2 Theoretical framework: adolescents’ reproductive health in the context of early childhood nutritional anthropometry and socialisation
2.1 Introduction
The aim of this chapter is to introduce a theoretical framework on adolescents’ reproductive health in the context of contemporary and early childhood nutritional anthropometry and gender-specific socialisation. Studying adolescents’ reproductive health status by taking explicitly into account early life conditions necessitates the application of a *lifecourse* approach. Indicators of adolescents’ reproductive health status that we consider are:

- timing of reproductive transitions (menarche and spermarche), and
- reproductive knowledge and perceptions.

As we will elaborate in this chapter, the underlying mechanisms determining this status refer to:

- processes or changes over time (nutritional status development, socialisation);
- whereby determinants are embedded within nested multi-level (micro, meso and macro) contexts.

The outline of this chapter is as follows. We first elaborate upon the key concepts of the theoretical framework (section 2.2), after which the nutritional status career, with particular reference to the adolescent period, is discussed (section 2.3). We then sketch the start of the reproductive career whereby we elaborate upon the concept of adolescents’ reproductive health within the context of Bangladesh, and subsequently address the physical pathways underlying timing of menarche and spermarche as well as the social significance of these transitions (section 2.4). Although the temporal scope of this study does not exceed the period of adolescence, thereafter some reproductive events are addressed that reflect the first steps into adulthood - marriage and childbirth - and which are in part directly related to nutritional and reproductive health status in (early) adolescence (section 2.5). Finally, a conceptual model is presented whereby we bring into focus the further outline of this study (section 2.6). The chapter closes with a discussion of the conclusions (section 2.7).

2.2 Main theoretical concepts
Given that this study aims to understand adolescents’ reproductive health status in view of early life conditions, a *lifecourse* approach is applied. Several concepts can be singled out while building a framework for the understanding of adolescents’ reproductive health status and its (multi-)lifecourse determinants (Figure 2.1).
In this section we will elaborate upon process, lifecourse and context (subsection 2.2.1), trajectory or career and transitions (subsection 2.2.2) and the concepts of timing and duration (subsection 2.2.3). The last 2 concepts are discussed in terms of sensitive or critical periods and potential to catch up early life growth failure. We hereby build further on the extensively described process-context approach, a multidisciplinary theoretical approach adopted by HERA and worked out in detail by Willekens (1990; 1992), Hutter and Willekens (1998), Hutter (1998), de Bruijn (1999) and Mills (2000). This approach is in turn grounded on traditional demographic fertility and mortality models of Bongaarts and Potter (1983) and Mosley and Chen (1984) respectively, that together include most reproductive events and their determinants. Furthermore, the process-context approach relates to earlier and recent studies in social demography (Greenhalgh 1989; 1994; 1995), institutional economy (North 1994; Denzau and North 1994) and cognitive anthropology (D’Andrade 1984; 1992; 1995). Apart from the process-context approach, while setting up our theoretical framework we draw upon the glossary of lifecourse epidemiology (Kuh et al. 2003). “Lifecourse epidemiology starts from the premise that various (…) factors throughout life, independently, cumulatively, and interactively, influence health and disease” (Kuh and Hardy 2002, p. 5). In lifecourse epidemiology the main interest lies in the associations between (linked) exposures and disease risks at a later stage. We are primarily interested in the associations between malnutrition and the timing of reproductive transitions (menarche), whereby for instance a ‘late’ timing (of menarche) is one of the outcomes.

2.2.1 Lifecourse within the process-context approach

We work further from the notion that the lifecourse can be seen as a specificity of the concepts of process and context combined: the lifecourse refers to the structure of life within a particular temporal order, whereby specific transitions and hence stages (for instance gestation, infancy, childhood, adolescence and adulthood) can be distinguished, which are contextually defined. The structure of life is thus time-bound and space-bound (Willekens 1999, p. 25). Pending the subject of study, various temporal orders or dimensions of time are distinguished that should not be regarded as completely separate constructs but, in the words of de Bruijn (1999, pp. 144-147), rather as “simultaneously running clocks, but of a different magnitude”. He outlines the following: historical or calendar time (the structuring into for instance years, months and days, examples being chronological and gynaecological age), institutional time (the evolution of various institutions that make up a specific context), social time (consisting of different stages, which are represented by distinct rules for relations with people, responsibilities, duties and behaviour), and biographical or individual time (the structuring in ages, age groups or life stages). The last mentioned is commonly referred to as the lifecourse, which encompasses and structures a broad range of life events pertaining to one individual within the period between his or her birth, or rather conception, and death. Next, we briefly elaborate upon the embedment of the concept of lifecourse within the process-context approach.

Process and lifecourse

An adolescent’s nutritional and reproductive health status is a far from static individual trait but rather the compressed outcome of a nutritional and reproductive development process, comprising a series of specific statuses and general health and living conditions that are respectively occupied and encountered earlier in life. The
pathways underlying nutritional and reproductive health status in adolescence are thus dynamic, i.e. they are processes (such as growth, maturation, health development, history of diseases) which are constantly re-formed over time. In general, a person can be regarded as being involved “in a continuous process of becoming” (de Bruijn 1999, p. 13).

One of the main rationales of lifecourse research is the interest in how current conditions or characteristics are influenced by conditions and experiences in the past. Lifecourse research is based on the notion that the basic life structure of individuals is universal and independent of (historical) time (Willekens 1999, p. 23), whereby life is considered to evolve according to the epigenetic principle, which entails that “development starts from a ground plan and out of that ground plan parts arise, whereby each part having its time of ascendancy, until all parts have arisen to form a functioning whole” (Willekens 2004). Examples of developmental processes that stem from the epigenetic principle are the processes of physical maturation and psychosocial development as formulated in the theory of Erikson from 1950 onwards (Erikson 1963; Sugarman 1986, p. 83; Zimbardo et al. 1993, p. 125; Erikson 1997). In the course of time, the concept of lifecourse has been defined in different ways and applied in multiple disciplines. Since reviews of the concept of the lifecourse have extensively been presented elsewhere (see for instance Berger 1996; Heinz 1997; Giele and Elder Jr. 1998; Dykstra and van Wissen 1999; Willekens 1999), within the scope of this study it suffices to say that lifecourse and longitudinal research (i.e. analyses of repeated characteristics of the same person) is:

- concerned with process(es) (for instance the lifecourse “progresses through time” (Clausen cited by Berger 1996, p. 129) and can be seen as “a complex and composite developmental process” (Willekens 1999, p. 29; Willekens 2004), and is thus dynamic);
- constituted by stages which are distinguished by transitions that give the lifecourse a “life structure” (Willekens 1999, p. 23); and
- embedded within a social and historical time context, i.e. there is “interplay between individual biography and social and historical processes” (Clausen cited by Berger 1996, p. 129; Hareven cited by Berger 1996, p. 131). Runyan (1982, p. 82) views for instance the historical context primarily as a background against which individuals act.

Context and lifecourse

The concept of context is defined by de Bruijn (1999, p. 251) as “the (institutionally) structured environment from which individual actors deduce information about options and constraints for behaviour and the values attached to these”. The word ‘structured’ in this definition points to an order or grouping according to a certain plan or set of ideas. The ‘overall’ context is structured, because it is - in its most abstract form - too complex to deal with. In practice, actors structure the overall context by distinguishing various contexts according to cognitive or mental schemas. By doing so they transform the unstructured context into their contexts: contexts are interpreted,

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8 A schema can be seen as a conceptual structure or mental map, which makes the identification of objects and events possible; they are learned as part of socialisation and they are culturally determined (D’Andrade 1992, cited by Hutter 1998, p. 10). An example of schema is how menstruation is perceived to be ‘polluting’ in Bangladeshi society, as described in section 2.4.3.
understood, and eventually defined by the actors they relate to. A part of the context consists of ‘meaning systems’, encompassing for instance cultural schemas, which are shared by a group of people (D’Andrade 1984, cited by Hutter 1998, p. 15). Thus actors structure and give meaning to their context.

Following de Bruijn (1999, p. 131), conceptually three levels of contexts are distinguished: the micro-level context refers to the individual and his or her interactions with immediate others, the meso-level context refers to (community) institutions and organisations, and the macro-level context applies to the society. Although generally not made explicit, individual characteristics also include ‘inner-micro-level’ traits such as one’s genetic make-up. Genes direct the process of maturation according to a systematic and predictable sequence (the genetically-based timetable or ‘blueprint’). Genes however only control the range of effects that the environment can have in shaping one’s phenotype (Zimbardo et al. 1993, p. 47). Whereas genes, or heredity, set a reaction range of potential, experience determines where in that range any individual will be. For example, in the field of anthropometry, it is heredity that determines how tall one can grow, whereas how tall one actually becomes depends partly on nutrition (Zimbardo et al. 1993, pp. 120-121). In line with the ‘consensus’ reached within the long-standing ‘nature-nurture’ debate, neither one of the extreme positions, ‘nature’ (genetic inheritance, de facto genes) or ‘nurture’ (external, environmental, inputs), is accountable for an individual’s biological, and hence nutritional, constitution, but these two influences are constantly interacting with each other. With regard to environmental inputs, Berger (1996, pp. 132-133) distinguishes the following influences:

- **age-graded influences**, which entail those aspects of development that are related to chronological age as well as age-specific societal expectations;
- **history-graded influences**, which are societal changes brought by historical events (for instance war); and
- **non-normative influences**, which constitute events such as accidents and natural catastrophes as well as unanticipated and unpredicted occurrences (for instance the loss of a parent and - common to Bangladesh - floods and famine).

This study addresses adolescents’ age-graded influences on reproductive health status, such as adolescents’ nutritional status and the process of socialisation. Both processes progress by age and are conceptually situated at the micro level. Nutritional status development is generally indicated by (chronological) age-specific anthropometric indices and socialisation is closely linked to age-specific societal expectations. Adolescents’ reproductive health is also subject to higher-level contextual influences. This can be illustrated for instance by looking at adolescents’ nutritional intake which underlies their nutritional status and which is in turn one of the most important non-genetic determinants of menarche, as we will elaborate in subsection 2.4.2. Adolescents’ nutritional intake is facilitated or inhibited by the cultural context (for instance, the allocation of food within the household is associated with gender-specific societal values), the economic context (a household’s expenditure on food is for instance mainly determined by the income generated by its members) and the ecological context (the cyclical rhythm of the natural environment determines for instance the onset and ending of harvest seasons, and hence the periods of food scarcity and abundance). With regard to higher-level contextual influences on adolescents’ reproductive knowledge and perceptions - the mental component of their
reproductive health status (see section 1.3) - we study for instance socio-cultural aspects of the process of socialisation taking place in Matlab and Bangladeshi society at large.

2.2.2 Careers and transitions

Within a lifecourse, trajectories can be distinguished that provide a long-term view of one dimension of an individual’s life over time (Kuh et al. 2003, p. 12). Such a notion resembles the concept of career, i.e. a domain-specific developmental process, or the chain of events and experiences that pertain to one particular sphere of the individual’s life (Willekens 1999, p. 37). Examples from the pathway of physical maturation are the nutritional status career, which is built up of a series of nutritional status over the lifecourse, and the reproductive health career (as illustrated in Figure 2.2). These careers are further discussed in section 2.3 and 2.4 respectively.

![Figure 2.2: Careers distinguished in study on adolescents' reproductive health](image)

Life events, experiences, states and situations often occur simultaneously. De Bruijn (1999, pp. 153-157) refers to the lifecourse as an organising principle for the synchronous and diachronous aspects of the individual life. Synchronous organisation relates to careers that are intertwining and (partly running) parallel (de Bruijn 1999, p. 186). An example of a parallel career related to the nutritional status career is the marital career whose onset will briefly be discussed in section 2.5. Other partially parallel careers are the educational and working careers upon we briefly touch. Social ramifications of adolescent childbearing on educational and work opportunities (see, for instance, TAGI 1996; Buvinic 1998) are however not addressed within this study.

The second or diachronic type of organisation of a lifecourse relates to the notion of conditional careers (de Bruijn 1999, p. 186). A conditional career is a parallel career that provides the resources and constraints for achieving the goals set in a particular career (Mulder 1993, p. 25). This perspective suggests a causal relation between conditions or processes over time (de Bruijn 1999, p. 186). An adolescent’s nutritional status career is closely related to his or her reproductive health career, whereby usually the former is considered to be conditional to the latter. For instance, in order to successfully pass or go through reproductive health events or developments, such as a pregnancy, one needs to have an adequate nutritional status. Also, an adequate
nutritional status, for example reflected by a certain ‘critical’ weight (Frisch and Revelle 1971), is believed to be a prerequisite for a timely menarche, as will be outlined in subsection 2.4.2. The relationship is however in some cases reversed (although not necessarily conditional): some events situated within the reproductive health career impact nutritional status, and hence, the nutritional status career; the most obvious example being pregnancy that increases a woman’s weight and hence her nutritional status.

Apart from the nutritional and reproductive health career, a ‘career of knowledge and perceptions’ may be distinguished, embedded within the pathway of socialisation, i.e. “the adoption of the behaviour patterns of the surrounding culture” (Webster 2004) or, more specifically, “the process by which the individual learns and adopts the various ways, ideas, beliefs, values and standards of his culture and incorporates them into his personality” (Davis cited by Monroy de Velasco 1985, p. 20). How adolescents in Bangladesh experience the reproductive transitions encountered during this stage of life, and how they cope with culturally-subscribed social roles, cannot be fully understood without taking into account the way adolescents have been socialised. Particularly the development of emotional maturity seems closely linked to the process of socialisation as, in the words of Lewin (cited by Monroy de Velasco 1985, p. 19) “adolescence is a period of transition in which the young person changes to the group to which he belongs”. It is in childhood that the foundations are laid for patterns of behaviour in adolescence and adulthood and based on the lifetime accumulation of knowledge and experiences, social roles are internalised. In Bangladeshi society, these roles seem to a large extent gender-specific: a girl grows up to get married and to become a good wife and mother (White 1992, p. 97), whereas a boy’s education entails “developing the ability to earn a living, marry and produce children, and becoming a respectable member of the samaj” or society (Blanchet 1996, p. 49). The pathway underlying the ways in which people are prepared for roles that culture assumes they will perform, the hidden curriculum, includes anticipatory socialisation and socialised anxiety (Berger 1996, p. 132).

This ‘career of knowledge and perceptions’, which we will study for adolescents, could also be viewed against the aforementioned theory of Erikson on psychosocial development (Erikson 1963). Erikson distinguishes psychosocial stages of development and refined and expanded the stages earlier identified by Freud. Erikson identified eight stages (later expanded to nine) that together make up the entire cycle of life. Also Erikson’s work stems from the epigenetic principle: in his view people develop through a predetermined unfolding of personalities 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 (developmental readiness). Central to the adolescent stage is the development of identity whereby adolescents who have not been able to develop a basic sense of trust during infancy face the risk of suffering from an identity crisis (Zimbardo et al. 1993, p. 148). Identity development includes elements like coming to terms with sexuality, one’s appearance, and internalising social roles. Erikson’s theory has formed the basis of an anthropological study by Aziz and Maloney (1985) that describes the stages in life in Matlab, Bangladesh. Based on their work, a background sketch of the social significance of the period of adolescence in Matlab is presented on the basis of secondary literature in subsection 2.4.3.
Transitions
Within careers, transitions can be distinguished that are “status passages that mark socially significant points of change in people’s lives” (Dykstra and van Wissen 1999, p. 6), whereby we should note that in our study they also entail physically important points of change (menarche, spermarche). Not only the transition itself but also its timing may have social connotations. If viewed in relation to other transitions, a transition can be labelled as earlier, later or simultaneously. Since there is considerable variability in the timing of events, individuals internalise social clocks and often gauge their progression through life accordingly (Berger 1996, p. 130). As with social roles, social clocks are constructed on the basis of social norms. It is also on the basis of these norms that events or behaviours can be evaluated in terms of ‘on timeness’ or ‘age appropriateness’ (Berger 1996, p 130; p. 134), labels often charged with emotional intensity and which can only be understood by taking the broader socio-cultural context into account. The timing of menarche has physical implications, but is also associated with certain age-related norms and behaviours that reflect the social significance of ‘late-bloomers’ or ‘precociousness’. Adolescent reproductive transitions are studied from both angles (physical and social) in section 2.4.

2.2.3 Sensitive or critical periods in relation to catch-up growth
The timing of two succeeding transitions determines the duration of a certain state. With respect to the pathway(s) underlying nutritional status at a given moment in time, it is important to know about the timing of a status change (for instance turning from well nourished into malnourished at age x), and the duration of this state (for instance being malnourished for y months). Timing and duration of malnutrition may both influence the likelihood of recovering from growth failure effectively later in life, and hence, impact the pace of the overall and reproductive maturation process.

The notions of timing and duration can be linked to specific periods distinguished within the nutritional status career, during which the effects of inadequate food intake and infections may have a detrimental, and possibly lasting, impact on (reproductive) health later in life. In this subsection, these special time windows - sensitive or critical periods during which the foundations are laid for the further course or pace of the developmental process - are juxtaposed against the catch-up potential of faltering growth9 in early life for adolescents. Studies on the long-term consequences of impaired nutritional status in the early stages of life have mainly been the domain of epidemiologists (for instance Elo and Preston 1992; Kuh and Ben-Shlomo 1997; Kuh and Hardy 2002; Ben-Shlomo and Kuh 2002). Although the timeframe of our study is considerably shorter (up to early adolescence), it is also here that common ground is found with research conducted by for instance Barker and his colleagues who investigated the foetal and infant origins of several adult diseases, among which include ischemic heart disease, stroke, chronic bronchitis and coronary heart disease (see for instance Barker 1992; 1993; 1998; Eriksson et al. 1999; Barker et al. 2001).

9 Though ‘growth’ generally refers to all systems of the body, in our study this concept is narrowed down to ‘somatic growth’, i.e. growth of body size (height) or mass (weight) (Bianculli 1985, p. 45).
Chapter 2: Theoretical framework

Programming

The rationale for identifying critical or sensitive time windows is that all forms of experience are not equally important to all stages in development (Bateson 2001, p. 931). In research conducted by Barker and his colleagues a sensitive period generally extends back to the period of gestation and infancy (Robinson 1992, p. 2). Their ‘foetal origins of disease hypothesis’ stems from the assumption that in utero nutritional deprivation may alter the baby’s growth, physiology and metabolism - changes that are believed to tend to persist through life (Barker 1993, p. 1). The sensitivity or critical character of a period relates to 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). Epidemiologists such as Kuh et al. (2003, p. 5) view a critical period as a limited time window in which an exposure can have adverse or protective effects on development and subsequent disease outcome. Within the nutritional status career, the hypothetical set of adaptations set in utero resulting in babies with a low weight at birth and a specific metabolic and cardiovascular make-up, is also referred to as the ‘thrifty phenotype’ (Bateson 2001, p. 930). Central to studies undertaken by Barker and advocates is that babies with thrifty phenotypes, i.e. babies who are ‘designed’ to live in an environment that is chronically short on food, and who subsequently grow up in affluent environments “may operate sub-optimally” (Bateson 2001, p. 931). As we will outline below, in Bangladesh, however, postnatal nutritional conditions are also often poor. The processes of positive or negative adaptations in the face of malnutrition refer to what is labelled by Kuh et al. (2003, p. 8) as extent of resilience and vulnerability respectively.

Cumulative causation

An alternative hypothesis within epidemiology - that of cumulative causation - refers to the accumulation of risk (chain of risks) during a lifecourse, which suggests that throughout the lifecourse exposures or insults gradually accumulated through episodes of illness, adverse environmental conditions and behaviours increase the risk of chronic disease and mortality (Kuh and Ben-Shlomo 1997, p. 6). Regarding Bangladesh, there is a well-documented list of factors (notably infectious diseases, diarrhoea, adverse behaviours and living conditions) that contribute in the negative to the ‘chain of risks’ impacting nutritional anthropometry. We will come back to some of these factors in section 2.3.1.

Mindful of the aforementioned definition of Barker and the ‘cumulative risk hypothesis’, in this study we focus on timing of menarche in particular in relation to contemporary and early life nutritional status, whereby we review certain critical time
windows (birth, early childhood). This study aims to understand whether and how certain conditions (malnutrition, notably stunting, i.e. being short for age) in early life have a (statistically significant) long-lasting effect on adolescent nutritional status and particularly the timing of menarche. We will not study empirically the early life origins of adolescents’ reproductive knowledge and perceptions. It is however acknowledged that during childhood and adolescence abilities, skills, habits, attitudes and values are accumulated and that they may strongly impact health (behaviour) later in life (Kuh and Hardy 2003, p. 7).

Studies that engage in the ‘foetal origins of adult disease hypothesis’ have been criticised among others for failure to adjust for postnatal conditions or changes in between the foetal stage and the current outcome (in adulthood), mainly due to a lack of data, as well as failure to explore the relative contribution of prenatal and postnatal factors (Lucas et al. 1999). The timeframe in our study entails the time span between birth and adolescence, whereby we take explicitly into account nutritional status in between, i.e. in early childhood. Given the association between maternal stature and that of her child (Silventoinen 2000, p. 16) and age at menarche between mothers and daughters (Gray 1993, p. 220), we also account for possible inherited influences indicated by height of the adolescent’s mother and maternal age at menarche.

**Catch-up growth**

Faltering growth in early childhood does not necessarily lead to stunting later in life because of the potential of catch-up growth. Catch-up growth is defined as the recovering of a delay in growth, a process first identified in plants and animals but later also in human beings (Silventoinen 2000, p. 22), or a ‘reduction of the deficit’. Two types of catch-up growth can be distinguished. The first type is an increase in growth velocity beyond the normal velocity for the chronological age, which is only possible when the environment that affects the slowed growth improves; the second type of catch-up growth is characterised by a growth that continues longer than usual while growth velocity does not change (Silventoinen 2000, p. 22). This second type is in most cases impossible to distinguish from normal puberty growth acceleration (Ibid. 2000, p. 22) and is also referred to as ‘spontaneous’ catch-up growth (WHO 2003, p. 23). Catch-up growth may also comprise a combination of the two types.

Regarding the catch-up potential of an individual it is important to know at what stage the growth curve slowed down. Because growth processes differ in pace - neural growth occurs for instance very rapidly in the first year of life and is much faster than overall physical growth whereas genital maturation does not occur until adolescence (Zimbardo et al. 1993, p. 122) - stages of development are identified within the overall process of physical growth. On the basis of longitudinal data on growth velocity by age and sex a growth curve can be modelled. The shape of the growth curve is non-linear: infancy is characterised by rapid, although decelerating, growth; in childhood growth is more or less constant or slightly decelerating; whereas in adolescence the final growth spurt sets in (Bianculli 1985, p. 47; Heald 1985, p. 51).

Apart from the period of gestation, growth velocity never becomes faster than in infancy. Consequently, growth faltering in infancy is most detrimental, in the sense that “stunting at this phase is more difficult to recover in the future than a delay during a later age” (Silventoinen 2000, p. 23). Substantial, if complete, recovery of severely stunted children is possible particularly in situations where growth is
delayed, not due to poor environment, but to some temporary treatable factor such as celiac disease or a reduced growth hormone secretion (Ibid. 2000, p. 23). However, the potential for catch up faltering growth (stunting) in childhood is believed to be limited after the age of two years, particularly when such children remain in poor environments (Gillespie and Flores 2000, p. 2). Catch-up growth may be identified by looking at the timing of ‘adiposity rebound’, which refers to the age at which the Body Mass Index (BMI) reaches its lowest point in childhood and which is usually at the age of five or six years (Colhoun and Chaturvedi 2002, p. 130; Power and Parsons 2002, p. 308). As outlined by WHO (2003, p. 10), in terms of nutrition, the period of adolescence is also critical because of:

- the dramatic increase in physical growth and the related requirements of (extra) nutrients. In adolescence, 15 to 20 per cent of adult height and 25 to 50 per cent of adult weight is gained, whereas approximately 45 per cent of skeletal mass is added during this period (WHO 2003, p. 10; Abassi 1998, pp. 507-511);
- socio-cultural factors or change in lifestyles and food habits influencing nutrient intake and needs;
- the increase in nutrients during specific periods such as illness and pregnancy; and
- the fact that adolescence could be the (second) opportunity in life to catch up growth if environmental (nutritional) conditions are favourable.

In practice however the potential for significant catch-up in adolescence is small and may be limited to the brief period of pre-pubertal growth spurt, some 18-24 months immediately preceding menarche (WHO 2003, p. 22). Given the rapid growth, particularly these two years in which the peak in growth velocity is reached, adolescence is a ‘critical period’ (Bassey et al. 2002, p. 148). Catch-up growth, notably taking the form of an above-average BMI or weight gain following low birth weight, may also be detrimental as it is for instance associated with higher death rates from coronary heart disease (Eriksson et al. 1999, pp. 427-431).

Catch-up potential depends on contextual factors, particularly living conditions, and it may be influenced by intrinsic factors such as sex, or rather, sex-specific traits related to growth development. Timing and tempo of changes in height, weight and body composition in adolescence vary greatly (WHO 2003, p. 10). Boys and girls have different rates of growth during adolescence (Bianculli 1985, pp. 49-53) and the spurt occurs two years later in boys than in girls, but is greater and lasts longer in boys (Lachance 1995, p. 7; WHO 2003, p. 10). Lean body mass may attain its adult level as early as by the fourteenth year in girls (Heald 1985, p. 52) but the growth spurt usually subsides at the age of sixteen (Bassey et al. 2002, p. 148). In boys adult height is reached later, possibly as late as at the ages 17 to 18 years (Heald 1985, p. 52). This difference is believed to underlie the approximate 10 cm difference in adult height between men and women. As girls enter puberty two years earlier than boys, their growth ceases at least two years before that of boys, and these two years also represent the years of peak height velocity for each sex (Heald 1985, p. 53).

In sum, the physical indicators of adolescents’ reproductive health status (menarche, spermarche) are viewed within the lifecourse, and more specifically, within the reproductive health career, which is in turn closely related to the nutritional status career. Mental indicators of adolescents’ reproductive health status that we consider are viewed within the ‘career of knowledge and perceptions’, that may be influenced
by the broader process of socialisation. Some developmental time windows earlier in life may be distinguished because of their ‘critical’ or ‘sensitive’ nature, meaning - simply put - that any enhancing or detrimental status or experiences in these periods have long-term implications. Within the process of physical maturation, critical periods that one may consider are gestation (growth in utero, which may be reflected, albeit crudely, by birth weight) and specifically early childhood. Detrimental effects of early life malnutrition may to some extent be counterbalanced at a later stage in life if living conditions improve. The potential for and type of catch-up growth may be sex-specific and influenced by timing and extent (duration and severity) of malnutrition. Such special time windows are distinguished also within developmental psychology. 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).

2.3 From birth to childhood: laying the foundations of adolescent anthropometry

In this section the role of early life nutritional status for nutritional status in adolescence is discussed. Figure 2.3 describes the lifecourse (life cycle) approach to nutritional status development within a largely malnourished population, as adopted from the United Nations Sub-Committee on Nutrition (United Nations 2000, p. 1). The (interrelated) effects of early life growth failure may be passed on from one stage in life to the next, via the mechanisms of ‘programming’ as proposed by Barker (1992) and ‘cumulative nutritional deprivation’ (see subsection 2.2.3), and could consequently be passed on to the next generation, resulting in an intergenerational cycle of growth failure. The cycle starts at birth. Low birth weight (LBW) is an intergenerational problem since LBW babies can grow up to become undernourished and stunted children and adolescents, and ultimately malnourished women of childbearing age, who in turn are more likely to deliver LBW babies, particularly when the ‘woman’ is in fact an adolescent girl who became pregnant before her own growth was completed (Pojda and Kelley 2000, p. 2).

Our research stems from the assumption that birth weight and, relative to age, weight and height in early childhood create a predisposition to nutritional status in adolescence (pathway of physical maturation, subsection 2.3.1). In addition, the nutritional status in early childhood and adolescence is influenced by living conditions of the household, gender and the way the adolescent is raised (pathway of socialisation, subsection 2.3.2). Both pathways are also outlined in Figure 2.2 (subsection 2.2.2). Subsequently, we elaborate further upon this model while discussing the consequences of early life malnutrition and ‘late’ timing of menarche, expressed by young gynaecological age, on adolescent childbearing (sections 2.5 and 2.6).
2.3.1 Physical maturation: programming and cumulative causation

Viewed from the lifecourse perspective, reaching the adolescent stage implies having survived all previous stages in life. From a developmental point of view, life starts at conception: “a child at birth is already nine months old” (Cameron and Hofvander 1983, p. 1). In the same vein, Mosley (1979, p. 120) remarked that “the road to health begins at the moment of conception”. Constitution at birth is a function of genetic inheritance in conjunction with intrauterine factors (in utero nutritional and environmental conditions). Under optimal conditions normal birth weight in Europe and North America ranges between 3.3 and 3.5 kg irrespective of sex, whereas the average infant (in general) is 50 cm long at birth (Cameron and Hofvander 1983, pp. 1-6). In Bangladesh, 50 per cent of the children are born with a birth weight below 2500 grams (WHO 2003, p. 8). Such a birth weight is commonly used as a proxy for intrauterine growth retardation as particularly in developing countries data on gestational age are often lacking (United Nations 2000, pp. 2-3).

The study on the relative contribution of genetic inheritance and intrauterine factors on weight and size at birth is ongoing10, 11 and, to date, findings are inconclusive (see

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10 In the Netherlands, Amsterdam researchers recently started the so-called ABCD study (Amsterdam-Born Children and their Development), which aims to understand the role of lifestyle and ethnicity on birth outcome (announced in Zorgnieuws 2003, p. 3).

11 In Matlab, ICDDR,B is currently conducting a study to measure the impact of nutritional supplementation (food and micronutrients) during the first trimester of pregnancy, whereby they look specifically at nutritional status in pregnancy, maternal weight gain, and foetal growth as detected by ultrasound. This study is undertaken as part of the ‘LBW-Initiative’ or ‘MINImat’ project (ICDDR,B 2002b, p. 41). Putting the first trimester of pregnancy, as a critical time window, central is highly relevant as such, but more insight may be gained if other trimesters are considered as well. Findings of Stein et al. (1995, p. 135) on the Dutch Famine Birth Cohort suggest that there may be cumulative effects of severe nutritional deprivation during pregnancy on birth size, which may be trimester-specific and only hold below a certain threshold. Intrauterine growth retardation in the third trimester may be due to poor placenta development in the early stages of pregnancy (van der Veen 2001, p. 57).
for instance Kramer 1987a; Kramer 1987b; Hutter 1994; Kusin and Sri Kardjati 1994; Padmadas 2000; Pojda and Kelly 2000; van der Veen 2001; Osendarp 2001; den Draak 2003; Fairly and Taylor 2003; Diamond 2004), as is the study on its relation to early life anthropometry and health later in life (see studies by Barker and his colleagues). Basically, low pre-pregnancy nutritional status and insufficient weight gain of the mother during pregnancy are believed to be main causes for LBW babies (Riley 1994, p. 97; Gillespie and Flores 2000, p. 1). In line with the Barker hypothesis, findings of Roseboom et al. (2001) suggest that maternal malnutrition during gestation may permanently affect adult health without affecting the size of the baby at birth. There may thus be ‘hidden’ (programmed) impairments, which possibly take effect years later. Also, there may be a ‘sleeper effect’ meaning that effects of starvation are not passed on the next generation but to the next generation’s offspring, i.e. children are marked by the deprivations suffered years earlier by their grandparents. Evidence for such an effect is provided by research based on the Dutch Famine Birth Cohort, which consists of children born in Amsterdam during the so-called ‘Hunger Winter’, i.e. between 1-8-1944 and 15-4-1945 (Diamond 2004).

In Bangladesh, maternal nutritional status both before and during pregnancy is low. For instance, more than 50 per cent of the women in this country are underweight (Gillespie and Flores 2000, p. 3). Particularly, rural Bangladeshi women are considered to be chronically malnourished (Fauveau 1994, p. 111). In Bangladesh, 57 per cent of the rural (poor) women are less than 147 centimetres in height as a result of stunting, virtually all mothers weigh less than 50 kg (Ross et al. 1996, p. 10) and 47 per cent is underweight according to BMI (i.e. BMI\(^{12}\) was 18 or lower) (WHO 2003, p. 8). Another study reports an average height of Bangladeshi women of nearly 150 cm (Riley 1994, p. 97). During pregnancy, weight gain is often insufficient due to strenuous activities, infectious diseases (Fauveau and Chakraborty 1994, p. 115) or taboos on food intake (Fauveau 1994, pp. 267).

Maternal height (and to a lesser extent weight) is one of the anthropometric indicators that we include in our study and which is part of the broad list of factors that contribute to a particular birth outcome (see for a complete list for instance van der Veen 2001, pp. 53-58). There is evidence supporting the hereditary nature of an impaired nutritional status: low height may become an embedded trait and passed on from mother to child. The role of genetics is reflected by the association between children’s birth weight and that of their mothers, and birth weight of siblings tend to be similar to each other (van der Veen 2001, pp. 53-58). This effect also holds later in life: a mother’s stature is probably the best predictor of a child’s height (Silventoinen 2000, p. 16). In addition, a mother’s BMI was found to be strongly positively related to height and BMI of her sons at the ages 7 to 15 years (Eriksson et al. 1999, pp. 427-431). The transmission from the paternal side seems far less influential (Silventoinen 2001, p. 16; van der Veen 2001, pp. 53-58).

In Bangladesh, also after birth nutritional status is likely to be inadequate: almost 60 per cent of the under-fives suffers from malnutrition (ICDDR,B 2002b, p. 36). It is estimated that in rural Bangladesh malnutrition accounts for 33 to 67 per cent of the deaths of 1 to 4-year-old children (Fauveau 1994, p. 251). In 1993-1995, 58 per cent

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\(^{12}\) A BMI of 18.5 or lower indicates underweight (see also subsection 3.3.2).
of the under-fives was wasted (low\textsuperscript{13} weight-for-height), 55 per cent was stunted (low height-for-age) and 73 per cent was anaemic (WHO 2003, p. 8). Particularly in the 12 to 23-month-age group, rural children in Bangladesh suffer from acute malnutrition (Ross et al. 1996, p. 10). In the study of Baqui (1990), which serves as our baseline study (see Chapter 3), the proportion of under-five children who were underweight (<-2 SD) ranged from 73 per cent to 78 per cent in 1988-1989 (depending the three-month period considered within these two years). The corresponding data for childhood stunting (<-2 SD) ranged from 68 and 76 per cent, respectively. The most common deficiency disease among young children is protein energy malnutrition (PEM), which entails weight deficit and linear growth failure (FAO 1992, p. 53; WHO 2003, p. 10). Children need, relative to their body weight, much energy and protein-rich food (Leemhuis-de Regt 1998, p. 9).

A cumulated list of factors underlies malnutrition among Bangladeshi children. Although PEM is primarily caused by a deficient intake of energy and usually protein, the condition is almost always aggravated by repeated episodes of diarrhoea and other infections for which especially young children are more susceptible. Wasted and stunted children are more prone to illness than well-nourished children, and diarrhoea and respiratory episodes are more likely to progress in severity in stunted children (Baqui et al. 1993b; Lachance 1995, p. 8). A child’s susceptibility to infectious diseases is exacerbated by poor or unfavourable living conditions. It is however difficult to disentangle the detrimental effects of infectious diseases from the impact of malnutrition as they often go hand in hand: being malnourished may increase the susceptibility to infectious diseases, while illness may lower the nutritional intake (WHO 1968; Norren van and van Vianen 1986). As a result of this synergistic relationship, children may suffer from malnutrition even during times of affluence, for instance during harvest seasons, when diet is adequate but infection may continue to be present (Hellen Keller International 1993, p. 7).

Diarrhoeal diseases are heterogeneous. In Matlab, dysentery (diarrhoea with blood) stands out as the one with most deleterious consequences on both ponderal and linear growth ( Alam 2001, p. 109), and the impact is dependent on the proportion of dysenteric episodes in the total diarrhoea burden (Alam et al. 2000a, pp. 916-921). Diarrhoeal diseases caused 56 per cent of the deaths among 1 to 4-year-old children in Matlab (Comparison area; see section 3.4) between 1978 and 1987 (Fauveau 1994, p. 177; Ross et al. 1996, p. 12). The incidence of diarrhoea tends to increase rapidly when complementary foods are given and particular when breastfeeding is stopped. Diarrhoea is therefore particularly common in the second year of life and is then referred to as ‘weanling diarrhoea’ (Cameron and Hofvander 1983, p.33). However, more and more, weaning starts at an earlier age. In Matlab, exclusively breastfed infants account for 70 per cent at 3 months and 37 per cent at 6 months (Alam 2001, p. 90). Onset of weaning, either too early or too late, may have detrimental effects on health and nutritional status. Among Indian children the timing of initiation of weaning is associated with stunting: children weaned at an age of 6 months or older were more likely to be stunted at a later age as compared to those weaned before 6 months, with odds ratios of 1.57 and 1.88 respectively (Padmadas 2000, p. 181; Padmadas et al. 2002, p. 855).

\textsuperscript{13} Below -2 Standard Deviation (SD) from the median of a well-nourished reference population (see also subsection 3.3.2).
Consequences of low birth weight and early childhood malnutrition

Short-term effects of LBW (higher morbidity and mortality particularly from infectious diseases) are in general well documented, although the link with for instance perinatal mortality (mortality in the period of the 28th week of gestation to the first week after birth) is not yet fully understood (Melve and Skaerven 2003; Wilcox 2003). The risk of neonatal death (deaths taking place within the first 28 days of life) is estimated to be 10 times higher for infants weighing 2 to 2.5 kilograms as compared to those weighing 3 to 3.5 kilograms (Gillespie and Flores 2000, p. 1). LBW babies typically have impairment of most immune functions and face an increased risk of diarrhoea and pneumonia (Gillespie and Flores 2000, p. 1). Razzaque (1989) found that for children conceived during the 1974-1975 famine in Bangladesh child mortality in the first two years of life in the period following the famine was higher.

A number of studies have tested the ‘foetal origins hypothesis’ and long-term outcomes of LBW have been published for many adult diseases, among which include ischemic heart disease, stroke, chronic bronchitis and coronary heart disease (see for instance Barker 1992; 1993; 1998; Eriksson et al. 1999; Barker et al. 2001). Also for girls born with a very low birth weight (i.e. below 1500 grams) an association was found with higher risk of pregnancy-induced hypertension (PIH) in their first pregnancy (Innes et al. 2003, pp. 861). Birth weight has also been shown to be positively related to subsequent fatness indicated by BMI at the ages 7, 11, 16, 23 and 33 years, in a J-shaped fashion with increasing age, but maternal weight largely explained the relation between birth weight and BMI at age 33 (Parsons et al. 2001). Cheung et al. (2002, p. 335) pointed out that the impact of a smaller size at birth may be compensated by a higher postnatal weight gain. They found birth weight and weight gain from birth to the age of 7 years to be inversely related to psychological distress in adults at the ages 23, 33 and 43 years. All in all, long-term effects of LBW have been studied but often entail a broader timeframe beyond the period of early childhood or adolescence. Also little is known about the mechanism of in utero programming on adolescent anthropometry.

Postnatal nutritional status, notably height in early childhood, remains crucial. In the short term, an inadequate dietary intake in the first years of life results in weight loss, growth faltering, lowered immunity and mucosal damage, which in turn elevates the risks of infectious diseases. In addition, the metabolic system may be further altered. Regarding long-term effects, in a recent review by Cole (2000, p. 323) on secular trends in growth, it was concluded that “the increment in adult height is achieved by the age of two years” and he suggests that “growth at this time is the outcome of an interaction between concurrent nutrition and the growth rate set during pregnancy, reflecting parental size”. Accordingly, it is believed that although some of the height differences between people are attributed to genetics, the general trend for average height to increase is almost certainly due to improvements in nutrition, and to a lesser extent, health (Bateson 2001, p. 930).

Chronic malnutrition and disease in childhood may stunt growth and potential adult height may not be reached (Bassey et al. 2002, p. 148). Regarding catch-up potential, there is little evidence that growth retardation suffered in early childhood can indeed be significantly compensated for in adolescence (WHO 2003, p. 22). Similarly, there is as yet, little evidence (and research) on the effects of supplementary feeding on
adolescent girls to prevent adult stunting (Leemhuis-de Regt 1998 p. 70). An exception is the two-generation study undertaken in Guatemala, which entails a prospective investigation of protein-energy supplementation early in life and growth of subsequent generation and which considers data collected between the years 1969 and 1977 and between the years 1996 and 1999 (Stein et al. 2003 pp. 162-167). The study showed that nutritional supplementation in childhood has positive effects on both the supplemented individuals as well as on subsequent generation, whereby the effect was more pronounced in (second-generation) boys than in girls. Within the context of fetal programming boys are in general more sensitive to nutritional deprivation than girls (Barker 1998). However, during infancy and childhood the opposite - girls being more vulnerable than boys - may be true with regard to intra-household allocation of food and care within Bangladeshi society, as will be outlined in the next subsection 2.3.2.

2.3.2 Socialisation: gender and the ‘accumulation of nutritional capital’
Adolescents’ reproductive health is usually studied in relation to various contemporary factors, with special emphasis on differences by sex or gender. Whereas sex refers to biologically-based characteristics, gender is a social and psychological phenomenon referring to learned sex-related behaviours and attitudes. Gender identity incorporates an individual’s sense of ‘maleness’ and ‘femaleness’ and awareness and acceptance of one’s sex (Zimbardo et al. 1993, pp. 144-145). The mechanisms through which gender is related to behaviour are often rather indiscernible, reflecting informal social rules and modes of conduct, among which are those directly related to nutrition and health.

As noted by Kuh and Hardy (2002, p. 13), the inquiry into gender inequalities in health usually lacked a temporal perspective, and it was certainly one that neglected childhood. During infancy and childhood, morbidity and mortality increasingly become a reflection of the competency of parental care, and it is only after 5 years that the child is able to extend at least a minimum level of care for himself or herself (Caldwell 1996, pp. 610-112). Particularly important are factors from the child’s embedded socio-economic and cultural context: hygiene, the allocation of food in the family and living conditions of the household in which the child grows up. Poor living conditions may exacerbate an inadequate nutritional status whereas sufficient accessibility of food and health care may leave open the possibility of recovering slowed growth and counterbalance some of the detrimental effects of growth failure experienced earlier in life. The FAO identified Bangladesh in 1996 as a ‘low-income food-deficit’ country i.e. a country that has not enough food to feed its population and one that lacks the financial resources to pay for imports (USAID 1997, pp. 8-9).

Apart from poverty (particularly at the micro level), an unequal allocation of food in the family at the expense of young girls is likely to reflect the low status of girls and women within Bangladeshi society. As stated by Ross (1996, p. 5) “by the time she reaches puberty a Bangladeshi woman has already experienced a lifetime of discrimination compared to males”. Blanchet (1984; 1996) describes several practices illustrating the lesser value of girls in Bangladesh: the dai (traditional birth attendant or midwife; Blanchet 1996, pp. 50-51; Carr et al. 1997, p. 222) cutting the cord of a boy nine fingers from the umbilicus but that of a girl only seven (1996, pp. 50-51); the dai who delivers a boy receives twice as much as one who delivers a girl (Blanchet
1984, p. 108; Blanchet 1996, p. 51); and the azan (an exclamation of joy after birth by the father or in his absence another man of the family to thank Allah) is louder, longer or different (for instance twice instead of once; in both ears in instead of one) for boys than for girls (Blanchet 1984, p. 120). Blanchet (1996, p. 50) notes furthermore that “the birth of a boy is always greeted with joy”, whereas “the birth of a girl is welcomed when it is a first child (the first fruit which announces the fertility of the ‘plant’), or when there are already boys and no girl in the family. Otherwise, it is often received with resentment”. Later in life discrimination continues in various domains of life. For instance, between 1992 and 1997 Bangladeshi women’s wages in manufacturing were 50 per cent that of men’s wages (Population Reference Bureau 2002).

Son-preference is related to the fact that the Bangladeshi society is patrilineal and that post-marital residence is largely patrilocal. The importance of having at least one son is rooted in the perceptions of the male as the bread-winner and sole source of social support for parents in old age (Mukhopadhyay and Savithri 1998, p. 30). Girls are born to be given in marriage, which is commonly accompanied by a dowry (the transfer of money or valuables from the family of the bride to the groom and his family) - despite its illegal nature - and consequently may impoverish the family14. In the words of Blanchet (1996, p. 50) “boys represent wealth, but girls are seen as a cumbersome responsibility”.

Although girls survive in greater numbers than infant boys almost everywhere, in a few countries, including Bangladesh, gender discrimination and neglect outweigh girls’ biological advantage (Population Reference Bureau 2002). Although at a first glance living conditions seem to be alike for all members of the household, intra-household customs may result in different feeding patterns, care-giving and health-seeking behaviour of parents towards their children, at the expense of girls (Chen et al. 1981; WHO 2003, p. 15). Examples are girls eating after having served all other family members, the belief that girls have less nutritional requirements15, girls’ diets being restricted for fear that they ‘grow too rapidly’, food restrictions for girls on specific items (WHO 2003, p. 15), and more girls being abandoned or given up for adoption than boys (Blanchet 1996, p. 52). A recent study undertaken in 8 districts in Bangladesh revealed that 54 per cent of adolescent girls’ brother(s) were given more food because of seniority or other (not specified) reasons, and that the diet of girls was more likely to be low in protein as compared to the male family members (Akther et al. 1999). Ramifications may be gender differentials in nutritional status and mortality from illness, as illustrated by several studies conducted in rural Bangladesh (D’Souza and Chen 1980; Chen et al. 1981; Bhuiya et al. 1988; Razzaque 1989; Bairagi and Chowdhury 1994). During the 1974-1975 famine infant mortality was higher among girls than among boys (Razzaque 1989). Under-five girls faced risks of mortality from measles that were twice as high as those for similar-aged boys (Bhuiya et al. 1988).

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14 The opposite system of dowry is ‘joutuk’, the brideprice paid by the groom’s family to the bride’s. In rural Bangladesh the norm of brideprice has shifted to that of dowry in the 1960s over a time span of less than one generation. As compared to brideprice, which has a more voluntary nature, dowry demands are more harsh and substantial (Amin and Cain 1997, pp. 290-293).

15 The amount of extra nutrients required depends on the rate of growth, degree of physical maturation or body composition, activity level and sex. Boys generally have higher energy requirements than girls do due to their larger proportion of lean body mass to adipose tissue and this differences has implications for the nutritional needs of adolescent boys and girls (WHO 2003, p. 11).
There are indications that discrimination against girls is negligible in small families but much higher in families with more than two girls (Ross 1996, p. 5). Muhuri and Preston (1991, cited by Caldwell 1996, p. 612) pointed out that girls growing up in rural Bangladesh without older sisters had only slightly enhanced mortality as compared to their brothers, while those with elder sisters were prone to almost double infant mortality. Similarly, in rural India, it was found that both boys and girls who were born after multiple same-sex siblings experienced poor outcomes (with regard to nutritional status and immunisation), that preference for sons exists and that boys who are born after multiple daughters have the best possible outcomes (Pande 2003, pp. 395-418). However, other recent studies do not show such a sex-selective care-giving behaviour of parents towards their children in Bangladesh or a gender-bias regarding food allocation in India (WHO 2003, p. 19). The possible recent shift in Bangladesh is also illustrated by the number of deaths under age 1 per 1000 live births in the period 1995-2000 which amounted to 79 for girls and 78 for boys (Population Reference Bureau 2002).

2.4 Adolescence: reaching menarche and spermarche

After having survived infancy and childhood the child enters the precarious stage of adolescence, which carries a particular importance to the reproductive health career. The definition of ‘adolescents’ reproductive health’ should basically not differ from the overall definition of reproductive health. However, because of their age, and in particular the developmental stage they are in, studying adolescents’ reproductive health may necessitate a specific approach. Next, we elaborate upon the concept of adolescents’ reproductive health, seen in light of the life-course perspective and the cultural context of Bangladesh (subsection 2.4.1). Thereafter the determinants of timing of menarche and spermarche are discussed, in part within largely malnourished populations (subsection 2.4.2). We close this section with a discussion of the social significance of these reproductive transitions in relation to the Bangladeshi cultural context (subsection 2.4.3).

2.4.1 Concept of adolescents’ reproductive health in Bangladesh

Delimitation by age

‘Adolescence’ is defined as the period from 10 to 19 years (UNFPA 1998a, p. 1). Some studies, however, apply a narrow definition of 15 to 19 years, while a few studies include all 10 to 24-year-olds, hereby applying the term ‘young people’ in general (UNFPA 1998a, p. 1). From a demographic point of view, it seems as if the choice of a narrow definition of 15 to 19 years is closely related to the overall definition of ‘reproductive years’, generally identified as the period of 15 to 45 or 15 to 49 years for women in fertility- or reproductive health-related demographic and health studies and censuses. As noted by Becker (1993, p. 21) “for fertility statistics, the 15 to 19 year age group is used”. The choice of a definition with a lower cut-off point of 15 years seems also related to the fact that in many countries childbearing among girls younger than 15 years is scarce. Moreover, for socio-cultural reasons questions dealing with fertility or reproduction may be addressed to married women only. This study is about adolescents’ reproductive health in Bangladesh, a country where currently 48 per cent of the 15 to 19-year-old girls is married (Population
Reference Bureau 2000, p. 21). Historically, the mean age at first marriage has been low in Bangladesh: 12.3 years in 1975 and 14.8 years in 1989 among ever-married women (Islam and Mahmud 1995, p. 23). Given these statistics, one could argue that research on adolescents’ reproductive health in Bangladesh should preferably apply the overall definition of adolescence, i.e. the period between years 10 and 19, thus including the youngest age group.

Classification according to physical, mental or social markers of development

Such a ‘dogmatic’ approach to the concept of adolescence, bounded by age-ranges, does not give enough credit to the complex and multi-dimensional character of this stage in life. Adolescence is generally identified as the period during which physical and social maturity take place. Transitions and processes, such as reaching menarche, developing close friendships, dealing with peer pressure, building an identity, becoming aware of one’s sexuality, do not exactly begin or occur at the age of 10 and stop on the day of reaching one’s twentieth birthday. To the contrary, as we will outline in the upcoming subsections 2.4.2 and 2.4.3, the timing and duration of these transitions and processes differ between populations and individuals. Although development processes (physical maturation, socialisation) are universal (albeit not the timing of transitions), the socio-cultural meaning attributed to processes and transitions differs between cultures. As stated by Jejeebhoy (1998, p. 1275) “variation in social and cultural settings between countries and biological differences concerning age of physical maturation render different connotations to the meaning of adolescence in different settings”. In addition, following Ojeda et al. (1985, p. 4) cultural and socio-economic factors, in particular educational level and the opportunities to participate actively in the work force, may be decisive for the chronological delimitation of an age group rather than biological factors. A case in point is that the meaning of ‘adolescence’ for girls working in (garment) factories in urban settings is altering gradually because of the opportunities their work brings (saving money, postponing marriage, greater social freedom) (Amin et al. 1998, pp. 185-200; Population Council and ICRW 2000, pp. 24-26). Much may thus depend on adolescents’ socio-cultural class or economic position. As noted by Monroy de Velasco (1985, p. 21) “the behaviour of adolescents in the basic areas of socialisation differs in accordance with the social class to which they belong”.

Indicators of adolescents’ reproductive health in this study

Given the great diversity among adolescents in terms of sex, gender, age, social and economic class, the concept of adolescents’ reproductive health may need to be defined in view of a mixture of (physical, social, mental, economic) factors. In the case of adolescent girls for instance, not only menarche may mark the onset of adolescence but rather the changes that occur with regard to expected social behaviours arising from this event. Before we can relate such a notion on adolescence in Bangladesh to reproductive health, we recall that at the ICDP 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). As noted in section 1.2, the Programme of Action (PoA) as adopted at the ICPD includes a broad range of topics associated with adolescents’ reproductive health but does not provide specific indicators of this status.
In this study, we confine the concept of adolescents’ reproductive health to two of the three components, i.e. physical and mental well-being in the reproductive domain. 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 acceptable and appropriate milestones for adolescent maturity rating (Soekarjo et al. 2003, pp. 27-39). 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 (see subsection 2.2.2). In this study we analyse knowledge and perceptions (including emotions) about reproductive transitions and developmental processes that are typical of the adolescent stage. If ‘prepared’, the reaching of menarche and spermarche is less likely to be experienced in a state of ignorance or anxiety. However, reproductive knowledge is also required in order to be ‘prepared’ for future reproductive health events (notably childbirth) and for maintaining reproductive health status in adulthood.

In the next two subsections 2.4.2 and 2.4.3 we subsequently discuss the timing of menarche and spermarche among adolescents and the social connotations of these reproductive transitions within Bangladeshi society. Such a contextual sketch provides insight into the conditions and circumstances that shape Bangladeshi adolescents’ knowledge and perceptions about reproductive health.

### 2.4.2 Timing of menarche and spermarche

**Menarche**

For girls, the adolescent stage is announced by the onset of menarche, the initiation of uterine bleeding. In most countries, particularly developed countries, the average age at menarche has gradually decreased in the past century due to improved nutritional conditions, better health care and improved environmental conditions. Throughout time, the reported ages of menarche differ considerably worldwide. Becker (1993, pp. 23-31), drawing largely on data published by Eveleth and Tanner in 1976, includes an extensive list of (median or mean) ages at menarche for various populations by world region, which originate from studies conducted between the 1950s and the 1980s. The average age at menarche ranges from about 12.5-13.0 years in contemporary Western countries (Riley et al. 1993, p. 50) to more than 15 years in developing countries. Cross-cultural trend studies show that age at menarche generally declines over time at a pace of two months per decade, although the decline is slacking or even coming to a halt in some developed nations (Becker 1993, p. 31). Other studies mention a secular decline at a pace of three to four months per decade (Rich-Edwards 2002, p. 25). Becker (1993, p. 31) notes that “it seems clear that a biological minimum age at menarche exists and the distributions of age at menarche in some developed countries are pushing up against this limit”.

Studies on menarche in Bangladesh, a country where malnutrition is highly prevalent - especially among children and adolescents - are not consistent about the average age
at which the menstrual cycle commences. Moreover they do not unambiguously point to a decline or delay of menarche, let alone the extent of it. This inconsistency may in part be related to the fact that censored cases (i.e. those girls who have not reached menarche at the time of data collection) are generally not taken into account. In 1976 median ages for Muslims and Hindus were respectively 15.8 and 16.0 years (Chowdhury et al. 1977). These high median ages are comparable with those found among economically less developed societies such as the New Guinea tribes (ranging from 15.5 and 18.4 years), Nepalis (ranging from 15.2 to 17.0 years\(^{16}\)), rural Rwandans (ranging from 16.5 and 17.0 years) and the nomadic Dobe !Kung in South Africa (16.6 years) (Becker 1993, p. 30) but are also comparable to estimates for nineteenth-century European populations. Historical data show that in Western societies a decline in age at menarche of about 3 years has taken place since the end of 1800.

In Matlab, the average age at menarche of Muslim girls increased from 12.9 years in 1961 to 17.4 years in 1977 (Chowdhury et al. 1977). This increase was ascribed to worsening nutritional conditions because of the war in 1971 and famine in 1974 (Becker 1993, p. 31). In the eighties, the adolescent growth spurt was still considerably delayed, extended and less intense in girls from Matlab as compared to a sample of British girls (Riley 1987). More specifically, age at menarche was delayed by about 3 years in Bangladesh (15.8 years in Matlab) as compared to Western populations (12.5 years). Riley suggests that this is due to chronic malnutrition in childhood. Data from the 1996 Matlab Health and Socio-economic Survey yield an average age at menarche for 20 to 24-year-old women of 14.6 years (own calculation). A study by Akther et al. (1999, p. 5) showed that of 1,000 adolescent girls, 92 per cent had reached menarche by the age of 14 years. However, in a study by Chowdhury et al. (2000, pp. 249-256) conducted in another rural Bangladeshi area (Rupganj thana\(^{17}\), Narayanganj District), a mean age at menarche of 13.0 years was determined by retrospective recall.

**Determinants of timing of menarche**

Studies on determinants of menarche are generally based on the two types of assumptions, which also reflect the discussion on nature versus nurture. Firstly, it is hypothesised that there is a potential age of reaching sexual maturity, which is ‘genetically programmed’, i.e. sexual maturity is bound to be reached at a certain age or after having reached a certain stage of physical development that follows a genetically-based timetable of maturation. Hormones mediate this underlying process but how endocrinal factors determine the onset of menarche is poorly understood (Gray 1993, p. 220). The underlying hormonal system entails among others small quantities of ovarian steroids, (an increasing level of) ovarian oestrogen in early puberty, which in turn triggers the release of a lutenizing hormone as a consequence of which ovulation is initiated (Gray 1993, p. 220).

A late menarche may ‘run in the family’. There is some evidence of genetic predisposition on timing of menarche, which is among others grounded on the finding that age at menarche of mothers and their daughters is positively correlated (Gray

\(^{16}\) These age boundaries reflect mean instead of median ages at menarche.

\(^{17}\) Regional unit, comparable with a sub-district (Faveau 1994, p. 13).
However, the predictive power of age at menarche of a girl’s mother is small (Grabber et al. 1995). Genetic factors probably account for approximately 10 to 15 per cent of the observed variation in age at menarche (Gray 1993, p. 220). Another way of examining the role of genetic inheritance in conjunction with ‘nurture’ factors on the reproductive maturation process is by conducting studies on twins. There is a strong association between age at menarche of monozygotic twins (who share identical genetic material whereas they live distinct lives) when compared to the association for dizygotic twins (Gray 1993, p. 220). In a classical study on twins the genetic contribution to the variance in age at menarche was estimated to be 45 per cent, with the majority (37 per cent) being due to dominant genetic effects (Snieder et al. 1998, pp. 1875-1880). At the group level, the role played by heredity may be reflected in associations between timing of menarche and ethnic group: Hispanic, Asian-Pacific Island and African-American girls are for instance more likely to experience early menarche than non-Hispanic white girls (Koprowski et al. 1999). Accordingly, Richardson et al. (1983) found that nutritional components cannot be fully held accountable for differences in timing of menarche among four ethnic groups in South African girls.

Secondly, it is hypothesised that other factors than genetic heredity impact the timing of menarche. It is widely recognised that nutritional status is one of the most important non-genetic determinants of menarche (Riley et al. 1993, p. 50). Menarche typically starts about one year after peak growth velocity (WHO 2003, p. 12) and better nourished girls reach menarche earlier than undernourished girls (WHO 2003, p. 15). Nutritional status, indexed by weight, height and adiposity, has been associated with menarche but the determinants of pre-pubertal growth (for instance diet, hormones, infections) which affect timing of menarche are not known, “nor is there agreement regarding the relevant ‘critical period’ for determining menarche” (Rich-Edwards 2002, p. 28).

Central to the so-called ‘critical weight hypothesis’ is the assumption that irrespective of age, menarche occurs only after an adolescent girl has reached a certain ‘critical weight’ (Frisch and Revelle 1969; 1971). However, the evidence presented in support of this hypothesis appeared to be weak (Trussell 1980). Rao et al. (1998, pp. 619-628) tested the critical weight hypothesis in Indian girls in relation to socio-economic class and found that at the group level the mean weight at menarche was around 38.0 kilograms in both socio-economic classes, irrespective of age at this event. Kurdzielewicz et al. (1999, pp. 354-358) found a weight of 48.0 kilograms (and a length of 159.2 centimetres, resulting in a BMI of 18.9) to correspond with a mean age at menarche of 13.1 years. Also the distribution of fat on the girl’s body may play a role: girls with fat localised around their hips (pear shaped) may have an earlier menarche than girls with abdominal fat (apple shaped) (Napieralski and Devine 1998, p. 1). Levels of fat accumulation during childhood and adolescence relate to adequacy of diet, particularly diet rich in protein and calories, in relation to the amount of physical labour or (excessive) exercise (Koziel and Jankowska 2002, p. 268).

Apart from weight, other studies (Delgado et al. 1985; Linhares et al. 1986; Koprowski et al. 1999) also underline the impact of height (changes in bone growth) and/or mid-upper arm circumference on age at menarche. Koprowski et al. (1999) found that among a group of Southern California schoolgirls, tall girls (>148.6 centimetres) reached menarche earlier than short girls (<135.9 centimetres). A similar
association was found between those with a high BMI (>20.7) versus those with a low BMI (<16.1). Also Chowdhury et al. (2000, pp. 249-256) found early menarche to be associated with better nutritional status, indicated by a significantly higher mean BMI and height among menstruating girls as compared to similar-aged non-menstruating girls. The findings indicate that instead of specifically weight or height only rather the combined effect of these two anthropometric measurements impacts the timing of menarche. Taller, heavier girls generally start menstruation earlier than shorter, lighter girls but both anthropometric indices and the distribution of body fat are also influenced by genetic inheritance (Napieralski and Devine 1998, p. 1). Whereas weight reflects current nutritional status, height can considered to be a reflection of nutritional status in the past. Okasa et al. (2001, pp. 68-78) note that age at menarche has been used as a marker of environmental conditions during childhood. The association between height and timing of menarche may be related to ovarian volume in childhood. Bridges et al. (1993, pp. 456-460) found that tall girls had significant greater ovarian volume, and concluded that growth hormone appears to influence ovarian growth.

It is assumed that foetal conditions, among others reflected in weight and size at birth, may influence the timing of menarche, although their relationship with reproductive maturation has not yet been completely established and not all studies support this hypothesis. In a study among Polish girls who reached menarche on average at the age of 12.7 years, it appeared that girls born with a low birth weight for gestational age (the cut-off value of the 10th percentile) were more likely to have experienced menarche by the age of 14 years as compared to their peers with a birth weight appropriate to gestational age (Koziel and Jankowska 2002, pp. 268-269). This finding corroborates the results obtained by Persson et al. (1999, pp. 747-755) who observed that onset of puberty and age at menarche occurred five months earlier among girls born small-for-gestational-age compared to girls born with normal body size for gestational age.

At first glance, such a finding is counter-intuitive in view of the fact that a) birth weight is positively associated with subsequent fatness (see for instance the overview by Power and Parsons 2002, pp. 310-311); and b) weight in childhood and pre-adolescence is associated with early onset of menarche (see overview above). However, in line with Barker’s programming hypothesis, disturbances in foetal growth may advance the onset of puberty and consequently earlier menarche due to patterns of early childhood growth18. Thus the impact of a smaller size at birth may be compensated by a higher postnatal weight gain (Cheung et al. 2002, p. 335). Similarly, Silva et al. (2003) initially found a similar counter-intuitive association between birth weight and menarche, but after controlling for growth in infancy (up to two years) the effect reversed whereby girls who were heavy at birth reached menarche earlier than others with similar infant growth (Silva et al. 2003, pp. 405-412). The authors consequently conclude that timing of menarche may be set in utero or early in life but be modified by changes in body size and composition in childhood.

However, as noted by Cole (2000, p. 323) “the timing of menarche is probably set near the time of birth, but the mechanisms involved are unclear”. A certain amount of

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caution is indeed called for because in research by Lumey and Stein (1997, p. 1964) on the basis of the earlier-mentioned Dutch Famine Birth Cohort no detectable effect was found between in utero famine exposure and age at menarche later. Also, in Guatemala daughters of mothers who received energy- and protein-rich supplementation during pregnancy did not significantly have a lower age at menarche than daughters of mothers who received a low-energy, no protein supplement (Khan et al. 1995, p. 1092). Today there are only a handful of reports that hint at fetal determinants of age at menarche (Rich-Edwards 2002, p. 27). Examples from animal studies do however point in the direction of some sort of ‘defence mechanisms’ set in utero. In Bateson’s view, predicting the kind of nutritional environment (adequate or poor) a girl will grow up in may be set in utero, a line of thinking which corroborates the Barker hypothesis. However, rather than use the term ‘programming’, as was en vogue with the Barker group, this process of ‘maternal nutritional forecasting’ is referred to as ‘induction’ in developmental biology (Bateson 2001, p. 929). Based on animal studies, the developmental rule among adolescent girls would be: “if conditions are good, become sexually mature early, but if conditions are poor, delay maturity” (Bateson 2001, p. 929).

Apart from genetic inheritance and contemporary and (very) early life nutritional status, the timing of menarche is often studied in relation to factors that are mainly behavioural in character (life style) or reflect a myriad of socio-economic conditions. In addition, given the knowledge that menarche and the menstrual cycle are triggered by hormones, the role of psychological stress on the menstrual cycle is recently being studied but not yet understood (Sanders and Bruce 1999). Evidence for this line of thinking involves among others data on delayed menarche in (adolescent) girls in wars (for instance World War II, Srebrenica) which could not be attributed to nutritional deprivation (Rich-Edwards 2002, p. 29). Other (correlational) studies on the determinants of menarche include socio-cultural, economic or environmental factors. Graham et al. (1999, pp. 257-267) found that year of birth, literacy status, county of residence, amount of physical labour, general health status, pesticide exposure before menarche, and drinking water source had led to the decrease in mean age at menarche from 16.5 to 13.7 over an approximate time interval of 40 years in two rural counties of the Anhui Province in China. Although the study on such indirect determinants of menarche is informative in itself, it should in our view be kept in mind that - with the exception of a few factors such as year at birth and pesticide exposure, which may impact levels of hormones related to reproductive functioning directly - all determinants are manifested through nutritional status.

In general, athletes or girls that undertake strenuous exercise reach menarche at a later age compared to non-athletes, which can be attributed to lower body weight and lower proportion of body fat in athletes, although this later age at menarche may also be due to heredity (Riley et al. 1993, p. 50; Napieralski and Devine 1998, p. 2). Riley et al. (1993, p. 51) discuss the suggestion that high daily energy expenditure activities such as carrying wood and water and harvesting, which are often done by adolescent girls in developing countries, can be related to later onset. However, they do not consider this likely. Despite the considerable energy required by these activities, they do not place the same demands on the cardiovascular and muscular skeletal systems as the athletic activities (Riley et al. 1993, p. 51).
In sum, from the above we learned that age at menarche is influenced by multiple determinants that partly (mainly the ‘nurture part’) vary between individuals and populations. Figure 2.4 (page 40) summarises the most important factors identified in this subsection as possible determinants of timing of menarche. Prenatal factors considered are maternal characteristics (mother’s age at menarche and her stature); postnatal factors discussed are nutritional status in (early) childhood and in adolescence, as well as those indicated by anthropometry.

Following the terminology adopted by Davis and Blake in 1956 and Bongaarts and Potter (1983), we may classify some determinants of menarche as proximate in contrast to indirect determinants. The principle characteristic of a proximate determinant is that it influences the outcome variable directly, meaning that if a proximate determinant changes, the outcome variable changes as well (assuming that the other proximate determinants remain constant), whereas this is not necessarily the case for indirect determinants (Bongaarts and Potter 1983, p. 1). Given the elaboration as presented in this subsection, it could be argued that nutritional status in preadolescence, indicated particularly by weight and, possibly to a lesser extent, height as well, may be considered as a proximate determinant of timing of menarche.

**Spermarche**

For boys from a biological perspective, the onset of the adolescent stage, as well as their reproductive career, commences with spermarche, the first release of spermatozoa (Hirsch et al. 1979, pp. 289-298). We would like to discuss timing of spermarche in a similar manner as we did for timing of menarche, whereby proximate determinants are distinguished from indirect determinants. However, data on spermarche are scarce particularly in developing countries (WHO 1995, p. 267). The study on spermarche has been hampered by social and ethical considerations (Hirsch et al. 1979, pp. 289-298). In studies on menarche and menstruation the main interest lies in their timing and periodic nature. The menstrual cycle follows a monthly pattern, directed by hormones, and is beyond the ‘control’ of the girl or woman in question. In contrast to menarche and menstruation, that are considered ‘natural biological’ events although often imbued with quite specific cultural meanings, spermarche is associated with masturbation (wet dreams, nocturnal emissions, ‘night pressure’), and generally tabooed, particularly in Bangladesh as will be discussed in subsection 2.4.3.

Among adolescent boys in Indonesia the median age at spermarche (self-reported nocturnal ejaculation) was 12 years (Soekarjo et al. 2003, pp. 27-39). Among Israeli schoolboys the rate of spermaturia was 38 per cent at age 12 and 69 per cent at age 13 (Hirsch et al. 1985, pp. 35-39). In an earlier study among Israeli schoolboys, the median age of spermarche was estimated 14.5 years (Hirsch et al. 1979, pp. 289-298). The latter findings are in accordance with the median age of spermarche at 14 years among American boys in 1988 (TAGI 1997, pp. 1-2). Few studies have been carried out about the short- or long-term effects of malnutrition on the maturation process of boys and men. The effects of malnutrition and, in its ultimate form starvation, in (adult) males are loss of libido and sperm quality, i.e. the decrease in prostate fluid, sperm count, loss of sperm mobility, and eventually the cessation of sperm production (Frisch 1993, p. 138). Persson et al. (1999, pp. 747-755) studied the hypothesis that perinatal factors (being born after pre-eclampsia or born prematurely), along with being born small, large, short or tall for gestational age, influence the onset of
puberty. They found that age at puberty for boys did not differ between ‘normal’ boys and boys affected by perinatal factors; boys who were small at birth and short for gestational age were however on average four centimetres shorter than ‘normal’ boys, whereas those born tall for gestational age were on average three centimetres taller than ‘normal’ boys at the onset of puberty. It is plausible to assume that, as is the case with girls, childhood malnutrition may also delay the growth spurt and pace of sexual maturation in boys, and, that pending different nutritional regimes the mean ages at which reproductive transitions take place are subject to change over time as well.

2.4.3 Social significance of reproductive transitions in adolescence

Having discussed the merely physical pathways underlying timing of menarche, this subsection addresses the socio-cultural connotations (or perceptions) of menarche and spermarche. Particularly in late childhood and adolescence the worlds of boys and girls in Bangladesh become increasingly segregated. Girls participate in child care, food preparation and other household tasks, and sons work for wages from a young age (Mukhopadhyay and Savithri 1998, p. 26). Being responsible for their family’s contact with the larger community, the focus or ‘world’ of a boy becomes larger.

When girls grow up, their lives are increasingly confined to their family compound (and later to her family-in-law’s). A symbolic aspect of this confinement is that girls are sometimes named after pet birds, whereas boys are given names connoting qualities of courage and leadership (Fauveau 1994, p. 276). As illustrated by the story of Monowara and Beauty (Chapter 1), girls enrolled in our study often had names or nicknames referring to their appearance such as Beauty, Lovely, Swapna (dream), whereas most boys bore names of typical Muslim leaders such as Mohammed and Hossein.

While studying the meaning of adolescent transitions, a reference should be made to the work of Aziz and Maloney (1985) entitled ‘Life stages, gender and fertility in Bangladesh’. We have drawn heavily upon their work, as well as on writings of Blanchet (1984; 1996), who is quite critical about Aziz and Maloney’s work: their fieldwork is considered relatively outdated, the words used by the authors seem to “belong to a literary tradition and are most likely to be used by educated Bangladeshis” and in reality the stages of adolescence in Bangladesh would not be that fixed and may be much more complex and vary by for instance socio-economic group or region (Blanchet 1996, pp. 45-46). However, to our knowledge, the work of Aziz and Maloney is the only study which follows a lifecourse perspective, whereby also the socio-cultural meaning of the adolescent stage is addressed, and which is undertaken in Matlab. Building further on the eight stages of life as defined by Erikson, Aziz and Maloney (1985) distinguish three periods in adolescence that are each characterised by specific behaviours considered appropriate for that particular stage (Figure 2.5): the pre-adolescence stage (kaisor prarambha), especially for girls of 11 to 12 years, early adolescence (kaisor) from 12 to 15 years, and late adolescence or youth (nabajauban).
Figure 2.4: Determinants of menarche as identified on the basis of literature review

<table>
<thead>
<tr>
<th>Prenatal factors:</th>
<th>Postnatal factors:</th>
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</thead>
<tbody>
<tr>
<td>Conception, gestation</td>
<td>Infancy and childhood</td>
</tr>
<tr>
<td></td>
<td>Adolescence</td>
</tr>
<tr>
<td>Constitution at birth: gestational age, weight, size at birth</td>
<td>Adolescent nutritional status: height, weight (BMI)</td>
</tr>
<tr>
<td>Maternal determinants: mother's age at menarche, mother's stature</td>
<td>Timing of menarche</td>
</tr>
</tbody>
</table>

Socio-economic living conditions and life style factors
The adolescent sub-stages are preceded by the stage of *shisukal* (up to 5 years of age) and *balyakal* (6 to 10 years). A *shishy* child is a child who “does not understand”. The concept of *shishy* does not yet distinguish gender. However, during the subsequent stages boys and girls increasingly learn the gender-specific roles that they are expected to play and consequently are addressed according to stage and gender: *balok*, *balika* and *kishor*, *kishori* (Blanchet 1996, p. 38). By the age of five, boys are fully aware of their specific gender roles and their hierarchical and oppositional characteristics (Kahn et al. 2003, p. 8). Although not explicitly studied, this probably applies to girls of this age as well.

Despite the aforementioned age boundaries, indicators of physiological development and transitions as well as the hereby imposed normative modes of conduct - which seem to be stronger for girls as compared to boys as we briefly describe below - are decisive for the distinction of the respective stages. A girl is for instance in the pre-adolescent age when her growth spurt begins, and certainly by the time she reaches menarche. Pre-adolescence in boys is celebrated with circumcision. A boy is identified to be in early adolescence at the time of his growth spurt, the production of semen, the growth of a moustache and the breaking of voice. As noted by Blanchet there is “great flexibility and tolerance in accepting the pace in which children develop” (1996, p. 46) and “Bengali culture and language recognise life-stages but years of age are not counted with any precision” (1996, p. 41).

**Pre-adolescence or kaisorer prarambha**

The period of *kaisorer prarambha* is distinguished more for girls than for boys because of the importance attached to girls’ behaviour during adolescence which directly impinge on the reputation of herself and her family. A girl in the pre-adolescence period is asked to learn to observe *purdah*, an institutionalised socio-cultural mode of conduct, perpetuated by religion (Ross 1996, p. 33). The norms imposed by *purdah* enforce a high standard of female modesty, dictates propriety in deed and thought, restricts mobility, limits autonomy and, makes women dependent (Ross 1996, p. 33). In practice, observing *purdah* means that a girl should attend to domestic cores, cannot go outside alone unless accompanied by an older woman, is not supposed to speak loudly but rather she should talk soft, and move politely and is expected to cover her head with a shawl (*ghomta*) in the presence of older men.
Walking to school is done in a group of peers or in the company of older brothers or sisters. Parents are afraid that if a girl works in the field, sexual mishaps (aghatan) will occur. Girls are not supposed to be hugged by their father after the age of 8 or 10 years, whereas boys are not to be hugged by their mother after the age of 10 or 12 years. It seems that Bangladeshi girls are expected to learn at a very early age (before the end of childhood) the gender schemas, i.e. how to behave as a woman as defined in Bangladeshi society.

In the pre-adolescent stage Muslim boys are circumcised, which is crucial to the embodiment of dhormo19 (Blanchet 1996, p. 56). The age at which this happens can vary considerably, anywhere between 4 and 10 years (Blanchet 1996, p. 56), but is certainly carried out well before boys are believed to reach sexual maturity. The circumcision procedure is in many ways comparable to a wedding ceremony and accompanied by special rituals and dietary precautions. After this rite of passage a party is thrown in honour of the - elaborately dressed up - boy in order to celebrate his new status and, moreover, to make a public acknowledgement of the transition. Illustrative for a boy’s transition to adulthood is that “a circumcised penis is given the name of an adult penis, even if the boy has not yet reached puberty” (Blanchet 1996, p. 56). The few rules or expectations for boys in this same period are learning to carry out farming tasks or other work in order to contribute to the family income and fulfilling some religious duties like for instance praying five times a day (namaz). Also, they are not expected to talk to adolescent girls alone and to look at them with ‘improper’ (i.e. a sexual or romantic) intention (Begum 2000).

Early adolescence or kaisor

The period of kaisor is most relevant to our adolescent study population. A Bangladeshi girl is in the period of early adolescence at least by the time she begins her growth spurt and certainly by the time she reaches menarche. A Muslim girl who has not yet reached menarche is called nabalika; a girl who has experienced this event is called sabalika. A Hindu girl in the latter stage is called upajukta, which literally means a girl who has become fit for coitus. Unlike India, in Bangladesh there is no public ceremony for girls reaching maturity (Aziz and Maloney 1985, p. 13). In general, in Bangladesh there are not many rituals of passage between stages as compared with other cultures (Aziz and Maloney 1985, p. 12).

A positive connotation of menarche is the term phul phuteche (Begum 2000). Phul means both flower as well as placenta (Blanchet 1984, p. 85). A woman’s reproductive system is referred to as gach, or tree (Blanchet 1984, p. 95). Often however, menarche and menstruation in general are called shorir kharap, meaning impure and ‘unclean’, although these words carry connotations of indisposition or sickness. Menstruation in general (mashik) is considered shameful (lozzajanak bepar) (Begum 2000) because the blood is regarded as “the greatest of all pollutions” (Blanchet 1984, p. 33). Beliefs about the polluting nature of menstruation and associated taboos are also described for other societies, for instance India (Garg et al. 2001; Hutter et al. 2002). Common statements in India during menstruation are for instance “I have become untouchable” and “I am mahar (I am sitting apart)” (Ibid.

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19 ‘Dhormo’ is the right action according to the stage of life (Aziz and Maloney 1985, p. 7) or, more specific, a by god-ordained life path or religion and relates closely to one’s ‘jati’, which is based upon one’s inherited religious or occupational group, and gender (Blanchet 1996, p. 33).
2001, p. 19). In India and Bangladesh, menstruation is associated with taboos and accompanied by restrictions on work, food, bathing and the strongest of all, avoidance of sexual intercourse (Garg et al. 2001, p. 20). In Bangladesh it is expected that women and postmenarcheal adolescent girls do not enter the cow shed, kitchen, fields, or visit other houses and particularly sick persons (as a menstruating woman’s touch may be harmful to the patient) and later in their lives, to abstain from sex and prayers during menstruation (Aziz and Maloney 1985, p. 149). It is commonly believed that a woman who does have sex while menstruating will contract a sexual disease (maulavi kabiraj) (Begum 2000). Also an irregular menstrual cycle (mashik animito) is associated with sexual intercourse during menstruation (Begum 2000).

For Bangladeshi girls, menarche is both an important event in their lives as well as a very private matter, generally viewed in a negative light. As in India, mothers seldom talk to their daughters about menstruation (Ross et al. 1996, p. 32). In a study of Akther et al. (1999, p. 5) undertaken in Bangladesh, only eight per cent of the girls was informed about menstruation by their mother. The silence surrounding menarche may be such that “the reason for the bleeding is not even disclosed” (Garg et al. 2001, p. 20), assuming that mothers do know about its physical origin. When a girl reaches menarche, the mother generally avoids any explanation or hides her shame or ignorance by using symbolic phrases like “your son is born” (Blanchet 1984, pp. 38-39). Regarding sexuality, ‘innocence’ is expected of adolescent girls and guilt and punishment are consequences for not observing the role that accords with the expected state of ‘understanding’, i.e. what it is they are expected to know as morally good and to practise it according to their life’s path and dhormo in life (Blanchet 1996, pp. 47-48). It closely relates to the concept of jati, i.e. one’s species, inherited religious or occupational group, or gender (Blanchet 1996, p. 33).

Research by Nahar et al. (2000, p. 1) among 4,000 10 to 19-year-old adolescent boys and girls from urban and rural areas in Bangladesh revealed that respectively 50 and 68 per cent of the boys girls knew about important physical changes that adolescents undergo. Only 34 per cent of the girls knew about menstruation before they reached menarche, as a result of which the experience was described as “a mental trauma” (Nahar et al. 2000, p. 1). A study by Akther et al. (1999, p. 5) found that 52 per cent of the girls shared similar experiences. Nearly 65 per cent of the girls enrolled in that study reported menstrual problems such as pain in the abdomen and back as well as weakness (Akther et al 1999, p. 5). After menarche, girls are informed about how to deal with menstruation and about the accompanying customs by their elder sisters, sisters-in-law or grandmothers; often, however, such information was found to be incomplete (Nahar et al. 2000, p. 1).

Although menarche may not be accompanied by special public rites it does induce a major transition in the young girl’s life, as she is now considered to be marriageable. Illustrative in this respect is a saying from Bengali literature emphasising a girl’s state of physical development in relation to marriage and dowry: “budding breasts in kaisor stage are worth one crore20 and “pomegranates, in late adolescence, are worth one lakh” (Aziz 1981, p. 51). Another case in point is that in rural Bangladesh, like many other rural societies, comparisons are made between stages of sexual development and the agricultural cycle: adolescent girls are, pending their physical development,

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20 A crore is ten million taka (the Bangladeshi currency); a lakh is one hundred thousand taka.
referred to as *auisya* or *amuinya*, a reference to paddy planted at the same time but the first type is ready to be harvested after 3 months whereas the latter takes 5 months to ripen (Aziz 1981).

For boys the production of semen seems to be an important indicator of the stage of development: before and after this event they are called either *nabalak* or *sabalak* respectively (which literally means ‘he who has semen’, but which is generally based on the appearance of secondary sexual characteristics). Similar to menstrual blood, semen is regarded as polluting when linked to masturbation. From an Islamic point of view masturbation is seen as a waste of semen as it does not lead to reproduction. In order to prevent boys from practising it, they are told that masturbation is likely to make the semen thin and less effective and to cause a series of harmful ‘impairments’ such as gonorrhoea, impotency, early ejaculation, infertility or deformed children later in life, and a general loss of health, charm and happiness (Aziz and Maloney 1985; Khan et al. 2003, p. 15). Adolescent boys from Dhaka associated semen to blood, whereby one drop of semen was considered the equivalent of 70 drops of blood, as a consequence of which masturbation is believed to seriously weaken the body and nocturnal emission is seen as a disease for which medicine is needed (Khan et al. 2003, pp. 18-20). Research among adult men in Matlab also revealed that masturbation and nocturnal omission were considered sexual problems for which treatment was sought (Rahman et al. 1997).

Other perceptions were that men have a limited and predetermined quantity of semen, which can be replenished by eating a large quantity of food but this process of replenishment is believed to become increasingly difficult as the man grows older (Fauveau 1994, p. 281). Only 29 per cent of the boys in some rural areas in Bangladesh did not know about ‘wet dreams’ prior to their onset (Nahar et al. 2000, p. 1). When boys received any information, generally from friends, it was incomplete, incorrect and associated with sickness. In a study by Alam (2002a, p. 1), semen emission, a source of *pourush* (male strength), was considered to be a major health problem among the respondents consisting of a mixed group of adolescent and adult males in a rural area of Bangladesh (not Matlab). Furthermore, the respondents were indifferent, unclear and uninformed about women’s reproductive health concerns and problems or special needs of women during pregnancy, childbirth and the postpartum and lactation period.

In this stage (*kaisor*), the differences with the previous stage are clearly visible in codes governing dress and behaviours. A girl in the pre-adolescence period wears pants and a blouse (unless she attends Koran classes), but a girl in early adolescence is expected to wear a *shelwar kamiz* or a saree, with an *orna* (scarf) to protect her breasts and cover her head, as a sign of respect and modesty in front of senior males (Blanchet 1996, p. 57). If men see either body or hair, it is the girls who bear the shame. For girls, an important part of their social education is to learn attitudes such as extreme modesty and feelings of shame (*lojja*) or, in the words of Blanchet (1996, p. 57), “shame is not only a desirable quality, it is an essential attribute of virtuous women which must be instilled in girls before puberty”. Boys do not yet need to take into account specific norms on clothing at this particular stage. Wearing of *lungi* is usually done at a later age. Boys at this stage - *sabalaks* - are however expected to perform adult duties, both in religious and societal terms, but in contrast to girls they
can still swim, climb trees, play in the paddy fields, and are free to roam around wherever they want to. Girls are restricted to and around the house (Begum 2000).

Late adolescence or nabajauban

During nabajauban adolescents ‘fine-tune’ the schemas on gender roles that are valid and appropriate in this stage of life and in adulthood. The differences between schemas for boys and girls become increasingly apparent. Nabajauban is a precarious stage: parents should be careful and watch an unmarried girl, and gender role expectations become exaggerated in this period (Aziz and Maloney 1985). The vulnerable position of the adolescent girl is confirmed by studies on violent deaths (notably suicide and homicide) among women of reproductive age (Fauveau and Blanchet 1989; Ahmed et al. 2004). In Matlab during 1982-1998, 22 per cent of the death rates among 15 to 44 year old women were due to violence and related causes whereby the main factors contributing to suicide and homicide were beatings, torture and ill-treatment by family and family-in-laws (Ahmed et al. 2004). Illustrations of what is euphemistically called ‘Eve-teasing’ are reported daily in Bangladeshi newspapers21 (Khan et al. 2003).

Modesty is particularly important in view of the adolescent girl’s future life as a daughter-in-law. A newly-wed girl “becomes the household’s most junior member, whose chief virtue is submission, learning how to do what will please the family and providing her worth through obedience, hard work, good temper and modest behaviour” (White 1992, p. 97). New wives are “new workers, whose labour, sexuality and fertility belong to the husband and his family” (White 1992, p. 98). As noted by Alam et al. (2000b, p. 5) “very young brides and grooms may not be able to cope emotionally with the heavy load of responsibilities in marital life”. Viewed from the perspective of the bride, living in with the family-in-laws combined with the heavy daily workload - finally the mother-in-law has someone to take over the major part of the household chores - as well as adjusting to the new role of wife are exacting on the young bride. In order to avoid marital tension, endanger the stability of the marriage and consequently increase the risk of divorce, she most probably undergoes this period of life by observing silence.

2.5 Transition to adulthood: marriage and childbearing

Timing of menarche is not only an indicator of reproductive health status per se, it may also be crucial for the rest of the reproductive career. The justification of a study on timing of menarche is particularly reflected by the consequences of a small time gap between timing of menarche and subsequent reproductive health events. In this section, the context of adolescent marriage and fertility is briefly sketched against the importance of motherhood in Bangladesh (subsection 2.5.1). Malnourished girls typically experience menarche ‘late’ i.e. later than they probably would have had if

21 One of the most dramatic forms of Eve-teasing is throwing (nitric or sulphuric) acid in the face, which causes the skin tissue to melt, often exposing the bones underneath the flesh and sometimes even dissolving the bones. The majority of these victims are women, and nearly half of them are adolescent girls below 18 years. They are attacked because they have spurned sexual advances of men, rejected a marriage proposal or because of family or land disputes, dowry demands or desire for revenge. Systematic data collection on this topic was started recently in 1999 by The Acid Survivors Foundation. In that year they documented 210 cases, but they believe that the number of actual cases is higher and increasing at an alarming rate (The Acid Survivors Foundation 2001).
they had been well nourished. Particularly for these girls the gap between menarche on the one hand and marriage, first pregnancy and childbearing on the other, may be small. Malnutrition and young gynaecological age are likely to increase the risks related with adolescent childbearing (subsection 2.5.2).

2.5.1 Adolescent marriage and fertility

Within the cultural setting of Bangladesh, menarche announces the start of the reproductive career and “readiness for marriage” (Riley et al. 1993, p. 52). Hence the relatively low - among the lowest in the world - mean ages at marriage among ever-married women in this country: 12.3 years in 1975 and 14.8 in 1989 (Islam and Mahmud 1995, p. 23). In 1984, legal restrictions on marital age were revised in the Child Marriage Restraint Act: the minimum legal age of marriage was set at 18 years for women and 21 years for men (Ross et al. 1996, p. 17). In Matlab, the mean age of marriage for women has been 18 years and above only since 1984, prior to which the average age at marriage among girls was consistently below the age of 18 years (Mostafa et al. 1996, p. 46).

Though well regulated in theory, in practice laws governing marriage are either “hardly known over the countryside” or “blatantly ignored because they are at such odds with social norms” (Ross et al. 1996, p. 18). As a consequence, the marriage is either unregistered or registered with overreported ages since it is believed to be a legitimate union in the eyes of the samaj or society (Blanchet 1996, pp. 43-44). In 1995, 42 per cent of the 15 to 19-year-old adolescent girls in Bangladesh was married (MWCA 1997, p. 17). In 2000, the average age at marriage in Matlab was 19.0 years for first-time brides (which is comparable to the 1995 national average of 19.9 years) and 26.3 for first-time grooms (ICDDR, B 2002a, p. 41; MWCA 1997, p. 17). There are indications that young people in Bangladesh are not in favour of such a large age gap between spouses (Haider et al. 1997). Differences in age at marriage may influence the power balance between the partners (UNFPA 2003, p. 16). In Bangladesh, girls and women have a smaller say in the marriage matchmaking process and also during the marriage they have a weaker negotiation position (Blanchet 1996, p. 57). Boys are generally informed about their upcoming wedding and may come “to view the bride” in advance, whereas girls are usually notified at a late stage and are “supposed to remain ignorant of and detached from the forthcoming marriage” (White 1992, pp. 99-100).

For a myriad of reasons the interval between age at menarche and age at marriage in Bangladesh is relatively small. Late age at menarche plays a role, but as important is the preference for early marriage, which can in part be attributed to the emphasis on izzat or honour (Mukhopadhyay and Savithri 1998, p. 28). In Bangladesh, preservation of virginity until marriage is highly valued (Caldwell et al. 1998, p. 147) and early marriage ensures that “the girl does not stray sexually” (Mukhopadhyay and Savithri 1998, p. 48). In Bangladesh, “sex outside marriage occurs only seldom since premarital sex is looked upon harshly in the society” (Islam and Mahud 1995, p. 23). Prohibition of premarital sex encourages premenarcheal marriages or short intervals between menarche and marriage (Riley 1994, p. 86). A few studies reveal however that unmarried adolescents in Bangladesh are sexually active, though probably not on a large scale (Gazi et al. 1999; Gubhaju 2002; Alam 2002b). Other (related) reasons for early marriage in rural Bangladesh are the demand for (higher) dowry for older
girls, poverty of the father, and criticism of the community about grown-up unmarried girls (Nessa 1997). There is a saying in Bangladesh that a women is old at the age of 20 years (‘kurite buri’) but that a man is still young at the age of 70 years (Begum 2000).

The process of matchmaking is highly sensitive, not only for the families involved but notably for the adolescents themselves, particularly the girl. Her dowry is influenced by personal traits such as appearance, complexion, and physical maturation. Nutritional status is also found to be associated with the age at marriage in the sense that relatively heavy girls marry at younger ages than their lighter counterparts, even when menarche status is controlled for (Riley 1994, pp. 94-97). Better nourished adolescent girls are viewed as more attractive, physically stronger and more matured as compared to undernourished girls (Riley 1994, p. 88). Not only the greater physical attraction per se, but also the fact that a good nutritional status reflects a relatively good socio-economic status may enable families with adequate resources to arrange an early marriage for their daughters (Riley 1994, p. 88).

In Bangladesh, the dhormo of girls is “marriage and the successful discharge of the roles of daughter-in-law, wife and mother” (Blanchet 1984, p. 119; Blanchet 1996, p. 49). This dhormo should not be underestimated: in the Bengali culture motherhood “is more than a role, it is a religion, the ultimate purpose of womanhood” and “a woman who is not a mother is an incomplete person, a failed woman” (Blanchet 1996, pp. 131-132). She has no status and no say in household decision-making until she becomes a mother (Mukhopadhyay and Savithri 1998, p. 28). As pointed out by White (1992, p. 98) marriage in Bangladesh is essentially contradictory: it is both a prime mean of female subordination as well as the culturally accepted basis of women’s fulfilment and advancement. Regarding motherhood, she observes a similar contradiction. Despite the highly celebrated status of motherhood, it involves according to White (1992, p. 110) also “a loss of the sense of self and one’s personal boundaries”. A case in point is that when girls marry and move to their in-laws’ home, they are just called bou (housewife, wife, bride or daughter-in-law), until they give birth to a child and are called mother-of-so-and-so which entails an higher status (Blanchet 1996, p. 54; Carr et al. 1997, p. 222; White 1992, pp. 110-111).

Islam (1999, p. 85) concludes that adolescent childbirth and motherhood are highly valued in Bangladeshi society since 78 per cent of the births to adolescents are wanted. As in India it is believed that the proven fertility of the newly-wed girl enhances her status (Barua and Kurz 2001, p. 58). The birth of a child is also believed to contribute to spousal satisfaction, with notably lower rates of divorce (Alam et al. 2000b, p. 12; White 1992; Nahar and van Ginneken 1997). Particularly the woman is socially stigmatised because of infertility (Papreen et al. 2000, p. 3). It is estimated that childlessness underlies 8 per cent of the deaths due to suicide among women of reproductive age in Matlab between 1987-1998 (Ahmed et al. 2004, p. 316). Age at first marriage is often considered equal to age at sexual initiation. In Bangladesh, effective married life begins almost immediately after the marriage ceremony or, in a few cases, within 6 months at the most (Fauveau 1994, p. 21). Despite this occasional period of post-marital habitation, the birth of the first child follows relatively soon after marriage; in Matlab for instance in the order of 1 to 2 years thereafter (Fauveau 1994, p. 110). (Adolescent) fertility is determined by various factors that are either
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behavioural or biological in character (Bongaarts and Potter 1983), which we briefly discuss below.

**Behavioural factors affecting (adolescent) fertility**

Behavioural factors that impact adolescent fertility are the frequency of intercourse, induced abortion and contraceptive behaviour. Little is known about the frequency of intercourse among adolescents (and adults) due to the private nature of the subject (see for instance the study by Ruzicka and Bhatia in 1978, cited by Becker 1993, p. 37). Induced abortion is for cultural and religious reasons illegal in Bangladesh under the Penal Code of 1860, except for those cases where the life of the woman is in absolute danger (Ross et al. 1996, p. 20). Studies on induced abortion are scarce in Matlab (Ahmed et al. 1998; Johnston 1999) and little is known about abortion among adolescents in this area. During 1976-1989, 19 per cent of the maternal mortality among 15 to 44-year-old women in Matlab was related to abortion (Fauveau 1994, p. 122).

Contraceptive behaviour among adolescents in Bangladesh is documented, although for cultural reasons, family planning services have traditionally been offered to married women of reproductive age in Bangladesh (Francisco de 1996, p. 10). Unmarried but also newly-wed adolescents often lack adequate information, skills and resources needed to prevent unwanted pregnancies and sexually transmitted diseases, for which girls are disproportionately vulnerable as compared to boys (WHO 2000, p. 1; UNFPA 2003, p. 23). Schools in Bangladesh generally lack legislative backing to undertake sex education and they often cannot obtain approval of parents. Typically, children and adolescents learn about sex through friends or similar-aged relatives as a result of which often incorrect or highly exaggerated information is passed (Verma et al. 1997, p. 483).

Islam and Mahmud (1995, p. 25) state that knowledge of contraceptives is “almost universal among both adolescents and adults in Bangladesh”. However, further investigation reveals that almost all of their interviewees were aware of certain methods but did not know how to use them effectively. Similar findings are described by Pachauri and Santhya (2002, p. 186) with reference to adolescents in the South Asian region as a whole. In a study by Alam (2002b) among sexually active boys of 14 to 19 years, it was found that they were reluctant to use contraception claiming that sexual intercourse must take place several times before conception can occur and that it is unlikely that sexual intercourse with an adolescent girl will result in pregnancy because she is not physically mature enough. The proportion ‘ever used a contraceptive method’ in Bangladesh amounted to 26 per cent among married adolescent girls aged 10 to 19 years, against 48 among adults (Islam and Mahmud 1995, p. 26). Whereas contraceptive pills as well as intrauterine devices (IUDs) and injectables are popular, condoms are quite unpopular (Francisco de 1996, p. 11). They

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22 Two-thirds of all reported STDs in Bangladesh occur among people under 25 years of age and the incidence is much higher among women aged 15 to 19 years than among men of the same age (Gubhaju 2002, p. 19). Worldwide, HIV/AIDS has become a disease of young people, with young adults aged 15 to 24 years accounting for half of the approximately 5 million new cases of HIV infection each year (UNFPA 2003, p. 23). In Bangladesh, the HIV/AIDS epidemic seems so far to develop at a slow pace and seems to be concentrated within high-risk sub-groups (FHI 2001; FHI 2003).
are more used by young men rather than by adult men (Islam and Mahmud 1995, p. 27).

**Biological factors affecting (adolescent) fertility**

In a normal population conception rates are about 20 to 30 per cent per cycle (Hamilton-Fairley and Taylor 2003, p. 6). The chances of conceiving in adolescence are in general lower due to a period of *postmenarcheal* sub-fertility, related to the probability of absence of menstrual periods (amenorrhea), non-ovulatory menstrual cycles (anovulation), infrequent or irregular menstrual cycles (oligomenorrhea), infrequent or irregular ovulations (oligoovulation), and the probability of foetal loss. Particularly, in adolescence not all cycles are ovulatory and cycle length may be variable (Gray 1993, p. 221). Irregularities after menarche may last 5 years (Metcalf et al. 1983). It is estimated that 60 to 70 per cent of the cycles are ovulatory among 15 to 19-year-old girls in developed nations, but whether this finding also holds for developing countries is unclear (Becker 1993, p. 33). Malnutrition may increase the incidence of anovulatory cycles. Adolescent sub-fertility may also be due to early foetal loss (before the pregnancy is recognised). The probability of foetal loss is higher among adolescents as compared to women in their twenties (Becker 1993, p. 40). Despite the lower chance of conceiving and higher probability of early foetal loss in adolescence, Bangladesh is among the countries with the highest levels of adolescent childbearing: 117 births per 1000 girls aged 15 to 19 in 2002 (UNFPA 2003, p. 71). In Matlab, the mean ages of women at first conception were on average 18.3 years in 1977, 19.5 years in 1982 and 20.3 years in 1985 (Fauveau 1994, p. 110). It should be noted that the actual number of pregnancies, and hence the burden of fertility on adolescent girls, is higher because only live births are included in the numerator whereas spontaneous and induced abortions and stillbirths are excluded (UNFPA 2003, p. 82).

**2.5.2 Adolescent childbearing, malnutrition and young gynaecological age**

The background against which adolescent childbearing in Bangladesh takes place is as follows: 67 per cent of all pregnant women never made an antenatal care visit throughout their pregnancy; about 92 per cent delivers at home and 87 per cent delivers without skilled attendants (ICDDR,B 2002b, p. 29). The untrained relatives and neighbours who attend births generally lack knowledge of hygiene and safe-delivery practices (Ross 1996, p. 29). A cultural obstacle in this respect may be *purdah* which prescribes that a girl (or woman) is not allowed to be on her own in public places (Mukhopadhyay and Savithri 1998, p. 32), as a consequence of which she needs to be chaperoned by for instance her husband, male family member or mother-in-law, who also need to be convinced of the need to seek medical care. *Purdah* may form a burden to visit hospitals since the overwhelming majority of the doctors are men and it is culturally prohibited that a woman is to be seen, let alone physically examined, by any male other than her husband except under dire circumstances (Ross 1996, p. 30). Taking into account statistics on maternal

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23 In Bangladesh women’s status, indicated by physical mobility and authority in household decision-making, is low although it differs according to individual, household and village characteristics (Balk 1997a; 1997b). Examples of women bearing their children in harsh conditions or alone are described by Blanchet (1984).
mortality, one has to conclude that adolescent childbearing brings along elevated (reproductive) health risks, both for the girl herself as well for her child. In Matlab, the maternal mortality rates (MMRs) of girls aged 10 to 14 and 15 to 19 were respectively 5 and 2 times as that of women aged 20 to 24 years (WHO 1991, p. 6; Mayor 2004, p. 1152). The overall MMR in Bangladesh, between 4 to 6 deaths per 1,000 live births, is one of the highest in the world (Ross 1996, p. 28).

Causes of maternal mortality deaths are usually classified as direct, indirect and coincidental (for an overview and specification of causes we refer to WHO 1991). In Matlab, mortality from (direct) obstetric causes constituted 28 per cent of the total mortality among 15 to 24-year-old women during 1976-1989 (Fauveau 1994, p. 113). In terms of maternal mortality, adolescent girls basically face the same risks as other women of reproductive ages. That some risks are elevated for adolescent girls is not related to age per se, but rather to associated factors typical of adolescents in general (a nulliparous state), or that may considered to be applicable to adolescent girls in rural Bangladesh (inadequate nutritional status and young gynaecological age). Below these factors are described briefly.

**Parity**

In general, and in Matlab as well, primigravidae face substantially higher maternal mortality risks than women with pregnancies of higher order (WHO 1991, p. 413; Ronsmans and Campbell 1998, p. 286). As a child born to an adolescent girl is most likely to be the first child, the risks can expected to be higher for adolescents. However, in some countries the elevated risk of maternal mortality associated with a nulliparous state may surpass the effect of young age as such (WHO 1991, p. 413). In terms of causes of death, parity is particularly associated with hypertensive disorders of pregnancy which are in developing countries most often seen in very young women and those pregnant for the first time (WHO 1991, p. 8). In 1976-1985 hypertensive disorders of pregnancy constituted 20 per cent of the total maternal deaths among primigravidae (against respectively 11 and 0 per cent among women with prior parity 1-5 and 6+) in Matlab (WHO 1991, p. 412). When broken down by age, hypertensive disorders of pregnancy constituted 18 per cent of the total maternal deaths among girls aged 15 to 19 years, against 13 and 0 per cent among women aged respectively 20 to 34 and 35 to 44 years (WHO 1991, p. 412). Hypertensive disorders of pregnancy constitute the most important cause of death among nulliparous adolescent girls.

**Malnutrition**

A second factor that elevates the risks involved with adolescent childbearing is related to short maternal stature and lack of micronutrients. That girls (and women) of small stature are particularly susceptible to obstructed labour is related to the fact that height

24 Worldwide the infant mortality rate (IMR, infant deaths per 1000 live births) among adolescent mothers is 1.5 times higher than it is among mothers aged 20 to 24 years (UNFPA 1997, p. 2). In 1996-1997, the IMR in Bangladesh among adolescent mothers was 106 against 79 for mothers aged 20 to 29 years (Mitra et al. 1997, p. 104). In Matlab, the IMR fell from 110 to 58 between 1966 and 2000 (ICDDR,B 2002a, p. 6), whereby for mothers born between 1976 and 1989, the IMR is constantly higher for infants born to adolescent mothers as compared to older mothers (Bairagi et al. 1999, pp. 58-59). In Matlab, the odds of dying during the late neonatal and post-neonatal period are even higher for second than for first children of adolescent mothers, possibly due to the depletion effect of repeated births with small spacing in between (Alam 2000c, pp. 229-236; WHO 1991, p. 6).
is correlated with pelvic size (WHO 1991, p. 6). Short women tend to have a small pelvis and for a height less than 145 cm and a weight lower than 45 kg there may be an obstetric risk (WHO 2003, pp. 22-23). Adolescent girls have, because of their age, not yet completed linear growth and are therefore likely to be shorter than 145 cm (and lighter than 45 kg), but their height and weight may as well be sub-normal because of malnutrition. Information on adolescent nutritional anthropometry is scarce (United Nations 2000, p. 2) particularly within the South Asian region including Bangladesh (WHO 2003, p. 6; p. 14). If the few studies reflect the national situation, adolescents in Bangladesh generally do not meet the necessary nutritional requirements. A survey by Shahabuddin et al. (2000, pp. 93-98) among unmarried adolescents aged 10 to 17 in rural Bangladesh revealed that 59 per cent of the girls (and 75 per cent of the boys) were thin (i.e. a low BMI-for-age) and 48 per cent of the girls (and boys) were stunted. In their study, the prevalence of ‘thinness’ declined by age whereas the prevalence of stunting increased by age. This points to an increased obstetric risk for adolescent girls. In India it was found that up to 67 per cent of the girls were classified as being at obstetric risk (by height and weight criteria) in their 15th year as compared to about 20 per cent in the 19th year (WHO 2003, p. 22).

Obstructive labour is commonly caused by cephalopelvic disproportion or CDP, a condition whereby the pelvis or bony birth canal is too narrow to permit easy and safe passage of the baby, particularly its head (WHO 1991, p. 8). Up to the middle of the twentieth century CDP was also common and remained one of the main causes of maternal deaths in Europe, where it was induced by childhood rickets (Gebbie 1982). The consequences of CDP relate foremost to complications attended by hours of agony that lead to higher health risks for the woman and her baby during childbirth. Without treatment a woman with obstructed labour will eventually die of haemorrhage, rupture of the uterus, infection or sheer exhaustion (WHO 1991, p. 8). Unhygienic practices by birth attendants heighten the risks as well.

With respect to obstructive labour in adolescent girls not only anthropometry of the girl herself is important but also that of the baby she delivers, notably the baby’s head circumference. In general, anthropometry of the baby may be influenced by trimester-specific nutritional deprivation. When growth restriction in utero occurs early in pregnancy the infant exhibits symmetrical (or proportional) growth with length, weight, head and abdominal circumference all below the 10th percentile reference for a given gestational age (stunting), whereas when growth restriction in utero occurs late in pregnancy, the infant inhibits asymmetrical (or disproportionate) growth with a normal length and head circumference, but low weight due mainly to a lower proportion of visceral and fat tissue (wasting) (Podja and Kelley 2000, p. 6). Particularly for stunted adolescent mothers-to-be obstetric problems may occur in case of asymmetrical growth of the foetus, whereby only the baby’s weight is subnormal but length and head circumference are normal.

In Bangladesh (1976-1985), the number of maternal deaths from obstructed labour amounts to 7, 5, and 8 per 1000 live births for women with prior parity 0, 1 to 5 and 6 and higher respectively (WHO 1991, p. 412). However, the observation that obstructive labour is not higher among nulliparous women (particularly adolescents) may be blurred because “information on the incidence of and mortality from obstructed labour is patchy, probably because in many countries deaths as a result of this condition are classified under the final cause of death, which may be sepsis,
haemorrhage, uterine rupture or obstetric shock” (WHO 1991, p. 9). Particularly adolescent girls (and women) who are anaemic do not tolerate blood loss as well as healthy girls (and women), which places them at higher risks during pregnancy and childbirth, particularly in case of haemorrhage. Many adolescent girls in Bangladesh suffer from high rates of anaemia (Chowdhury et al. 2000; Shahabuddin et al. 2000; Hasan and Ahmed 2002). Additionally they have a lower resistance to diseases, making them more susceptible to puerperal infection (WHO 1991, pp. 7-9). In general, in case of haemorrhage, treatment (blood transfusion) is required within a few hours. Among adolescent girls in Matlab mortality from haemorrhage and sepsis constituted respectively 15 and 5 per cent of the total mortality from direct causes of maternal mortality in the period between 1976 and 1985 (WHO 1991, p. 412).

In general, in case an adolescent girl or woman does survive the delivery she may be seriously compromised by chronic reproductive morbidity among which obstetric fistula, an injury to her birth canal, which leaves her with chronic incontinence (leaking of urine and/or faeces) and possibly also frequent bladder infections, ulceration of the genital area and nerve damage to her legs. Fistula results from the prolonged pressure of the baby’s head against the pelvis, which cuts off the blood supply to the soft tissues surrounding her bladder, rectum and vagina; the injured tissue rots away and leaves a hole or fistula (UNFPA 2003, pp. 39-40). The child often dies. Because of their physical immaturity, adolescent girls are particularly prone to fistula. It is estimated that fistula affects about 15 to 30 surviving women for every woman who dies in childbirth (UNFPA 2003, p. 39). To our knowledge, there are no data available on obstetric fistula in Bangladesh, let alone data broken down by age.

Young gynaecological age

The third factor that potentially influences adolescent childbearing is seldom made explicit as it crosscuts with small maternal stature and malnutrition. More than chronological age, physical ‘readiness’ for pregnancy and childbirth may be related to gynaecological age. Menarche takes place at the time of maximum increase in muscle mass and about one year after peak in growth velocity (Heald 1985, p. 52; Riley et al. 1993, pp. 56-57). Height and pelvic size are correlated and 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 (WHO 1991, p. 6). The average growth after menarche is reported to be 6 to 8 cm (Riley et al. 1993). As a general rule the earlier the menarche, the greater the growth thereafter (Lachance 1995, p. 7). Whereas in optimal conditions a girl’s lean body mass may attain its adult level as early as at the age of 14 years (Heald 1985, p. 52), in some girls in Matlab linear growth continues past the age of 20 years (Riley 1994, p. 92). Growth of the pelvis may continue for some time after linear growth is complete (Riley 1994, p. 91).

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25 Excluding abortion-related deaths, almost 50 per cent of all maternal deaths in Matlab occur during labour or within 48 hours of delivery (Fauveau and Chakraborty 1994, p. 133). It is estimated that about 20 per cent of pregnancies in Matlab are complicated, out of which 10 to 15 per cent may ultimately require a caesarean section, and 3 per cent may require comprehensive obstetric care (Francisco de 1996, p. 8). The Bangladesh Service Provision Assessment Survey 1999-2000 revealed however that among facilities providing delivery and postpartum care, only 3 per cent has the capacity to carry out caesarean sections (Saha 2002, pp. 36-37).
These observations corroborate the notion of Silventoinen (2000, p. 23) that in modern societies growth usually comes to an end in (late) adolescence, but that in poorer environments growth may continue longer, which would suggest catch-up growth of the second type, i.e. longer growth but no increase in growth velocity (see also subsection 2.2.3). Undernourished girls with a delayed menarche grow more slowly but for a longer period (Gillespie and Flores 2000, p. 2). Accordingly, length of growth after menarche varies in studies from 1.4 to 5 years (Riley et al. 1993, pp. 56-57). The influence of postmenarcheal living conditions to bring about an effect on postmenarcheal growth seems to be limited. Socio-economic factors have for instance shown little impact on adult height when earlier height is controlled for (Riley 1994, p. 96). How early pregnancy interferes with the completion of growth in malnourished (stunted) girls is not fully understood (Riley et al. 1993, p. 56). There are indications that growth during pregnancy does occur in adolescent girls, particularly during the third trimester, which can have negative effects on the pregnancy outcome if additional dietary and weight gain allowances are not made (WHO 2003, p. 13, p. 36).

In sum, young gynaecological age (reproductive immaturity) may jeopardise the course and outcome of pregnancy through two mechanisms. Firstly, the relative immaturity of the young mother per se (i.e. smaller body size, lower weight, less well-developed reproductive organs) may place them and their infants at higher risks of poor birth outcomes. Secondly, the growth needs of the mother and foetus may create a competition for nutrients to fulfil maternal growth needs ( linear growth, growth of uterus and pelvis) and to support pregnancy (Riley 1994, pp. 90-91). The uterus of young women may be structurally or functionally less able to carry a foetus to term as compared to older women (Riley et al. 1993, p. 54). In the words of Gebbie (1982, p. 669) “when stunted girls conceive and the next generation develops within them, the foetuses are not stunted and labour becomes a struggle between a genetically well-developed foetus and an environmentally deprived maternal pelvis”.

2.6 Conceptual model
In this section the conceptual model of this study (Figure 2.6) is introduced. This conceptual model is directly based on the earlier discussed Figure 2.3 which presented the lifecourse (‘life cycle’) model (section 2.3) and Figure 2.4 which summarised the determinants of menarche as identified in the literature review (section 2.4).
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Figure 2.6 sketches over the *lifecourse* and within the *context* of (rural) Bangladesh for adolescent girls\(^\text{26}\) the following:

1. The *outcome indicators* of adolescents’ reproductive health (section 2.4), i.e.:
   - timing of menarche;
   - reproductive knowledge and perceptions.

2. The *main nutritional determinants* of timing of menarche (section 2.3), i.e.:
   - nutritional anthropometry in early life, i.e. in early childhood and at birth;
   - nutritional anthropometry in adolescence;
   - nutritional anthropometry of the adolescent’s mother; and
   - (possibly) age at menarche of the adolescent’s mother.

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\(^{26}\) For adolescent boys the pathway of physical maturation is not worked out for the period after adolescence. We do study the nutritional status maturation of adolescent boys empirically (Chapter 5) as well as - briefly - their timing of spermarche (Chapter 6) and their reproductive knowledge and perceptions (Chapter 7).
3. The importance or *justification* of menarche and nutritional status for future reproductive health (section 2.5), i.e.:

- the possible consequences for adolescent childbearing due to contemporary and early life malnutrition and young gynaecological age.

Later in this book we will analyse data pertaining to part of the adolescents’ lifecourse, i.e. to the period between *birth, early childhood* and *adolescence*. More specifically, we aim to study the reproductive health status of 12 to 16-year-old adolescents, indicated by timing of menarche (and spermarche) and reproductive knowledge and perceptions. We will study timing of menarche in relation to contemporary and early life nutritional status, i.e. early childhood (i.e. up to the age of five years) and birth (by means of recalled birth weight). We hereby also take into account the height of the mother and her (recalled) age at menarche.

### 2.7 Conclusions and discussion

This study is about adolescents’ reproductive health, indicated by timing of reproductive transitions (menarche, spermarche) and reproductive knowledge and perceptions, which reflect respectively *physical* and *mental* well-being in the definition of reproductive health as formulated at the ICPD (ICPD 1994). We study adolescents’ reproductive health from a *lifecourse* perspective, which is one of the angles that can be taken within the *process-context* approach. Adopting this approach to adolescents’ reproductive health is rather new within the discipline of demography.

The universal character of the lifecourse refers to the occurrence of *stages*, separated by *transitions*. The combined effect of inherited traits and environmental inputs allow individuals to go through the respective stages at a different pace, and hence, timing of transitions differ. Within the lifecourse, a main developmental process is the *nutritional status career*, which is closely intertwined with the *reproductive health career*. In addition, a career of ‘knowledge and perceptions’ may be distinguished.

Regarding the *nutritional career*, the statistics on LBW babies and under-five nutritional status in Bangladesh are a far from positive point of departure with regard to the nutritional and reproductive health status of children who are about to enter the stage of adolescence. Because of the rapid growth during gestation and early childhood, intrauterine conditions and nutritional status in these periods are most important for nutritional status later in life. These stages may therefore be labelled as *critical*. Programming - the central concept to Barker’s hypothesis - describes how an early stimulus or insult operating at a critical period results in a long-term change in the structure or function of the organism. The age of two years may indicate a turning point regarding the potential to *catch up* early life growth faltering, i.e. after this age it becomes increasingly difficult to attain the adult height which would have been reached if circumstances were optimal. Catch-up growth may either take the form of an increase in growth velocity beyond normal growth for chronological age or of a growth that continues longer under a normal growth velocity regime. Whether catch-up growth takes place depends on the accumulation of risk factors during the lifecourse (*cumulative causation*). In Bangladesh, infectious diseases (diarrhoea), adverse behaviours and living conditions form the ‘chain of risks’ affecting nutritional
Anthropometry in the negative. Girls seem to be disadvantaged in the nutritional and health domains as compared to boys.

The onset of the reproductive career is announced by the reaching of menarche and spermarche. Spermarche is by far less studied than menarche. Timing of menarche is in part determined by genetic reproductive endowment but is moreover influenced by contemporary and early life nutritional status, and is possibly even set in utero (programmed). Menarche is likely to occur ‘late’ if the girl has been or still is suffering from malnutrition. Despite malnutrition being highly prevalent in Bangladesh, studies on menarche in this country do not unambiguously point to a delay. However, within subgroups of girls - the severely malnourished - menarche may indeed be reached ‘late’. Timing of menarche is not only an indicator of reproductive health status per se, it may also be crucial for the rest of the reproductive career and carries both physical (pertaining to the biological clock) and social significance (relating to the social clock). What is striking is the different approaches to the respective rites of passage passed through by adolescent boys and girls in Bangladesh. Although circumcision, which precedes spermarche, is of a different order from the reaching of menarche, a common denominator shared with menarche is that it marks the entrance into the next stage of life, including the internalisation of the corresponding modes of conducts. With circumcision, the new status of an adolescent boy is celebrated festively and made public, whereas the reaching of menarche by an adolescent girl is kept silent and generally viewed negatively because of the alleged polluting nature of menstrual blood and the new ‘dangerous state’ she has entered into, i.e. she sexually matured. The public acknowledgement of the transition from childhood to adulthood associated with circumcision contrasts sharply with the silence surrounding menarche.

Adolescence suggests a life in between: different from childhood but certainly not yet equal to adulthood. Such a stage, however, does not seem to correspond with the picture of the adolescent period that emerges from descriptions by Aziz and Maloney, and Blanchet. Particularly the Bangladeshi rural poor seem to consider sabalikas as ‘little women’, soon-to-be wives and mothers, whereas adolescent boys, sabalaks, get involved in ‘on-the-job training programs’ in the paddy fields and at market places, are urged to pursue economic independence. Throughout the respective sub-stages of childhood and adolescence, girls are expected to learn their gender role at an earlier age as compared to boys. In addition, the period of adolescence seems to last longer for boys as they generally marry later. Given the overall, apparently normative, emphasis put on learning and internalising adult roles, it may be argued that a distinctive period of transition between childhood and adulthood, i.e. adolescence, does not really exist in rural Bangladesh and may be no less than a theoretical construct. The onset of the period of adolescence, as well as its ending (i.e. where adulthood begins), is highly culturally determined and a function of a broad range of factors. Defining ‘adolescence’ in such a way that credit is given to all possible relevant factors and circumstances is hard, if not impossible, because of conflicting definitions of cut-off points. Marriage, for instance, turns a 15-year-old girl into a wife, which marks the end of her adolescent period. However, it remains to be seen whether such a (sudden) start also indicates ‘adulthood’ in physical terms, as her body is not yet fully grown, but is rather as equally immature as that of her unmarried peers.
How pregnancy in an adolescent girl interferes with her own growth and reproductive maturation is not exactly known. There are however indications that catch-up on early life growth faltering in adolescent girls is characterised by a growth that continues longer than usual while growth velocity does not change. This may have serious implications for adolescent girls’ reproductive health because of the longer period required to achieve maturity of the reproductive organs, such as the pelvis. Consequently, these girls would typically reach physical ‘readiness’ for childbirth also at a later stage. The light hereewith shed on timing of menarche is manifested in gynaecological age, the time in years since menarche. Young gynaecological age (immaturity of the young mother-to-be) may not only jeopardise the course and outcome of the pregnancy but is likely to increase the risk of obstructive labour as well, herewith endangering the life of the adolescent mother and that of her baby. Gynaecological and biological age (indexed by nutritional status) rather than chronological age seem most important to an adolescent girl’s reproductive health status. Young gynaecological age is only one side of the coin: socio-cultural norms favouring early marriage and childbirth provide the counterpoint in the framework on adolescents’ reproductive health.