

Early Menarche: A Review of Research on Trends in Timing, Racial Differences, Etiology and Psychosocial Consequences

Rachel Blumstein Posner

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Abstract This paper elucidates varying definitions of “early menarche” and reviews evidence in four well-documented areas: (a) A potential trend toward earlier maturation, (b) racial differences in menarcheal timing, (c) etiology of early puberty, and (d) consequences of early puberty. While teachers and physicians perceive menarche as occurring earlier than in the past, mean menarcheal age has remained relatively constant over the past 50 years. Conflicting results concerning racial differences in timing highlight the need for further research to unravel the effects of race and social economic status (SES). Evidence regarding the relative etiological contributions of nutrition, environmental stress, and genetics is evaluated. Maturing earlier than one’s peers has negative consequences for girls, especially when combined with simultaneous stressors. However, the negative psychosocial consequences of early puberty may not last into later adolescence or adulthood. Few studies have investigated early-maturing adolescents’ subjective experience with menarche, particularly those from non-white and non-middle-class backgrounds.

Keywords Pubertal timing · Menarche · Menstruation

Women bleed; some consider this the primary point of difference between the genders (Lupton, 1993). Menstruation

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R. B. Posner (✉)
Department of Applied Psychology, New York University,
239 Greene Street, New York, NY 10003, USA
e-mail: rpb210@nyu.edu

Present address: 2711 Henry Hudson Parkway, #7G, Bronx,
New York 10463

serves as a common container for societal anxiety about female sexuality. Indeed, menstrual taboos are the most enduring and stringent across cultures, underscoring male fear of female sexual power (Bettleheim, 1962; Delaney, Lupton, & Toth, 1988). Unlike other gradual pubertal changes, menarche dramatically signals the transition from girl to woman. Most contemporary American girls view menarche as a “hygienic crisis” rather than a maturation process (Brumberg, 1997); however, menarche signals reproductive fertility and the advent of adult sexuality (Koff & Rierdan, 1991).

Although menarche occurs relatively late in the process of puberty, it has long been used as a marker of puberty because it occurs suddenly and is memorable, making it feasible to measure by self-report. In recent years, research on the psychological and social consequences of early puberty has burgeoned (Caspi & Moffitt, 1993; Dick, Rose, Viken, & Kaprio, 2000; Ge, Conger, & Elder, 1996; Graber, Brooks-Gunn, & Warren, 1995; Stice, Presnell, & Bearman, 2001) and fears about early puberty, exacerbated by the media, have seized popular imagination (Belkin, 2000; Lemonick, 2000). Most research into early pubertal maturation has focused on females; there has been little interest in male development. Additionally, this line of research has been preoccupied with early, rather than late, timing of pubertal development.

The media barrage decrying early puberty has somewhat obscured the different questions that researchers are asking. This review will focus on four research questions that have been actively pursued in the medical and psychological literature in the past decade, including: (a) Is there a national trend towards girls maturing earlier? (b) Are there racial/ethnic differences in timing? (c) What is the etiology of early puberty? (d) What are the psychosocial consequences of early puberty? This review aims to survey our current understanding of this phenomenon, and illuminate areas for future research.

The definition of early puberty

Early puberty has been variously described as (a) a national trend in the mean age of maturation, (b) an uncommon endocrine disorder, and (c) a socially defined category relative to peers, depending on the purpose of the dialogue and the professional orientation of the discussant. Pubertal age norms vary from population to population. The “normal range” for onset of menarche in the United States is now considered between ages 10 and 14 (Lerner, Lerner, & Finkelstein, 2001). Controversy exists over whether the mean age of onset breast budding, or thelarche is earlier than previously thought. However, there is ample evidence to show that the mean age of menarche has remained stable over the past 50 years (Adams Hillard, 2002).

While many social scientists investigate population trends over time, endocrinologists have focused their investigation on girls who deviate from the norm within their population. The most recent norms for the United States define “precocious puberty” as onset before the age of 6 or 7, “early puberty” as between ages 7 and 9, and “normal puberty” as beginning after age 9 (Mul, Oostdijk, & Drop, 2002). There are several different endocrine disorders involving early pubertal maturation, including “true” or “central” precocious puberty (CPP), premature thelarche (breast budding), premature adrenarche, and premature menarche (Traggiai & Stanhope, 2003). These disorders, including concerns about the attainment of full height, have been associated with psychological as well as medical risks. The diagnosis and treatment of these disorders are beyond the scope of this article. (See Dorn and Rotenstein, 2004, for a discussion of the physiological and psychological consequences of premature adrenarche.)

Although the diagnosis and treatment of disorders such as CPP should be distinguished from questions about the overall decline in the mean age of pubertal onset, the media has confounded these separate issues. Thus, in a Time Magazine article, two clinical cases of precocious puberty (diagnosed by endocrinologists) are followed by an assertion that such cases are occurring “everywhere you turn” and that “a generation (has) been put on hormonal fast-forward” (Lemonick, 2000). Dorn and Rotenstein (2004) noted that the public’s perception that early maturation has become the norm might inhibit parents and doctors from identifying and treating true endocrine disorders.

Psychological studies of early puberty often use a “socially defined sense of timing.” That is, timing of maturation is measured relative to the development of other peers in the same community (Simmons & Blyth, 1987). In this sense, “early puberty” is not a disorder akin to CPP, but a means for categorizing individuals in order to grasp the psychosocial implications of maturing earlier. This “socially defined” sense of timing will be considered in the following re-

view of the etiology and psychosocial consequences of early menarche.

Conceptual framework

Research into pubertal timing must be understood within the framework of societal beliefs, fears, and expectations about adolescent sexuality. The developmental period of adolescence was a “modern invention” (Irvine, 1994; Moran, 2000). G. Stanley Hall coined the term “adolescence” to describe the youth culture emerging in the United States at the turn of the century. The need to control adolescent sexual urges was the organizing principle behind the act of defining adolescence for Hall, and for the legacy of psychologists, sociologists, physicians, and politicians concerned with managing adolescents. In our present-day culture, adolescent sexuality has remained “a social problem” (Irvine, 1994). Our culture has decried adolescent sexuality, searing in the minds of young people the fears associated with it: STDs, loss of educational opportunities, and teenage pregnancy. The “escalating cultural panic” surrounding teenage pregnancy (evident in research agendas, popular media, and social programs) has served to make adolescent females, particularly those who are poor and/or Black and Latina, “the source of public anxiety and the target of social control” (Irvine, 1994).

The sexuality of African-American and Latina females who are poor and live in urban areas has been particularly problematized in research agendas and in the media. Tolman has noted that “the unstated assumption that certain girls—poor girls, girls of color, urban girls—are more sexual and thus are at higher risk of negative outcomes is reproduced by the intensive study and surveillance to which these girls are subjected” (Tolman, 2002, p. 6). However, the negative consequences of teenage pregnancy have mixed support (Irvine, 1994). The “myth” of an “epidemic” of teenage pregnancy has not borne out in sociological research; nevertheless, reactive fear of “children having children” has driven public policy over the past several decades (Nathanson, 2000). Societal anxiety about adolescent female sexuality has inhibited young women’s abilities to healthfully and positively consolidate their sexuality into their identities.

Adolescents, particularly girls, have received conflicting cultural messages regarding their sexuality and their selves. The media barrage of sexualized teens has sold sex as fun and important. However, schools have socialized children through sex education classes to view sex as a dangerous game in which men are aggressors and women are victims (Fine, 1992). Puberty in general (and menarche in particular) has represented a gateway to adolescent sexuality. The significance of menarche has been entwined with cultural beliefs regarding adolescent female sexuality and pubertal research must be evaluated with an eye toward

the entangled relationship of menarche and adolescent sexuality.

Pubertal Timing: A National Trend Towards Earlier Maturation?

The age of pubertal onset has increasingly become a focus of research and media attention, as a debate has ensued over the possibility of puberty occurring earlier and related psychosocial consequences. Menarcheal age for girls in industrialized Western societies decreased in the past 150 years (Tanner, 1991), probably due to improvements in nutrition and living conditions. In 1997, Herman-Giddens and her colleagues captured the attention of researchers as well as the media when they revealed their findings on the pubertal development of over 17,000 girls, aged 3–12 years, who visited the offices of 225 pediatricians. The researchers found girls developing at younger ages than suggested in standard pediatric texts and previous research studies (Herman-Giddens et al., 1997). Herman-Giddens et al.'s research has been criticized on several fronts. First, because Herman-Giddens et al.'s sample included only girls from ages 3 to 12, girls who reached menarche later than 12 were not included in the study, biasing the results toward early maturers (Chumlea et al., 2003; Dorn & Rotenstein, 2004). A second criticism of Herman-Giddens et al.'s study concerns the imprecise methods used to determine pubertal development (see Dorn and Rotenstein, 2004, for further critique). Thirdly, the clinic population treated in the offices of pediatricians who participated in the study may not represent the US population as a whole (Dorn & Rotenstein, 2004). Additional criticisms of Herman-Giddens et al.'s work include concerns about their handling of ethnic factors. Namely, the researchers fit participants into ethnic categories of "Black" and "White." Other ethnic categories were not included, which renders the relationship between pubertal timing and ethnicity/race difficult to distinguish (Obeidallah, Brennan, Brooks-Gunn, Kindlon, & Earls, 2000). Finally, the confounding effects of SES and nutrition were not investigated in this study. Recent research (Obeidallah et al., 2000, discussed further later) has offered results that contradict Herman-Giddens et al.'s findings.

Though it is clear that the age of menarche has decreased in the past century, the trend has probably not continued in the past half century (Adams Hillard, 2002). Comparing data over a 30-year period, researchers found that menarcheal age has decreased by about 4 months, a statistically insignificant change (Chumlea et al., 2003). Notably, teachers and physicians have perceived menarche as occurring earlier (Finlay, Jones, & Coleman, 2002), though research findings on recent changes in the timing of menarche mostly indicated that menarcheal age has remained constant. Because studies assessing menarcheal timing vary significantly in sample size, setting, age of participants, and methods for assessing

age at menarche (i.e., self-report or parental report), drawing conclusions based on meta-analyses of research findings is difficult. Nevertheless, reviewing 12 studies using data from 1948–present (Coleman & Coleman, 2002) concluded that there is scant evidence to suggest a continued decline in menarcheal age. It appears that while the age of onset of puberty may be decreasing, the age at which girls attain reproductive capability has remained relatively constant in past 50 years.

Ethnic/Racial Differences in Pubertal Timing

In Herman-Giddens et al.'s study, African-American girls (9.6% of the sample) matured earlier than White girls, at every age and for each characteristic assessed. The reasons for earlier onset of puberty in African-American girls remain unclear, but may be related to genetics or nutrition. Research on pubertal timing has predominantly focused on middle-class, White females. Those who have examined differences across races, such as Herman-Giddens et al., have collapsed ethnic differences into categories of "African-American" and "White," obscuring the measurement of Latinas, Asians, or other ethnic minorities. Additionally, more work must be done to "disentangle the effects of SES from those attributed to racial/ethnic differences." (Obeidallah et al., 2000).

Are the results of Herman-Giddens et al.'s study replicable? Obeidallah et al. (2000) found that African-American and White females did not significantly differ on menarcheal age. In Obeidallah et al.'s study (2000), Latina adolescents reached menarche significantly earlier than their White and African-American peers. However, when social economic factors were controlled for, the significance in differences between Latinas and Whites disappeared and the differences between Latinas and African-Americans were diminished. The researchers concluded that SES, conceptualized as an environmental stressor, is an important component to consider in relation with other variables that influence timing (Obeidallah et al., 2000). Chumlea et al. (2003), in contrast with Obeidallah et al. (2000), found that African-American girls reached menarche significantly earlier than non-Hispanic White and Mexican American girls; these researchers did not control for SES. Thus, recent studies have provided conflicting results on racial and ethnic differences in the timing, and have highlighted the need for further investigation into the role that SES plays in potential timing differences.

The Etiology of Early Puberty: Three Hypotheses

Why do some girls mature earlier than their peers? The three most common hypotheses regarding the etiology of

differences in pubertal timing are (a) nutrition, (b) increased environmental stress, and (c) genetics. Recently, researchers have identified increases in obesity as an important factor in earlier onset of puberty (Anderson, Dallal, & Must, 2003; Kaplowitz, Slora, Wasserman, Pedlow, & Herman-Giddens, 2001). Kaplowitz et al. (2001) re-analyzed the 1997 Herman-Giddens et al. data in an effort to understand the relationship between nutrition and timing of puberty, and found that body mass index (BMI) was significantly correlated with early puberty in White girls and, to a lesser extent, in African-American girls. In a rare study that included males, Wang (2002) found earlier maturation associated with obesity in girls, but not in boys. Davidson, Susman, and Birch (2003) found that girls with higher percent body fat at age 5 were more likely to exhibit earlier maturation. Taken together, these studies have strongly implicated obesity as an important variable in pubertal timing.

Although genetics and nutrition have long been accepted as the most salient predictors of pubertal timing, other theories regarding the antecedents of early menarche have developed. In 1991, Belsky, Steinberg and Draper proposed a controversial sociobiological theory regarding early menarche, which they couched in an evolutionary framework. They suggested that early environmental stress triggers early maturation in girls. Belsky et al., (1991) targeted father absence as a condition for a “stressful rearing environment” that predisposed girls to early puberty (p. 647). Therefore, whereas pubertal changes were traditionally viewed as predicting elevated levels of family conflict, more recent research has investigated whether the relationship between maturation and family conflict may be reciprocal, with family conflict also predictive of early menarche (Moffitt, Caspi, Belsky, & Silva, 1992).

According to Belsky et al.’s (1991) sociobiological theory, early puberty is an adaptive response to a child’s early experience of the “stressful rearing environment” of a father-absent home (p. 647). Thus, a female reared in a high-risk environment develops early and reproduces early, ensuring continuation of her genetic line. She has experienced unstable relationships in her own upbringing, and therefore invests little in child rearing. In contrast to this “high stress” line of development, girls raised in secure, two-parent homes with low environmental stress experience delayed puberty, defer reproduction, and invest more time and energy in their offspring to ensure survival (Belsky et al., 1991). Researchers have attacked Belsky et al.’s theory on several fronts. Some have posited that genetic factors explain the proposed pattern of father absence, early puberty, and precocious sexuality (Comings, Muhleman, Johnson, & MacMurray, 2002; Rowe, 2002). Where Belsky et al. (1991) theorized that evolution shapes individuals’ reactions to the environment in which they find themselves, allowing one of two developmental patterns to be expressed, geneticists suggested that

the genes that code for this pattern of development (i.e., the cycle of early puberty, precocious sexuality, insecure pair-bonds, low parental investment) and are passed from father to daughter. Thus, in fathers, the X-linked AR gene is expressed in aggression and impulsivity leading to interpersonal conflict, and in daughters it manifests in early puberty, precocious sexuality, and interpersonal conflict (Comings et al., 2002). The implication of the genetic hypothesis is that this developmental pattern is relatively fixed, whereas the sociobiological, evolutionary hypothesis privileges environmental influences as a mechanism for shaping development and behavior.

The association between biological father absence and early menarche has received support in the research literature. Researchers have found that girls from homes with divorced parents and/or higher levels of family stress reached menarche earlier than those from intact homes (Graber et al., 1995; Steinberg, 1988; Surbey, 1990; Wierson, Long, & Forehand, 1993). In one study, biological father absence and stepfather presence emerged as a powerful mediator of the relationship between early puberty and other psychosocial stressors; that is, the presence of stepfathers in the home and the absence of biological fathers were associated with early menarche (Ellis & Garber, 2000). Children adopted from developing countries have frequently manifested early puberty (Mul et al., 2001). Additionally, studies of reproductive functioning in animals have shown that the presence of a biologically related male delays reproductive maturation and functioning, while presence of unrelated males speeds reproductive maturation (Izard, 1990, Vandenberg, 1969). Taken together, these findings point to biological father absence as a potential influence in menarcheal timing.

However, a deficit in some of the studies investigating the relationship between father absence and early menarche has been their inability to control for confounding factors such as weight, nutrition, and hereditary transmission from mother to daughter (Wierson et al., 1993). Brooks-Gunn (1988) measured a sample of 150 adolescent girls and found no relationship between father absence and pubertal timing. This study emphasizes nutrition and exercise as the most salient predictors of pubertal timing. Graber et al. (1995) examined a variety of possible antecedents to pubertal timing in a sample of 75 White, middle-class girls, including hereditary transmission, weight, stressful life events, family relations, absence, or presence of adult male in home, and psychological adjustment. They found that psychosocial factors, especially family relations, predicted menarcheal age over and above the influence of weight or breast development. The presence of an adult male at home or stressful events was not predictive of menarcheal timing in this study. Nevertheless, because most of their sample lived in intact homes, Graber et al. (1995) could not differentiate between the presence of biological fathers and unrelated adult males

in the home, a difference found to be significant in other studies.

Other types of environmental stress, such as stress due to war conditions, have also been investigated. Stress due to war conditions, including poverty as well as psychological and physical trauma, appeared to delay, rather than speed onset of menarche. Girls exposed to war conditions experienced a reversal in the secular trend of menarcheal timing (Preberg & Bralic, 2000; Tahirovic, 1998). In sum, environmental stress is related to menarcheal timing in a complex manner; severe physical and psychological stressors such as war conditions or extreme malnutrition delay menarche whereas stressful family environments (i.e., father absence or mother's mental illness) may trigger early menarche. The exact mechanisms that trigger early menarche have not been fully discerned.

Psychosocial Consequences of Early Puberty

Research has indicated that reaching puberty earlier than one's peers has negative psychosocial consequences for girls (Caspi & Moffitt, 1993; Ge et al., 1996). Early menarche has been associated with increased symptoms of menstrual distress (Brooks-Gunn & Ruble, 1982) and a higher degree of worry about menstruation (Stubbs, Rierdan, & Koff, 1989). Additionally, early maturers have been found to be at risk for increased levels of depression (Brooks-Gunn, 1988; Rierdan & Koff, 1991; Stice et al., 2001), negative body image and disordered eating (Attie & Brooks-Gunn, 1989; Simmons & Blyth, 1987; Striegel-Moore et al., 2001), and substance abuse (Dick et al., 2000; Stice et al., 2001). However, not all studies have found unequivocal support for the negative effects of early menarche. Simmons and Blyth (1987) described mixed results with regard to early pubertal change. Early maturers, they noted, were at risk for problems with body image, school performance, and school behavior. However, they tended to have more success with social popularity. Dorn, Susman, and Ponirakis (2003) found that later maturing girls suffered more problems with self-image and behavior than did their on-time or early-maturing peers. Additionally, the effects of pubertal timing on behavior problems and adjustment have varied depending on who is rating pubertal timing (Dorn et al., 2003). Specifically, Dorn et al. (2003) found more significant adjustment problems among adolescents when physicians were rating pubertal timing than when pubertal timing was assessed for by self-report or parent report. The variability in methods for measuring pubertal timing used across studies calls into question our ability to generalize across findings (Coleman & Coleman, 2002; Dorn et al., 2003).

Early puberty has been associated with earlier onset of sexual activity (Flannery et al., 1993; Lam et al., 2002; Phinney, Jenson, Olsen, & Cundick, 1990; Wyatt et al.,

1999). Using a national sample of females ages 15–19, Phinney, Jenson, Olsen, and Cundick (1990) found that early-maturing girls were more likely to initiate dating and intercourse earlier than later-maturing peers. In a study of Hong Kong Chinese adolescents, Lam et al. (2002) found early maturation to be predictive of later pre-coital behavior, such as dating. However, they found no significant difference of timing of first intercourse between early and average maturers (Lam et al., 2002). Surprisingly few studies have investigated the links between pubertal timing and teenage pregnancy. In a retrospective study of 97 pregnant adolescents (ages 13–18), Ravert and Martin (1997) found that their subjects had menarcheal ages on par with national norms, not earlier. Frequently, the specters of sexually transmitted diseases (STDs) and teen pregnancy are held up by the media as “the obvious fallout of early development” (Lemonick, 2000). Although early puberty has been associated with earlier first sexual experiences, the relationships between early puberty and STDs/early pregnancy have not been empirically established.

Perhaps one of the most difficult challenges facing early maturers is that they do not fit the cultural image of ideal feminine beauty, that of a tall, slim figure. Girls who matured earlier were bigger than their peers and often grew to be heavier and shorter than peers (Simmons & Blyth, 1987). Further research is needed to disentangle the psychological effects of obesity from the effects of early puberty. That is, are girls concerned about their figures because they are early maturers or because they are overweight? Early puberty may predispose girls to problems with negative body image and disordered eating (Striegel-Moore et al., 2001). But early maturation in and of itself may not affect body satisfaction unless combined with other factors. Early maturers who also synchronously faced the stress of beginning to date and transitioning into middle school were at greater risk for dissatisfaction with their bodies (Smolak, Levine, & Gralen, 1993).

Early maturers were more likely than peers to use alcohol, cigarettes, and marijuana in 7th and 8th grades (Lanza & Collins, 2002). Stice, Presnell, and Bearman (2001) found early puberty to be a risk factor for substance abuse, but they note that the effects of their study are small in magnitude. Though early maturers were more likely than peers to initiate substance use at younger ages (40% by age 15) differences persisted until age 16, and then dropped off (Dick et al., 2000). In sum, early maturers used substances earlier than peers, but differences disappeared in later adolescence.

Do the effects last into middle and late adolescence? into adulthood?

Smolak et al. (1993) found no long term effects on the relationship between relative timing of menarche and body

satisfaction or eating disorders. Early puberty in and of itself may not negatively affect girls, but combined with other factors, relatively long-term psychosocial effects emerge. Simmons and Blyth (1987) followed girls from early adolescence (grades 6–7) into middle adolescence (grades 9–10) and found that differences in independence, academic success, and school behavior problems only lasted through early adolescence. However, differences in body image persisted through middle adolescence, as did increased popularity and dating. That is, early maturers maintained negative images of their bodies and dated more than their late-maturing peers as they progressed to 9th and 10th grades (Simmons & Blyth, 1987). Magnusson (1988) found that early-maturing girls were more likely to drink, engage in conflict with adults and lose interest in school as teenagers. However, these negative psychosocial effects of early maturation were not found to last into later adulthood, although these girls were more likely to marry earlier and join the workforce earlier than their later maturing peers.

Conclusion

Menarche is inextricably linked to the advent of female sexuality, and adolescent female sexuality is a flashpoint for societal anxiety. Researchers, parents, journalists, and doctors are invested in understanding and treating early-maturing girls. However, the category of “early puberty” remains arbitrary and ill-defined. Much of the current research in this area has aimed at discovering the “causes” of early puberty, and has produced a subtext that pathologizes early puberty in particular and female sexual development in general.

When educators, parents, and policy makers have expressed anxiety about “adolescent sexuality” they have mostly referred to *female* adolescent sexuality. In many ways, to be an adolescent girl is to be over-identified as a sexualized being. Additionally, implicit in much of the research on teenage sexuality has been the assumption that to be urban, poor, and/or a member of an ethnic minority is to be hypersexual (Tolman, 2002). Accordingly, the focus of research into early puberty has almost exclusively targeted girls. Girls tend to suffer more negative psychosocial consequences related to early puberty than boys do, so this focus makes some sense. Nevertheless, underlying the agenda of most research into the antecedents and consequences of early puberty has been a drive to control and limit adolescent girls’ sexuality (see Tolman, 1994, 2002, for discussions about this tendency). This line of research has aimed to determine how sexual behavior among adolescents can be prevented. Researchers have problematized early maturation by investigating consequences (which are almost always negative). But increasingly they have also searched for antecedents of early puberty as a way of “unraveling girl’s delinquency” (Caspi & Moffitt, 1993,

p. 19). Adolescent girls must navigate the conflicting messages they receive about their growing bodies and their emerging sexuality, and much of the research into early puberty has not helped girls or their caregivers chart these treacherous waters.

The prevalence of research into early maturation has highlighted societal anxieties about emerging female sexuality. These fears have been on display in academic literature and in the popular media. Girls should be “reading fairy-tales, not fending off wolves,” worried a recent *Time* magazine article (Lemonick, 2000, p. 68). Such sentiments have reinforced dual cultural stereotypes: The belief that children are (or should be) asexual, and the view of males as sexual predators and females as helpless victims. As educators, politicians, and parents have worked to control adolescent female sexuality, adolescent females have struggled to determine how and when they are in control of their own changing bodies (Fine, 1992). An astonishing amount of recent research has focused on the etiology, treatment and consequences of early puberty. However, few studies have investigated adolescents’ subjective experience of pubertal timing. As the scientific community continues to pursue the antecedents and consequences of early puberty, missing are the voices of adolescent females.

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