1 Introduction
1.1 A lifecourse approach to adolescents’ reproductive health in Bangladesh

Monowara, now a 31-year-old mother, married and moved in with her in-laws at the age of 12 years. Then she had not yet reached menarche, the first menstruation. Menarche occurred one year later, when she was 13 years old. She menstruated three times before she got pregnant. She was still 13 years old at that time. When she was seven months pregnant, her husband died. Her in-laws sent her back to her father’s house. Two months later, at the age of 14 years, she delivered her firstborn, a girl. When Monowara was 16 years old, her parents arranged a second marriage for her. She got pregnant after six months of marriage and gave birth to - at the age of 18 years - her second daughter ‘Beauty’.

Adolescents in Bangladesh

Beauty is one of the girls enrolled in our study on adolescents’ reproductive health, which was conducted in Matlab, a rural area in Bangladesh. Adolescence is a challenging stage in life, the stepping stone for a child to reach adulthood, and generally defined as the period from 10 to 19 years (UNFPA 1998a, p. 1). The term adolescence is also referred to as the period of puberty. The biological ethology of both concepts is reflected in the related Latin words pubertas (fertile age), pubescens (be covered with hair, arrive at puberty) and adolescere, meaning growing up to adulthood. In 2000, 24 per cent of the population in Matlab comprised adolescents (ICDDR,B 2002a, p. 22). In Bangladesh on the whole about 25 per cent of the population falls within the adolescent age group (Population Council 2002, p. 1). Due to this large proportion of adolescents - or rather the country’s young age structure - it is estimated that Bangladesh’s population will amount to 265 million by the year 2050 (ICDDR,B 2002b, p. 75). This constitutes a considerable increase given that the country’s population stood at 120 million in 1995 (MWCA 1997, p. 4).

Despite being generally delimited by age, adolescence is primarily a social classification based on physical, mental and social markers of development, of which the origins are partly laid in early childhood (embedded within for instance the process of physical maturation and socialisation). The importance of this stage in life has far-reaching implications: adolescence is increasingly seen as the ‘gateway to health’ because behavioural patterns acquired during this period tend to last throughout adult life (Dehne and Riedner 2001, p. 11). In general, the stage of adolescence includes many, often complex, processes and rites of passage, such as the reaching of menarche and spermarche (often indicated by the first self-reported ejaculation of boys as proximity), developing close friendships, dealing with peer pressure, struggling with identity, becoming aware of one’s sexuality, developing ideals, and adopting and taking examples from role models. In addition, in Bangladesh adolescence is for girls also a very - perhaps even the most - ‘demographically dense’ phase in life, as “more demographic actions occur during these years than at any other stage of life” (Islam and Mahmud 1995, p. 22).

---

1 Names in this thesis have been altered to protect the identity of the persons concerned. The story of Monowara and her daughter Beauty has been pieced together from information collected during the fieldwork conducted for this study.
Currently, 48 per cent of the 15 to 19-year-old girls in Bangladesh is married (Population Reference Bureau 2000, p. 21). Historically, mean age at first marriage has been low in Bangladesh: for instance, 12.3 years in 1975 and 14.8 years in 1989 among ever-married women (Islam and Mahmud 1995, p. 23). In Matlab, the mean age at first marriage for girls gradually increased from 16.0 to 18.9 years between 1975 and 1996 (Razzaque et al. 1998, p. 74). Because the low average age of marriage started to increase only three decades ago, the concept of female adolescence is considered a “recent development” in Bangladesh (Caldwell et al. 1998, p. 146). Corresponding average ages at marriage for men in Matlab in these years were 24.5 and 26.0 years respectively (Razzaque et al. 1998, p. 74). Births to adolescent girls aged 15 to 19 years make up 18 per cent of the total fertility rate (TFR) in Bangladesh. The TFR in this country is 3.3 (Population Reference Bureau 2000, p. 21). In 1993-1994, no less than 21 per cent of the adolescent births in this country were unplanned (TAGI 1998, p. 52-53). The proportion of girls in Bangladesh who have given birth by the age of 20 years is 63 per cent (Population Reference Bureau 2000, p. 21). Less recent data show that 20 to 24-year-old women in Bangladesh who had a child by the age of 15 and 18 accounted for respectively 11 per cent and 47 per cent in 1993-1994 (Singh 1998, p. 121).

Education seems to be a factor of singular importance in this respect: in Bangladesh the proportion of 20 to 24-year-old women having a child before the age of 18 was 54 per cent in 1993-1994 among those with less than seven years of schooling and 19 per cent among those with seven or more years of schooling (TAGI 1998, pp. 52-53). A similar pattern is found in Matlab (Shaikh 1997). In addition, employment may delay early marriage and childbearing, as illustrated by research among adolescent garment factory workers (Amin et al. 1998, pp. 185-200). Pregnancy and childbirth are leading causes of death among adolescent girls in developing countries. In Bangladesh the risk of maternal mortality may be five times higher for mothers aged 10 to 14 as compared to mothers aged 20 to 24 years (Mayor 2004, p. 1152). Often risks are further elevated because pregnant adolescent girls are less likely to undergo antenatal and obstetric care (WHO 2003, p. 36).

ICPD and the early life paradigm

Manifold appeals advocating adolescents’ well-being (for instance IPPF 1994; Kabir 1997; UNFPA 1997; UNFPA 1998a; UNFPA 1998b; UNFPA 1999; Dutch Ministry of Foreign Affairs 1999; UNFPA 2000; ICRW 2002; UNFPA 2003) and two major paradigm changes have laid the foundations for this dissertation. The first paradigm change relates to the shift in focus within the population and development framework, as became manifest at the International Conference on Population and Development (ICPD) in Cairo in 1994. Apart from the dearly won agreement on reproductive health per se and the acknowledgement of reproductive health as a human right, at the ICPD the importance of adolescence to sexual and reproductive health throughout the lifecourse was stressed. Moreover, it also - for the first time in an international agreement - recognised that adolescents have particular health needs that differ in important ways from those of adults (UNFPA 2003, p. 4).

The second change refers to the shift from the ‘lifestyle paradigm’ to the ‘early life experience paradigm’, of which studies conducted by Barker and his colleagues probably are the most salient exponents (Barker 1992; 1993; 1998; Eriksson et al.
Adolescents’ reproductive health in rural Bangladesh

1999; Barker et al. 2001). Central to the ‘foetal origins of disease hypothesis’ (also referred to as the ‘Barker hypothesis’) is the concept of metabolic programming, meaning that an early stimulus or insult, operating at a critical or sensitive period, results in a long-term change in the structure or function of the organism (Robinson 1992, p. 2). It has been suggested that metabolic and cardiovascular changes are adaptations for foetal survival in an inadequate nutritional (in utero) environment, and that these changes persist postnatally, contributing to adult chronic diseases when nutrients are plentiful (Pojda and Kelley 2000, p. 7). The hypothetical set of adaptations occurring in utero resulting in babies with a low weight at birth and a specialised metabolic and cardiovascular make-up, is also referred to as the ‘thrifty phenotype’ (Bateson 2001, p. 930). The shift to the early life experience paradigm reinforced the need for further application of lifecourse research. The lifecourse can be seen as the period from conception to death that encompasses the totality of experiences of life at a given time in history (Berger 1996, p. 167).

Aim of the study

In this study the two aforementioned paradigm changes are examined simultaneously. We aim to study the reproductive health status of 12 to 16-year-old adolescents in Matlab, Bangladesh, in relation to contemporary and early childhood (i.e. up to the age of five years) nutritional status. In this study nutritional status is assessed on the basis of international standards of anthropometric indices (combinations of measurements) such as weight-for-age (undernutrition), height-for-age (stunting), mid-upper arm circumference (MUAC) and body mass index (BMI) that indicates thinness and which is also referred to as the Quetelet Index (WHO 1995). In addition, age at menarche and the nutritional status of the adolescent’s mother is taken into account.

Indicators of adolescents’ reproductive health

Reaffirming the vision agreed upon in the Alma Ata Declaration in 1978, at the ICPD reproductive health was defined to encompass “a state of complete physical, mental and social well-being (…) in all matters relating to the reproductive system and to its functions and processes” (ICPD 1994 paragraph 7.2, p. 45). The Programme of Action (PoA) as adopted at the ICPD refers to a variety of topics associated with adolescents’ reproductive health, such as unwanted pregnancy, unsafe abortion, sexually transmitted diseases (STDs), including HIV/AIDS, the prevention of early marriage and high-risk childbearing (ICPD 1994; UNFPA 1999; FCI 1999). However, no specific indicators of adolescents’ reproductive health were defined.

In order to arrive at an indicator of physical reproductive well-being in adolescence, a reference could be made to the ‘Gold Standard’ of adolescent maturity: the method developed by Tanner in 1962 and still in use, which is based on stages of breast development, testicular size and pubic hair (Soekarjo 2003, p. 19). For obvious reasons this method is not suitable for fieldwork studies (WHO 1995, p. 267). However, in a study undertaken in rural Indonesia, self-reported age at menarche and (first) nocturnal ejaculation (spermarche) showed to be valid, as well as culturally

---

2 Spermarche is the first release of spermatozoa, which can be detected in urine samples (Hirsch et al. 1979, pp. 289-298). In general, measuring spermarche is an expensive procedure for which highly specialised equipment and facilities are needed, as well as very specialised training and skilled personnel, and requires multiple observations or long-term longitudinal data (WHO 1995, p. 267).
acceptable and appropriate milestones for adolescent maturity rating (Soekarjo et al. 2003, pp. 27-39). We will study the timing of these reproductive transitions (menarche and spermarche respectively) among adolescent girls and boys in Matlab, Bangladesh.

With respect to mental reproductive well-being in adolescence, a link can be made to what is called ‘developmental readiness’, which is key in Erikson’s theory on psychosocial development which he consolidated from 1950 onwards (Erikson 1963; Sugarman 1986, p. 83; Erikson 1997). In his view people develop in stages whereby progress through each stage is in part determined by success or lack of success with acquiring certain developmental tasks in previous stages. In this study we analyse knowledge and perceptions (including emotions) about reproductive transitions and developmental processes that are typical of the adolescent stage. If one is ‘prepared’, the reaching of menarche or spermarche is less likely to be experienced in ignorance or anxiety. Moreover, ‘reproductive knowledge’ (or ‘knowledge about reproductive health’) is required in order to be ‘prepared’ (or ready) for future reproductive health events (notably childbirth) and for maintaining reproductive health status in adulthood. In this study adolescents’ reproductive knowledge is reviewed on the basis of generally accepted bodies of knowledge about for instance the origins of menarche, human procreation and the working of contraceptive methods. Having an understanding is a prerequisite of (contemporary and future) informed choice, a concept closely associated with other so-called ‘ICPD glossary’ such as reproductive rights, dignity, empowerment, self-determination and responsibility. In sum, following the ICPD PoA, adolescents’ reproductive health status is considered to comprise a physical and mental component, whereby the outcome indicators are respectively:

- timing\(^3\) of menarche and spermarche (physical component); and
- reproductive knowledge and perceptions (mental component).

\(^3\) Given the focus of our study, we explicitly refer to ‘timing of menarche and spermarche’, though this may seem redundant since these transitions, expressed by age, already include an indication of time. In order to avoid confusion in this study we apply the term ‘age at menarche’ instead of ‘menarcheal age’ as the latter is sometimes interchanged with ‘gynaecological age’ which is defined as the time since menarche (Becker 1993, p. 33).

---

Beauty was 13 years old when we interviewed her. She had not reached menarche yet. Contrary to most of her peers, Beauty has been prepared for mashik\(^4\) or menstruation. She was informed by her sister - not by her mother, because her mother does not talk to her about such things. Beauty knows it can happen any time now, probably before her next birthday. Or later. Among Beauty’s 15 and 16-year-old peers respectively 41 and 19 per cent are still premenarcheal (as revealed in this study). Beauty does not remember ever experiencing hunger in her childhood. However, as an under-five child, Beauty was severely underweight (i.e. having a low weight-for-age) and moderately stunted (i.e. having a low height-for-age). Now, in adolescence, she weighs almost 30 kg and is 138 cm tall, i.e. still moderately underweight and moderately stunted. She does not differ in this respect from her peers. It will take some time before she approaches her mother’s height of 150 cm.

However, data on spermarche are usually collected by retrospective recall, as in the study of Soekarjo et al. (2003).

**Beauty** was 13 years old when we interviewed her. She had not reached menarche yet. Contrary to most of her peers, Beauty has been prepared for mashik\(^4\) or menstruation. She was informed by her sister - not by her mother, because her mother does not talk to her about such things. Beauty knows it can happen any time now, probably before her next birthday. Or later. Among Beauty’s 15 and 16-year-old peers respectively 41 and 19 per cent are still premenarcheal (as revealed in this study). Beauty does not remember ever experiencing hunger in her childhood. However, as an under-five child, Beauty was severely underweight (i.e. having a low weight-for-age) and moderately stunted (i.e. having a low height-for-age). Now, in adolescence, she weighs almost 30 kg and is 138 cm tall, i.e. still moderately underweight and moderately stunted. She does not differ in this respect from her peers. It will take some time before she approaches her mother’s height of 150 cm.

---

\(^4\) Bangla words and concepts are explained in the glossary (Appendix A).
Lifecourse approach and careers

As noted, we adopt a lifecourse approach to the study on adolescents’ reproductive health whereby we study particularly the anthropometric determinants of menarche. Within the lifecourse, intertwining and partly running parallel careers can be distinguished (de Bruijn 1999, p. 186). The reproductive health career is closely related to the nutritional status career. For instance, in general, girls who are severely stunted face a risk in their reproductive health as stunting delays the first menstruation, may jeopardise the course and outcome of pregnancy, and is likely to increase the risk of obstructive labour (Riley 1994, pp. 90-91; WHO 2003, p. 13). These detrimental outcomes may be reinforced by the adolescent girl’s underweight due to recent malnutrition. However, adolescent nutritional anthropometry, notably stunting, is an outcome of a series of early life nutritional anthropometry and merits study in its own right.

Pathways: programming and cumulative causation

We study menarche (and to a lesser extent spermarche since there is much less data and evidence-based literature about this topic) retrospectively, i.e. in relation to contemporary and early childhood nutritional status. Nutritional status is widely recognised as one of the most important non-genetic determinants of menarche (Riley et al. 1993, p. 50). In the early 1970s, timing of menarche was believed to be ‘triggered’ by a certain critical weight (Frisch and Revelle 1969; 1971), but the evidence for this relationship was weak (Trussell 1980). In later studies, other anthropometric indices such as adolescent height, MUAC and BMI were (also) positively associated with menarche (for instance, Delgado et al. 1985; Linhares et al. 1986; Maclure et al. 1991; Koprowski et al. 1999). More recently, there is growing support for the possibility that timing of menarche may be set in utero or early in life but may be modified by changes in body size and composition in childhood (Silva et al. 2003, pp. 405-412), a line of thinking which relates to the aforementioned Barker hypothesis.

Among the population of Bangladesh malnutrition has been prevalent for generations as a result of which individuals are both prenatally as well as postnatally exposed to nutritional micro and macro deficiencies. In addition, in Bangladesh there is a well-documented list of factors (notably infectious diseases, diarrhoea, adverse environmental conditions and behaviours) which contribute to the ‘chain of risks’ impacting nutritional anthropometry in the negative. This chain of risks is an alternative pathway - that of cumulative causation - which describes how experiences in early life increase the likelihood of future events which in turn lead to a change in the risk of adult diseases and which can be advantageous or detrimental in their effect (Kuh and Ben-Shlomo 1997, p. 7).

Sensitive or critical periods

Within the Bangladeshi population stunting seems to have become an embodied\textsuperscript{5} trait. The overall picture in Bangladesh is one of widespread malnutrition, particularly

\textsuperscript{5} Embodiment describes how extrinsic factors experienced at different life stages are inscribed into an individual’s body functions or structures. This may be through a developmental process associated with critical periods (Kuh et al. 2003, p. 5).
among women and children. In rural Bangladesh, 57 per cent of the women are less than 147 centimetres tall as a result of stunting, virtually all mothers weigh less than 50 kg (Ross et al. 1996, p. 10), and 47 per cent has a BMI below 18, indicating underweight (WHO 2003, p. 8). Over 60 per cent of the under-fives in this country suffers from malnutrition (ICDDR,B 2002b, p. 36). More specifically, 58 per cent of the under-fives in Bangladesh (1993-1995) is underweight, 55 per cent is stunted, 73 per cent is anaemic and 78 per cent has vitamin A deficiency (WHO 2003, p. 8). In addition, Bangladesh has the highest rate (50 per cent) of children born full-term with low birth weight (LBW), defined as a weight at birth below 2500 grams, as a result of intrauterine growth retardation (Pojda and Kelley 2000, pp. 3-4). Such a high prevalence of LBW is an intergenerational problem (Pojda and Kelley 2000, p. 2).

Gestation and early childhood are sensitive or critical for the adolescent stage in life. A delay in early life growth can hardly be stopped or reversed and after the age of two years the potential for catch-up growth is indeed limited when such children remain in poor environments (Gillespie and Flores 2000, p. 2). If environmental conditions improve, particularly in terms of favourable nutrient intake, the period of adolescence could be a window of opportunity to catch up early life growth faltering (WHO 2003, p. 10), although evidence of complete catch-up in developing countries is limited (WHO 2003, p. 22). In one of the few studies on this, undertaken in Guatemala, catch-up growth was reported to take place in adolescents, but they did not fully negate the growth retardation of early childhood (Martorell et al. 1995). Also within developmental psychology such special time windows have been identified. Reviewing multi-dimensional development processes, Jenniskens and Verduin (1998, p. 17) outline four points in life at which it is not possible to catch up on deficits (also called ‘points of no return’, i.e. interventions cannot make up the deficit), respectively at birth, at 12 months (brain development), at 3 years (height and mental development) and adolescence (behaviour).

Justification of a study on menarche

The justification of a study on timing of menarche relates mainly to future transitions embedded within the reproductive career. A key aspect is gynaecological age, i.e. the time in years since menarche (Becker 1993, p. 33). Irrespective of age, at the time of reaching menarche girls have approximately 4 per cent more height and 12 to 18 per cent more pelvic growth ahead of them, and height and pelvic size are correlated (WHO 1991, p. 6). A stature below 145 cm and a weight below 45 kg are considered as cut-off points for obstetric risks (WHO 2003, p. 22). We therefore argue that young gynaecological age (as a result of delayed menarche) at the time of childbearing in conjunction with malnutrition (reflected by a biological age lagging behind chronological age, i.e. age measured in calendar years) is more important to reproductive health than young chronological age.

Context

Though the indicators of adolescents’ reproductive health as well as contemporary and early life determinants are situated at the micro level (i.e. they are individual traits), they are influenced by (higher-level) contextual factors. For instance, socio-cultural family and societal norms influence intra-household distribution of food and

---

Catch-up growth is defined as the recovering of a delay in growth (Silventoinen 2000, p. 22).
impute early marriage and childbirth. These higher-level contextual conditions and circumstances shape the adolescent’s ‘career of reproductive knowledge and perceptions’, or generate a socio-cultural climate which places reproductive information or services within or beyond the reach of adolescents. It is within the process of socialisation during childhood and adolescence that gender roles are internalised and perpetuated. Particularly in adolescence, it becomes apparent that societal expectations in Bangladesh, a country where 88 per cent of the population is Muslim, differ considerably for boys and girls (Aziz and Maloney 1985; Blanchet 1996; Amin et al. 1997). This should also be viewed within the overall socio-economic context of Bangladesh. In 1996, the FAO identified Bangladesh as a ‘low-income food-deficit’ country i.e. a country that has not enough food to feed its population and lacks the financial recourses to pay for imports (USAID 1997, pp. 8-9). Poor living conditions directly influence the adolescents’ nutritional status, educational and professional opportunities.

Beauty does not have a boyfriend. In due time, her parents will arrange a marriage for her. As far as she knows they have not done that yet. However, in contrast to her future husband she may very well only be informed about her marriage at the final stage of the negotiations, possibly even on the wedding day itself. And much will depend upon her dowry. If it was up to Beauty, she will marry when she is 20 years and become a mother two years later. She is familiar with possible health problems - notably difficult labour and childbirth - when a girl gets pregnant at an early age. She wants to have three children later, at least one son and one daughter. In order to accomplish that, she needs to learn about sexuality and family planning. She has heard about the pill, but does not know how it works. She would like to be informed by a health worker. Neither her mother, Monowara, nor her father, has completed a single year of education. Beauty, however, enjoys going to school very much and has completed four years. She aims to finish secondary school as well. After that, she will stay in Matlab and become a health worker. And a wife and mother, naturally.

1.2 Embedment of the study
Bangladesh has officially adopted the ICPD definition of reproductive health. Reproductive health services, policies and programmes aimed at adolescents, as well as on the improvement of maternal and infant nutrition, are either in effect or underway (Hardee et al. 1998, p. 6). Inspired by the ICPD PoA, the government of Bangladesh submitted the Health and Population Sector Strategy (HPSS) in 1997, on which it also based its 1997-2002 Fifth Year Plan. However, the planned reproductive health services for adolescents pertain to married adolescents only (Hardee et al. 1998, p. 65). Unmarried adolescents remain a marginalised group. In this study we have identified some of the reproductive health needs as prevalent in the early stage of adolescence of unmarried adolescents in particular.

In addition, this study focuses explicitly on adolescent girls and boys. For a long time most reproductive health studies tended to focus on (married) women only, particularly in Bangladesh. Recently, policy makers and researchers emphasise however the need to incorporate the ‘male’ perspective into research and action programs. As stipulated by UNFPA (1997, p. 9) “in adolescent programming, it

7 Transfer of money or valuables from the family of the bride to the groom and his family (Amin and Cain 1997, p. 296).
should be natural to stress the equal and individual responsibility for safe and healthy sexual behaviour, the need for the man to respect the reproductive choices of the woman, and the shared responsibility in case of pregnancy and childbirth”.

Our study is the result of collaboration between HERA (HEalthy reproduction: Research for Action, a co-operation between the Population Research Centre of the University of Groningen and the Netherlands Interdisciplinary Demographic Institute) and ICDDR,B (Centre for Health and Population Research, formerly known as the International Centre for Diarrhoeal Disease Research, Bangladesh). ICDDR,B is a well-known institute with years of experience in reproductive health research and adopts a very similar approach to reproductive health as the one adopted by HERA: both are engaged in translating research results into action. Examples of successful projects engaging community participation that respect and use existing social structures (by community organisations) are for instance Spandana in rural India run by HERA in co-operation with local researchers and a local NGO (Hutter 1998), and the Chakaria Community Health project by ICDDR,B in rural Bangladesh (Eppler et al. 1996).

For nearly four decades ICDDR,B has been carrying out research in Matlab, an area that is known for its rich research history, reflected in the elaborate collection of data. Virtually all inhabitants of Matlab are enrolled in a Health and Demographic Surveillance System (HDSS), maintained by ICDDR,B. The basis of HDSS is a so-called Registration IDentification (RID) number. In 1997, a three-month feasibility study was conducted in Matlab (Bosch and Hutter 1998), which led to the development of a research proposal for this study.

1.3 Research questions
This study is designed to examine adolescent’s reproductive health from the lifecourse perspective and it is grounded on the following overall research question:

What is the reproductive health status of adolescent girls and boys in Matlab, Bangladesh, and to what extent is this status associated with contemporary and early childhood nutritional anthropometry?

We aim to answer this overall question by addressing five specific research questions that account for physical and mental well-being of adolescents’ reproductive health:

Questions pertaining to physical well-being of adolescents’ reproductive health

1. What is the reproductive health status of adolescent girls and boys as indicated by the timing of menarche and spermarche respectively?

2. What is the contemporary nutritional status, as indicated by anthropometry, of adolescent girls and boys, and does this differ by sex?

3. Is nutritional anthropometry in adolescence predisposed by nutritional anthropometry in early childhood, birth weight, and height of the adolescent’s mother? And, related to this, is there any potential to catch up early childhood growth faltering in adolescence?
4. Is timing of menarche predisposed by contemporary and early childhood nutritional anthropometry, birth weight, as well as height and age at menarche of the adolescent girl’s mother?

*Question pertaining to mental well-being of adolescents’ reproductive health*

5. Are adolescent girls and boys informed about and prepared for menarche and spermarche respectively, and reproductive development in general?

By subsequently answering each of the five research questions, the study endeavours to disentangle the multitude of factors constituting adolescents’ reproductive health status and to assess the relative contribution of some of its main contemporary and early childhood determinants.

### 1.4 Study population and longitudinal data collected in two surveys

Studying adolescents’ reproductive health from a life course perspective requires analyses of longitudinal data. Our study involves the follow-up of 707 under-five children who were enrolled in a study on persistent diarrhoea conducted in Matlab in 1988-1989 by Baqui, a paediatrician affiliated with ICDDR,B (Baqui 1990; Baqui et al. 1992; 1993a; 1993b; Zaman et al. 1996; 1997). His study served as a baseline for a follow-up survey, which we undertook in 2001. By that year the under-fives had grown up to adolescents, aged 12 to 16 years, and the majority of them (569) was surveyed again. In order to learn more about perceptions about reproductive health, additional information was collected among 18 adolescents, 8 parents and 3 local key-persons by means of in-depth interviews. We also analysed the HDSS records of those children who were lost for follow-up due to death or migration.

The analyses of the data involves descriptive statistics and binary logistic regression techniques (odds ratios) of the sample (observed) data; calculation of estimates (of age of menarche) by means of lifetable (survival) analysis and the Cox regression model; and reviews of the ‘voices of the adolescents’ (based on the in-depth interviews).

### 1.5 Scientific and social relevance of the study

The opportunity to follow up a group of under-fives 13 years later made it possible to study adolescents’ reproductive health in view of context as well as life course. To our knowledge, there have been only few of such longitudinal studies conducted in developing countries, for instance in Guatemala (Martorell and Scrimshaw 1995; Stein et al. 2003), in Gambia (Ceesay et al. 1997; Moore et al. 2001), and in Indonesia (Kusin and Kardjati 1994; Alisjabana and Kusin 2003).

The specific features of this study are as follows:

- a study population consisting of unmarried adolescent boys and girls in rural Bangladesh;
• a focus on their reproductive health status, a ‘sensitive’ topic studied among a 12 to 16-year-old population which has for long been neglected in (reproductive health) research undertaken in this country;
• a focus on reproductive health status from two different angles, i.e. consideration of a physical component (indicated by timing of menarche and spermarche) and a mental component (indicated by reproductive knowledge and perceptions);
• the application of a lifecourse perspective, which is one of the angles that can be taken within the process-context approach. Applying this approach to adolescents’ reproductive health is rather new within the discipline of demography;
• crediting the important role of contemporary and early childhood nutritional anthropometry in reproductive health, which enhances the increasing interdisciplinary character of demographic research;
• conducting analyses based on longitudinal data, consisting of quantitative (survey) as well as qualitative (in-depth interviews) data, whereby
• the quantitative database consists of linked data, i.e. secondary or baseline data and primary or follow-up data.

1.6 Organisation of the book
Chapter 2 presents a descriptive and explanatory framework of adolescents’ reproductive health viewed from the lifecourse perspective, with special reference to the mediating role of nutritional anthropometry from birth onwards. We particularly focus on the timing of menarche, both from a physical as well as social perspective. Moreover, we address the meaning of adolescence in (rural) Bangladesh from a gender perspective.

Chapter 3 discusses the research design, including the hypotheses, the operationalisation of the main variables, required data and methods of data collection. The last named includes a thorough description of the experiences encountered while undertaking the fieldwork among the adolescents in Matlab.

Chapter 4 introduces a brief demographic and socio-economic profile of the study population, both in childhood as well as in adolescence. In addition, we elaborate the characteristics of the children who were lost for follow-up because they passed away or migrated out of Matlab before the onset of the follow-up survey in 2001.

Chapter 5 is devoted to the nutritional status career. We discuss nutritional anthropometry in adolescence in relation to nutritional anthropometry in early childhood, at birth and height of the respondent’s mother. Central to this chapter is the question of the extent to which adolescent nutritional anthropometry is predisposed by nutritional conditions earlier in life. While answering this question we also address the potential of girls and boys in adolescence to catch up early childhood growth faltering.

Chapter 6 discusses results of analyses on the timing of menarche and spermarche (the physical component of reproductive health), which marks the onset of the reproductive health career. Timing of menarche is discussed in terms of age, and by comparing age at menarche between mothers and daughters. In particular the nutritional pathways underlying the timing of menarche are studied in view of contemporary (adolescent) and early childhood nutritional anthropometry.
Chapter 7 discusses the adolescents’ knowledge and perceptions (the mental component of reproductive health) about reaching reproductive transitions, menstruation, markers of adolescent development, procreation, early marriage and childbearing, contraception and HIV/AIDS prevention.

Finally, Chapter 8 summarises the main findings of the study and discusses its conclusions. Additionally, we propose some recommendations for further research and interventions in the field of reproductive health of adolescents and young women in Bangladesh.