23.9	0.462
Group comparison	p<0.001		p=0.839			
What do you imply with becoming a physician? A job for a living (0) vs a mission (100)	73.8±23.2	65.6±25.7	73.8±23.2	65.6±25.7	69.4±24.9	
Group comparison	p<0.001		p=0.075			
Medical profession means for me more handicraft (active duty for humanity =0) or more a scholastic occupation (100)	43.2±21.8	42.3±23.7	43.2±21.8	42.3±23.7	42.7±22.8	
Group comparison						

profession. Factors like the desire for helping people and the ability to provide healing and support correlated clearly with social and humanistic attitude (depending on the comparison p<0.0001 or p=0.036, Table 3).

Career Options

Most students start medical school with some idea about a specialty choice and most of them articulated at least some preferences when specifically asked. Even those with a strong preference acknowledged that the career preference might be subject to change with further training.

Table 3 Pearson Correlations Coefficient. There is a Strong Correlation Between the Decision to Become a Doctor, Socio-Humanistic Attitude Towards the Medical Profession and Empathy. Sig = Significance. Numbers in Parenthesis in the First Column = Rating Points Interviewees Could Give in Selected Question

		How did you Decide to Study Medicine ?	What do you imply with Becoming a Physician?	Medical Profession Means for me More Handicraft or More a Scholastic Occupation ?
How did you decide to study medicine ? By chance (0) vs goal-oriented (100)	Pearson-correlation	1	0.318**	−0.065*
	Sig. (2-sided)		0.000	0.036
	N	1053	1053	1053
What do you imply with becoming a physician? A job for a living (0) vs a mission (100)	Pearson-correlation	0.318**	1	−0.140**
	Sig. (2-sided)	0.000		0.000
	N	1053	1053	1053
Medical profession means for me more handicraft (active duty for humanity =0) or more a scholastic occupation (100) ?	Pearson-correlation	−0.065*	−0.140**	1
	Sig. (2-sided)	0.036	0.000	
	N	1053	1053	1053

Notes: **Correlation significant with < 0.01 (2-sided). *Correlation significant with 0.05 (2-sided).

After medical school, almost all graduates planned to start residency training in hospitals for learning purposes. Ultimately, most students from both groups saw their future in a private practice either as a general practitioner or as a specialized private practitioner (eg in psychiatry, pediatrics, dermatology). The following reasons were given: personal decision-making authority in contrast of staying low in "the food chain" when working in a hospital, better for family planning, lack of shift work, having free weekends, and relatively independence from others including a superordinate administration.

> In the first years [after graduating] I definitely see myself in the clinic. To do really good medicine and to learn a lot. But I think it's quite likely that I'll switch to a private practice later on. (PBC, WH805)

Working in a team rather to be alone, care of challenging cases, and intense medical training provided in hospitals were reasons for that decision. The responses from the individual interviews nicely matched with the data from the qualitative study part. Students clearly preferred to do patient care, preferably in the hospital, but also as a family doctor in a practice (Likert scale about 5 vs about 4, Table 4). This was more noticeable in the PBC- and in the graduate student group choosing a Liker rating >5 (Table 4). Patient remote activities (eg laboratory work, pathology, pharmaceutical industry, government institutions) were from minor interest (Liker rating ≤3), although male students preferred those more, than female students (p<0.001). Differences between PBC/SBC or graduation level were not found (Table 4). These attitudes prevailed even when asked for their long-term (>15 years after graduation) career plans. An academic career is perceived as an equivalent option to working in a non-academic hospital or as a family doctor, although female students preferred the private practices (mean Likert scale 4.8±1.7 vs 5.3±1.5, p<0.01) because of the assumed and desired lower working hours (Table 4, Table 1 Supplement, Figure 1).

Regardless of gender, curriculum type or graduate level 60% to 70% of the students preferred a well-adjusted balance of family, lifestyle, profession and business, although PBC-students (0–100 rating: PBC 39.3±24.7 vs SBC 34.5±22.8, p=0.01), male students (male 41.5±26.3 vs female 35.0±22.6, p=0.01) and undergraduate students (undergraduate 39.8±23.5 vs graduate 34.5±23.8, p<0.001, Table 2 Supplement) all rate the professional engagement over the work-life-balance significantly higher than their comparators respectively. Although indicating their earnestness to engage themselves in the medical field, >50% were unwilling to let their work dominate their private live. Family allegiance and sufficient spare time had a high priority (Table 2 Supplement). Other desired work specifications for of all interviewees were (rating in Liker scale ≥4.3): pleasure at work, good learning opportunities, adoption of responsibility and job security, but not necessarily high wages (Table 3 Supplement).

Study Related Statements

In the first part of this study, students expressed the desire to go deeper into the curriculum in order to get the best training and therefore the foremost foundation to become a good health professional. The SBC- but not the PBS-group expressed their concerns that the curriculum is too science-based and lacks practical bearing necessary for the management of patients.

> … I wish, we had more practical courses, because we were taught from time to time in hospitals but without seeing patients. Otherwise we are standing somewhat shaky in front of real patients in medical clerkship.

The quantitative data confirmed that SBC-students regard PBC as clinically more applicable. Graduate students accented this notion particularly (p<0.001). Non-curricular study properties like socialization and fun are rated equally important to medical training in all groups, and women significantly prefer flexible study hours (p<0.001, Table 4 Supplement), which matches nicely with their higher ratings for a good work-life-balance (p<0.01, Table 2 Supplement) compared to their male counterparts.

Perceptions about different aspects of the study varied considerably between the three groups. While PBC is characterized by frequent patient interaction in undergraduate level, and students enjoy a holistic teaching approach, SBC students wished the same but perceived the first two study years as more clinically distant (0 = early patient contact to 100 = clinically distant rating: PBC 47.7±26.4 vs SBC 57.6±27.7, p<0.001), regard them comparably old fashioned (0 = old fashioned to 100 = modern: rating: PBC 67.0±23.0 vs SBC 47.0±22.5, p<0.001) and as a less competitive in medical training (rating: PBC

Table 4 Preferred Working Condition and Career Directly After Graduating from University

| My Personal Focus as a Physician Will be Do not Know (=1), Declined (=2) – Fully Agree (=7)	Do not Know	PBC	SBC	Male	Female	Undergrad.	Graduate
Working with patients	1.4%	6.5±0.9	6.3±1.2	6.4±1.0	6.4±1.1	6.3±1.1	6.5±1.0
Group comparison		p = 0.04		p = 0.098		p = 0.029	
Working as a GP in private practice	7.3%	4.0±1.8	3.9±1.7	3.9±1.7	3.9±1.8	3.9±1.8	3.9±1.7
Group comparison		p = 0.283		p = 0.970		p = 0.867	
Working as a specialist in private practice	5.9%	5.0±1.7	4.9±1.6	4.9±1.6	5.0±1.6	5.0±1.7	5.0±1.6
Group comparison		p = 0.276		p = 0.117		p = 0.866	
Working in a hospital	3.6%	5.2±1.7	5.1±1.6	5.5±1.4	5.0±1.7	5.0±1.	5.2±1.6
Group comparison		p = 0.571		p < 0.001		p = 0.139	
Direct patient contact (Internal Medicine, Surgery)	2.6%	6.1±1.3	6.0±1.4	6.1±1.2	6.0±1.5	5.9±1.5	6.2±1.3
Group comparison		p = 0.250		p = 0.631		p<0.001	
Non-direct patient contact (Laboratory, Pathology)	3.3%	2.9±1.2	2.9±1.2	2.9±1.2	2.9±1.2	3.1±1.3	2.8±1.1
Group comparison		p = 0.526		p = 0.9.16		p = 0.001	
Patient-distant work	7.3%	2.6±1.2	2.7±1.2	2.9±1.3	2.6±1.2	2.6±1.2	2.7±1.2
Group comparison		p = 0.156		p < 0.001		p = 0.002	
Pharmaceutical industry	4.3%	2.4±1.0	2.5±1.0	2.7±1.1	2.4±0.9	2.4±0.9	2.5±1.0
Group comparison		p = 0.394		p < 0.001		p = 0.994	
Official institutions like WHO, government	5.5%	2.8±1.3	2.9±1.3	3.0±1.3	2.8±1.3	2.8±1.3	2.9±1.3
Group comparison		p = 0.231		p = 0.069		p = 0.1.50	
Medical Publisher	4.9%	2.5±1.0	2.6±1.1	2.6±1.0	2.5±1.1	2.5±1.1	2.6±1.1
Group comparison		p = 0.067		p = 0.459		p = 0.184	
Working in health politics	5.4%	2.8±1.3	2.7±1.2	3.0±1.3	2.7±1.2	2.8±1.3	2.7±1.2
Group comparison		p = 0.384		p < 0.001		p = 0.765	
I intend to work at least temporarily abroad	37.7%	UD: 40.2%	UD: 34.1%	UD: 33.9%	UD: 38.0%	UD: 37.7%	UD: 36.4%
		No: 34.9%	No: 34.6%	No: 40.5%	No: 32.7%	No: 31.7%	No: 36.9%
		Yes: 24.9%	Yes: 31.3%	Yes: 25.5%	Yes: 29.3%	Yes: 30.6%	Yes: 26.7%

Abbreviations: GP, general practitioner; UD, undecided.

competitiveness 72.1±21.7 vs SBC competitiveness 47.0±22.5, p<0.001). PBC-, male- and undergraduate students rated their relationship to the faculty significantly better than their respective counterparts (Table 5).

Discussion

This study consists of an exploratory part (phase A), which served as a template for a quantitative questionnaire (phase B) to explore the motivation of the millennials generation medical students towards key aspects of medical professionalism. The findings extracted from the second study phase validated the results from the first phase.[27]
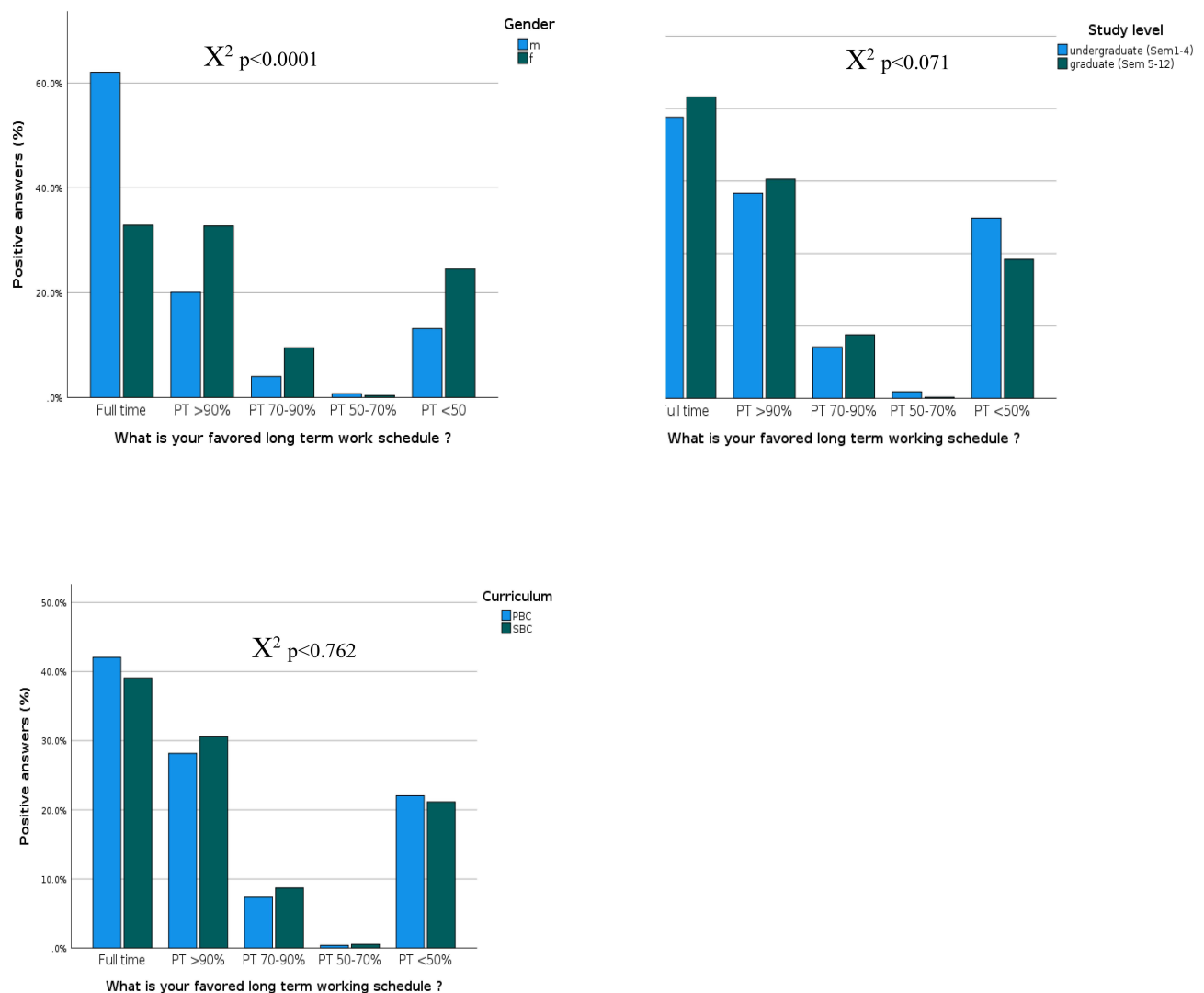
Figure 1 Men mostly favor full time job assignments while women prefer part time jobs in the long run. Regardless of curriculum type or study level about 20% favor part time jobs with <50% working schedules.
Abbreviations: PT, part time; m, male; f, female; sem, semester; PBC, problem-based curriculum; SBC, science-based curriculum.

Students' Choice

Before the 19th century, women were considered unable to be doctors, which changed later gradually. In this study, women prevailed by almost 4:1 over men which is exceptionally high even compared to other recent surveys from developed countries. Many determining factors were cited for choosing the medical career such as interest in science and academia, social interest, but also socio-economic factors including flexible working hours and work independence, prestige, job and financial security, and interest in humanitarian topics.[13,43,44] The qualitative part of this study validated this reasoning. The decision to study medicine was very much goal-oriented and had a strategic objective which has been reported earlier.[45] In addition, this study found that PBC students had a significant higher intrinsic motivation to study medicine and associated their future engagement in healthcare more often with humanistic ideals than the SBC group. These perceptions was evenly distributed among sexes, which is in contrast to other studies stating higher motivation levels in females.[46–48] Although speculative, these gender differences might be due to the heterogeneous study admission process for medical students in Germany. The admission is primarily based on high school GPA. But students can improve their acceptance chance with a cognitive test as well as an situational judgment tests and job experiences, which – however - are graded quite differently depending on the university.[49,50] Once we recruited medical students in a nationwide survey, gender differences were probably diluted by this selection processes.

Table 5 Medical Students' Perceptions Toward Their Studies as a Good or Bad Preparation for Becoming a Medical Doctor

Question	PBC	SBC	Male	Female	Undergrad.	Graduate
What do you prefer in the undergraduate studies: early patient contact (0) or scientific basics (100)	47.7±26.4	57.6±27.7	55.5±29.8	52.2±26.6	52.5±26.6	53.4±28.1
Group comparison	p < 0.001		p = 0.090		p = 0.510	
Is it important to teach medicine atomistic (separated by diciplines) (0) or holistic (100)	69.9±27.2	67.8±24.4	66.8±26.7	69.5±25.3	69.2±26.1	68.6±25.5
Group comparison	p = 0.013		p = 0.265		p = 0.535	
In undergraduate studies I got a good impression for later studies and medical profession: not all (0), fully agree (100)	50.2±25.9	31.1±22.7	43.1±27.5	38.9±25.4	47.7±25.2	34.4±25.3
Group comparison	p < 0.001		p = 0.048		p < 0.001	
Undergraduate studies were clinically distant (0), clinically relevant (100)	59.2±	29.7±21.6	46.7±28.5	42.3±27.5	48.8±27.6	39.6±27.4
Group comparison	p < 0.001		p = 0.025		p < 0.001	
My study as old fashioned (0), modern (100)	67±23.0	47.0±22.5	55.9±25.8	56.4±24.5	62.4±24.2	51.9±23.4
Group comparison	p < 0.001		p = 0.939		p < 0.001	
Is the relationship to the faculty disgraceful (0) or supportive (100)	74.4±20.3	65.2±22.8	72.1±22.4	68.6±22.0	74.6±22.3	66.6±21.6
Group comparison	p < 0.001		p = 0.009		p < 0.001	
How were your lectures emphasized: inadequate (0), adequate (100)	59.7±23.4	51.7±23.1	53.9±24.7	55.9±23.2	61.0±21.4	51.4±24.3
Group comparison	p < 0.001		p = 0.440		p < 0.001	
Which curriculum is more competitive: SBC (0) or PBC (100)	72.1±21.7	67.4±23.2	67.7±24.1	70.2±22.0	71.3±20.9	68.3±23.7
Group comparison	p < 0.001		p = 0.238		p = 0.107	

Medical students regard a balanced combination of academic workload as well as the absorption into a clinical environment with their private live essential for their well-being.[51,52] An effective work–life balance protects against risks like anxiety, depression and stress.[53] In this study, personal maturity, social contacts and pleasure at work were seen as equally important, and work–life-balance prevails over fascination for profession and career in PBC, male and undergraduate students even more than in the comparator groups respectively. However, when asked for their preferred working hours, more women than men wanted to work part time although a sizable proportion of men (39%) declined to work full time too, which is high in comparison to Japanese and Australian studies but similar to a surveys from Chicago and Germany.[52,54–56]

Career Options

The majority of the students from this study preferred direct patient contact for their future career path, which is in concordance with numerous studies in the past.[57] This tendency increased in graduate level or with higher semester level.[58] Male and female students expressed similar attitudes regarding the preferred work setting (GP, specialization), although the first favor hospital work at the beginning of their medical training more than the latter, the majority of all students aim for a private practice because of presumed flexible working hours as a GP. Curriculum or semester level had

no influence on this attitude. In other European studies medical students' career plans varies between becoming a family doctor (GP) or the desire to further specialize.[59–62] Because students in the qualitative study part were undecided what subspeciality to choose and how they want to specialize in the future, claiming that they lacked the appropriate information or not having attended specific medical courses, we included questions of students' attitudes of more general profession types like patient distant professions. Very clearly, a patient distant career option was not within the scope of almost all interviewees. Male students had in some of those professions statistically more positive attitudes than women. Tendency in favor of direct patient care in contrast to patient-distant careers mitigated even more with further study time. Working in the pharmaceutical industry or for a medical publisher was seen as least attractive. This aspect was only rarely investigated in the literature. But also job opportunities in eg pathology, in a laboratory or for administrative institutions (eg WHO) had a low priority and matched earlier reports.[63,64]

An academic career or research-oriented careers including entering a PhD program were seen as an equivalent options in this study. Significantly more PBC, male and undergraduate students expressed their interest in working in academia and research than their comparators. Besides non-minority status, male gender, lower debt at graduation, strong attitudes toward research at time of graduation, and greater social pressures also a patient – centered curriculum and study level are associated with a positive perception toward a career in medical research.[65] Unexpectedly, less SBC-students wanted to pursue an academic career, which contradicted the results from the qualitative study part. In systematic reviews and a meta-analysis of 75 studies with almost 900,000 individuals performed in other developed countries, up to 80% of students expressed interested in academic work being higher than in this study.[25,66]

Study Related Statements

This study found significant differences between PBC and SBC students regarding their perceptions of the undergraduate study years. While PBC students enjoyed early patient contact and rate their relationships to faculty members high, SBC-students rated those first 2 year as old-fashioned, clinical distant and less competitive. These data hint a difference in students' motivation depending on curriculum type. Studies studying the effect of different curriculum types on students' motivations in studying medicine and learning are rare. Del-Ben et al (2019) found that students with the reformed curriculum (small group discussions, clinical activities with real patients, promoting active learning methods) had higher autonomous and controlled motivation than those of the traditional (science based, mainly lectures) curriculum.[17] Clearly teaching methods can improve or weaken motivation levels. For example, the introduction of standardization in medical education, problem-based and learner-centered methodologies improved students' cognitive and metacognitive processing.[18]

Limitations

This study has a few limitations: a) It covers a broad spectrum of different aspects regarded as important for professionalism building in medical students, but did not investigate each theme in depth as done as other investigations. b) The second part of the study was based on the results of the quantitative section omitting the use of validated questionnaires in specific areas of professionalism themes. c) The statements/questions may not reflect scientific clarity. The reason was that these statements and consequently the questions are based on the qualitative study part. This issue was addressed through a discussion of each item by the authors and by testing the questionnaire in a pilot study with students (see methods). d) although the questionnaire of the second study part was send to the majority of medical students in Germany, only a fraction replied bearing the risk of a selection bias. e) This study was carried out solely in Germany and as such not necessarily mirroring students' perceptions in other countries or regions, although the comparison with comparable studies done in other developed countries revealed, depending on subthemes of professionalism, similar results.[58,67]

Conclusion

In this study for the first time to the authors' knowledge, the influence of curriculum type, gender and educational level was investigated in parallel on professionalism forming in medical students. Important themes students were aware of, included their specific intention why they choose to study medicine, educational specifics of the curriculum, career

expectations including thoughts of work-life-balance and attitudes towards becoming a "good doctor". Students expressed clear thoughts about central aspects of medical professionalism also in undergraduate level, which matched with their focused strategy to get admitted to medical studies. Humanistic ideals prevailed in the choice to enter medical school and to become a physician. PBC students were found to be more idealistic and patient oriented as well as more "faculty supportive". They consider their curriculum more competitive. Gender differences comprised on the acceptance of more working hours but also being more flexible in accepting a patient-distant line of work. Undergraduate SBC students saw their medical studies as old-fashioned citing lack of patient contact. This however, mitigated in the graduate study part. A balanced work, family and lifestyle was essential for all students. Predominantly women but also almost 40% of the men desired part-time engagements. Obviously, medical students who represent the coming generation of physicians have very distinctive thoughts about their medical training, their time in university, their professional career and achieving a satisfactory work-life effectiveness.

This study offers in important insight to policy makers and educators to understand the motivation and perceptions of the millennial generation to accommodate educational policies in university and later with the beginning of medical training and specialization.

Ethics Approval and Consent to Participate

Every participant confirmed informal consent at the beginning of the survey. All participants of the qualitative study part agreed to the audio recording, either verbally or in written form. The study was performed in accordance with the Declarations of Helsinki. Confidentiality was warranted through an anonymization process. Ethical approval of the study was obtained prior to the first interview from the University Faculty of Medicine and Dentistry Committee for Ethics at the University Witten-Herdecke (# 137/2919).

Author Statements

All co-authors authorize Adrian Gillissen to submit the research article. A. Gillissen, T. Kochanek, M. Zupanic and J. Ehlers are the sole authors of the article and are legally able and entitled to submit the article and authorize Dove Medical Press (DMP) to publish the research article. We, the authors certify, that the research article is original, has not already been published in any other journal (medical, or otherwise) or is not currently under consideration for publication by another journal, and does not infringe any existing copyright or any other rights prescribed by law. The article contains nothing that is unlawful, defamatory, or which would, if published, constitute a breach of contract or of confidentiality. Due care, diligence and all other requisite investigations were carried out in the preparation of the research article to ensure its accuracy. To the best of our knowledge, all statements contained in it purporting to be factual are true and correct.

Data Sharing Statement

The datasets used and/or analyzed during the current study are available from the corresponding authors on reasonable request.

Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising, or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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Disclosure

The authors declare that they have no competing interests.

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