Developmental dynamics of the teenager

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Beginning at birth, the human experience builds one layer upon the other. The human organism learns at each step along the way those responses that best serve to increase or protect the individual's perceived sense of well being. It is this sense of well being which is central to any definition of health.

The potential for growth exists within every living organism. The ordered and orderly fashion in which this growth occurs is dependent not only on forces programmed within the organism but also on less controlled environmental and social forces. Growth, by definition, is change. This change becomes manifest as biological maturation, which triggers increasing adaptation. Although traditional concepts of growth focus upon the biological change, an integrated view needs to include both biological and behavioural expression.

For paediatrics and family medicine, this lies close to the very definition of their work; as developmentalists, they become witness to the cascade of events which interact with the family and the wider social community to promote the uniqueness of each child. And, given the privilege of a longitudinal lifetime view of human growth, this developmentalist would see that this interaction continues and encompasses increasingly complex relationships between the bio-behavioural aspects of maturation and the social environment. It is for these reasons that the etiology of disease and dysfunction cannot be viewed by the simplistic one-cause-one-effect paradigm.

Vulnerability to external influences, be they positive or negative, biological or environmental, depends not only on change but also on the rate of change. Growth rates are greatest during intrauterine life and during pubescence. This prompted the French philosopher, Jean-Jacques Rousseau, to comment, "We are born twice over - once into existence, and the other into life." The birth of the baby into existence, the nurturance of the parents, the guidance of the family, and the education of the school all transport the child to the doorstep of pubescence and adolescence. And it is here that labour begins again: the process of birth that leads the organism from existence into life, from childhood into maturity.

The obstetrical forces of this second birth are not only the biological forces of puberty which accent the maleness and femaleness of the human species, but also the psychosocial forces that create what in Western thought is the period of adolescence. These forces, modulated by family, society, school, media, beliefs, and values are the amniotic fluid which is meant to protect but which sometimes becomes toxic to the human organism. And, to carry the metaphor one more step along, the first stage of labour is precipitated not only by a biological readiness, *i.e.* gestational maturity/pubertal maturation, but also by outside forces such as the attractiveness of an increasingly uninsulated interaction with the world. For many teenagers prepared only by the experiences of childhood, the sudden exposure to the full benefits and adversities of the human and natural elements comes as a surprise. For many, therefore, adolescence as a growth process becomes a perilous period of increased exploration and change.

Edward Abbey once quipped that "Growth for growth's sake is the ideology of the cancer cell." And, although some would view the period of the teenage years as best resembling a "malignant tumor", there is purpose to the change and chaos. The behaviours are points along the growth curve of adolescence and serve a purpose. They are part of an axis of influences which propel the teenager towards increasing independence, responsibility, and social functioning. As such, these behaviours are not only expressions of growth but also, in and of themselves, serve a purpose. They become markers of maturity. They expose the individual to new risks and to risk taking. This risk taking becomes almost a maturational lubricant and is essential for change. It is this risk taking, this drive for maturation, this increasingly uninsulated interaction with the world which also increases the likelihood of disease or dysfunction.

These biobehavioural interactions - the vulnerability of disease causation to socially weighted cofactors - have prompted an expanded definition for the age of consent and assent to allow for easier access to care. Physicians who wish to provide medical services to teenagers must complement the traditional ingredients of clinical care with knowledge about access, compliance, consent, confidentiality, and advocacy. State-of-the-art technology becomes not so much high-tech as high-touch.

Several basic and general principles about adolescents and their development become apparent:

1. Common to all adolescents are the biological changes of puberty, the psychological tasks of adolescence, and the subsequent social adaptations. It is the interaction of these maturational forces which drives their situational expression.

2. Endocrine and the subsequent physical changes of puberty establish the foundation for concurrent and consequent emotional and behavioural responses.

3. Biological maturation of the central nervous system provides the basis for the transition from the concrete cognitive-style thinking of childhood to the more abstract, wondering, thinking style of adolescence.

4. The hypothalamic-pituitary trophic hormones drive puberty, while psychological tasks drive adolescence.

5. The concepts of growth delay and maturational arrest, while accepted at the biological level, also may occur during psychosocial growth. The impact this has on the individual is no less than and is sometimes much greater than that occurring at the physical level.

6. The accentuation of sexual dimorphism, psychosexual adaptation, and attainment of reproductive competence have the potential both to enhance and to compromise the adolescent experience.

7. Although little understood by science, but greatly appreciated by the individual, puberty awakens an increased appreciation of pleasure.

Puberty

Pubertal maturation is the interactive product of linear growth, accentuation of sexual dimorphism, and the attainment of reproductive competence. The biological changes of puberty, both in their intensity

and complexity, often disturb not only the child but also parents, relatives, teachers, and even professional care givers.

Thelarche (onset nine through 13 years) marks the initiation of puberty in girls, while increased testicular volume (greater than 2.5 cc) does so in boys. The initiation of the dimorphic changes in girls begins approximately two years ahead of those in boys. At this early stage, preoccupations and often behavioural interests are not congruent between the sexes. Of importance to clinicians are guidelines for distinguishing normal from abnormal physical growth:

1. The growth spurt, or peak height velocity occurs in Western cultures at a mean age of 11.5 years for females and 13.5 years for males. Studies in Asian societies concur with these findings.

2. Pubertal growth accounts for approximately 25% of adult height.

3. Boys, though having a later onset of their growth spurt, have a greater peak height velocity: a mean of 9.5 cm per year versus 8.3 cm per year for girls. As a group, therefore, boys have a greater ultimate height.

4. Girls have their height spurt at sexual maturity rating of Tanner (SMR) Il-Ill, while boys have theirs SMR IV.

5. The height spurt lasts on average 24-36 months, with linear growth in girls usually reaching completion at 16 years of age and in boys at 18 years of age.

6. For both sexes, early maturers tend to have greater intensity of peak height velocity than do late maturers with comparable final adult heights.

Clearly, the ultimate stature of any individual is determined largely by familial, racial, and other genetic influences. Other modulators are those of intrauterine growth patterns, infant and childhood nutrition, and psychosocial enrichment or deprivations. Chronic medical conditions occurring during childhood and adolescence may influence physical growth and development, thus having a significant impact on the psychological and social manifestations of adolescence.

Weight has become a preoccupation for many teens of both sexes. Both underweight and overweight conditions, with accompanying malnutrition, are not uncommon problems in the clinical practice of adolescent medicine. Understanding the developmental aspects of weight at puberty provides a foundation for decision-making and management:

1. For both sexes, weight gain during puberty accounts for approximately 4O% of ultimate adult weight.

2. This weight gain is accounted for by both subcutaneous fat and increased muscle mass. Subcutaneous fat deposition peaks during the period of increased height spurt, while muscle growth peaks approximately three months after the height spurt.

3. In boys, lean body mass increases from 80% of the total to 90%, whereas in girls it decreases from 80% to75%.

4. Women have more subcutaneous fat, primarily in the pelvis, the breasts, the upper back, and arms, than do men.

5. On entering puberty, females have 15.7% mean body fat versus 4.3% in males, and by adulthood, attain 26.7% mean body fat versus 11.2% in men.

Underlying disease may become evident not only through delayed onset of pubertal events, but also through diminished intensity of the rate of linear growth, pubertal change, or actual arrest of the progression of puberty. Standards of linear growth plotted against an axis of both chronological age and sexual maturity rating are now available. With practice, the clinician can become skilled at detecting those minor variations in developmental correlates which may signal an underlying pathology. The exact definition of the discordant pubertal event may be established through endocrinologic, radiologic, and other biochemical studies. For those teenagers showing a clear potential for discordant development, e.g. individuals with a chronic illness, the physician now has an opportunity for anticipatory guidance. This may lead to diminished defiance and an increased compliance with management plans.

The teenage years have been referred to as the "springtime of adult life". The period is a time of much hope, much expectation, and an anticipated realization of potential. It is also a time of many firsts, myths, and mysteries to those within the experience. Striking changes occur in physical appearance and influence the young person's relationship with his or her world.

The appearance of secondary sex characteristics symbolizes the physical and physiological preparation for reproductive competence. In girls, menarche occurs on the downslope of the height velocity curve, usually at SMR IV, chronological age 10 to 16.5 years, mean 12.8 years. Perhaps the best correlate with onset of menarche is that of body fat: total body fat is usually at 23% when menarche occurs. Ovulation as a regular reproductive event does not occur until 3-12 months after menarche. Episodic ovulation, e.g. oligo-ovulation in the first six post-menarche months, is the rule rather than the exception. During the first year, then, ovulation is unpredictable for both developmental and environmental reasons as the girl's body adapts to her emerging womanhood.

Although increased testicular volume (mean onset 11.5 years) is the hallmark of the onset of male puberty, spermarche does not occur until SMR III, or at a mean age of 14 years in Western societies. Physiological gynecomastia, either unilateral or bilateral, affects over 70% of males, occurring at approximately the same time as spermarche. Discordant appearance of gynecomastia in the developmental sequence (after SMR V), or a failure to resolve in two to three years, should prompt an evaluation for a possible underlying pathology.

The pubertal period provides a singular opportunity for education and informed decision-making. Behaviours which are a direct manifestation of developmental maturation are often outside the influence of the family but may still be influenced by a health professional. The development of reproductive competence, for instance, provides the adolescent with new options and experiences that may be used to achieve adolescent tasks (e.g. independence, peer group relations, etc.). It also provides the opportunity for the clinician to provide information about contraception, sexually transmitted diseases (including HIV infection), and the relationship of these diseases to sexual lifestyles and practices. This education,

integrated into an office visit, now has a context which is relevant both to developmental need and to the teenager's personal interests.

Anatomy of Adolescence

The similarity has already been noted between the hypothalamic-pituitary-gonadal axis, driving pubescence, and the tasks of adolescence driving the psychosocial developmental process. This metaphorical view of the tasks of adolescence provides a very useful model for the clinician. Just as the events of puberty may be documented at the physical, anthropomorphic, biochemical, and endocrinologic levels, a similar approach may be used to document the events of adolescence. An awareness of this interrelation between the biological and psychological provides the context in which a disease or dysfunction occurs. Understanding the disease within this context then allows the clinician to apply not only the science but also the art of medicine. It opens up new ways of thinking about a problem, often giving rise to innovative solutions. Merely examining the medical aspects of teenagers' problems makes them no different from other patients in whom physical and developmental differences must be taken into consideration. It is the biobehavioural aspect which makes the difference and thus must be appreciated.

Adolescence is driven by tasks which not only occur sequentially but also tend to overlap. An attempt to address a later task before addressing an earlier one increases the risk for dysfunction in the present. Further, these tasks act like hormones. What are seen in different behaviours are situational responses to a maturational psychological drive. So, in the realm of the psychobiological, behaviours are the anthropomorphic expression of maturational tasks. If the behaviour is a problem, usually not for the adolescent but for those around the adolescent, the purpose of that behaviour must be determined. *For what are often seen as problems by an adult are actually perceived by the teenager as solutions.* If resolution of the problem behaviour is to be accomplished, it is necessary to replace it with an alternate solution or behaviour satisfying the same underlying task. Understanding this concept allows the clinician to make a quantum leap in understanding the bio-behavioural aspects of adolescent medicine.

Adolescence is usually considered to be that period between the ages of 12 and 18-19 years. Its goal is to attain maturity, characterized by responsible and independent functioning. Thus, culture and society play a major role in determining the length of this period of preparation. As the technology of a culture increases, the period of preparation also increases, prolonging the period of adolescence. It is this prolongation of adolescence which leads to the possibility of or increased propensity for problems during the process.

The five generally accepted psychological tasks of adolescence which are interdependent with the physical development of puberty are:

1. lndependence/dependence
2. Peer group acceptance
3. Sexuality and life goals
4. Intimacy
5. Physical emancipation

These tasks are usually addressed concurrently with the biological development of puberty and thus usually correlate with chronological age. Any unresolved issues from early adolescence become compounded by each successive psychological maturational challenge. Middle and late adolescence may give rise to a cornucopia of behaviours, actions, and moods which are not easily understood in the context of the present. Understanding their developmental origins illuminates the role of present behaviours.

Adolescence and young adulthood is also characterized by changing and evolving relationships. Outside the perceived protection of the family, young people are often ill-equipped to fully understand the risks and consequences of interpersonal relationships. Expressions of feelings and emotions are unpracticed and difficult. Non-acceptance and rejection may become manifest as low self-worth and esteem, often leading to self-destructive behaviour. Young people, while establishing the boundaries of their own identity, seek validation in a world of similars, the peer group. Feeling propelled by their own adolescent issues and by a necessity to keep others happy, they may participate in behaviours which may not only arrest their maturational process but also greatly compromise their physical health.

Adolescents often participate in actions and behaviours which promote a sense of well-being in one domain while creating a risk in another. Confronting the teenager and looking for compromise usually does not alleviate the behaviour in this situation. However, focusing on the maturational forces which cause the problem behaviour to be seen as a solution and recognizing its domain of origin does provide an opportunity for developing an intervention that can modify the behaviour. Understanding this complex interaction of motivating forces within a developmental paradigm affords the clinician a new set of skills in dealing with adolescents.

Social, Legal, and Political Issues

Social issues play a major role in defining the adolescent process. Understanding some of these issues often clarifies the motivations for certain behaviours and the obstacles to their easy resolution. It must be realized that not all social forces have a negative impact. Some of these forces actually work in favour of teenagers, while others are merely responses to their perceived needs.

In the United States, most states have passed legislation allowing certain young people to give self-consent to medical care. Each state has defined the particular conditions under which these mature minor laws apply. Most states allow a physician to provide care to minors if they are officially emancipated by the court, are emancipated by a lifestyle, or have a condition - STD, drug abuse, physical sexual abuse - such that if parental permission were required, medical care would be avoided or delayed. Such laws have become a necessity as adolescents become increasingly caught up in adversive social influences for accomplishing their adolescent tasks. It is also within this context of a consenting and confidential relationship that the professional can provide a relationship of trust and truth. Otherwise, important information may be withheld by the teenager, and this may significantly contribute to misdiagnosis or poor management.

The markers for maturation in today's society are primarily social and educational. This is particularly true during the mid-teen years, when markers of maturation within the peer group include such activities as alcohol and drug use, driving an automobile, participating in high-risk "dared" behaviours, sexual gallantry, and/or membership in a gang. It is no wonder that the top three causes of age-adjusted

mortality are heavily influenced by social factors - motor vehicle accidents (with or without driving under the influence of alcohol), homicide, and suicide.

Morbidities in adolescents have significant social components which are the direct or indirect manifestations of adolescent behaviour. Prevalence rates of sexually transmitted disease, pregnancy, substance abuse, and physical injury are high. These occur together with the usual illnesses such as respiratory infections, asthma, skin conditions, endocrine dysfunction, and psychosomatic disorders.

As the year 2000 approaches, the adolescent and young adult task has become discordant and confused. The prolonged developmental process creates an experience of disempowerment for young people. While seeking out the maturational demands promulgated by physiology and psychology, the adolescent is influenced by a distorted reality created by the media. Sexual behaviour often becomes discordant with psychosexual development. Normal development, when accompanied by sexual experimentation, carries the risk of lethality through HIV infection.

Adolescence and the Medical Profession

Kurt Lewin once remarked that there is nothing more practical than a good theory. Theory is often felt to be the backbone of basic education and research and not clinical practice. But what adolescent medicine has lacked is a cohesive theory that integrates developmental concepts into clinical practice and concepts that efficiently enable the busy clinician to decipher biobehavioural interactions and integrate these into management plans. It is also important that the clinician utilize the available community resources and programs, e.g. schools, churches, youth organizations, indigenous health facilities, and so on.

Specialty in medicine arises not only from the cloistering of knowledge but also from development of unique methods of application. It is this method of thought, or even perhaps of a special procedure that defines the boundaries of expertise, that gives definition to the experts. Specialized language evolves that facilitates communication. Teaching of any specialty entails an exchange of knowledge and language along with the acquisition of a method through demonstration and experience.

Developmental knowledge, with an awareness of biobehavioural interaction, was the foundation from which adolescent medicine evolved. Early method could best be characterized as the generous use of rapport, charisma, and human understanding. Success varied from professional to professional depending on interest and personality. Now with approximately 25 years of history, the foundations of a method have appeared. These methods or techniques are not user-dependent but experience-dependent. They define the technology of adolescent medicine, a technology which relies more on human skill than on the inventions of science. Clinicians in adolescent medicine need to be divergent thinkers, using the access point of the clinical complaint to understand better the context in which it occurs, the adolescent. Traditional medical/clinical teaching emphasizes convergent thinking in which the physician filters an array of clinical information to develop a singular diagnosis which may or may not interrelate with other diagnoses. Although psychological and social information is considered, it usually does not significantly influence treatment plans. In adolescent medicine, failure to recognize biobehavioural and biopsychosocial interactions limits problem definition and thus effective interventions.

There will always be a need for clinicians who understand the issues of the teenage patient, recognize their origins, and are able to provide an initial assessment. My experience has taught me that the more

physicians have the theory and practice of adolescent medicine made clear to them, the more interested they become. These are usually individuals who enjoy growth, change, and challenge. And as with any successful venture, awareness, courage, and sensitivity are required. However, the rewards are commensurate with the commitment.

Discussion

Dr. Sacks opened the discussion by asking Dr. MacKenzie to elaborate on his definition of normal adolescence. Dr. MacKenzie replied that we should be talking about a dynamic normalcy: "A normal adolescent is one who is able to cope with change, to adapt to risk within a spectrum which is not going to compromise health; risk is healthy, but risk then goes beyond a certain point where you begin to get into unhealthful behaviours."

Dr. Sacks then asked from which body of knowledge do we get our norms to teach: "What can we expect at various stages rather than at various times, reflecting the divergence between pubescence and adolescence?" For Dr. MacKenzie, this science should come from experts in adolescent medicine and not only from psychologists or sociologists whose traditional tools merely shadow the real pathology, as barium enemas do. "We are developmentalists and integrative thinkers, we are the ones who see the pathology, and we have to create ways to interpret that pathology within a science." There have been interesting studies on the question of adolescent normalcy, such as the longitudinal studies of Dr. Offer, but they leave aside the biological issues.

Dr. Tonkin thought what Dr. MacKenzie said about normal adolescent development was important in terms of what is happening in the AIDS epidemic. "You hear things such as 'You can get AIDS from sex, so don't have sex.' It is unrealistic and not normal to tell teenagers that they should not be sexual beings."

Dr. Wolfish asked Dr. MacKenzie about the model of adolescence as a rebirth process and if he could comment on the fact that normal adolescent development may be a point midway between childhood and adulthood where, along the way, the physician may encounter things that appear not to be normal. As examples, he mentioned antecedents to difficulties in adolescence, such as attention deficit disorders, giving rise to social complications, or problems starting in adolescence and affecting people as adults, such as hypertension. How could the rebirth model be used in terms of positive interventions along this continuum?

Dr. MacKenzie replied that the model is simplistic if it is used to explain all variance in terms of adolescent problems. Anyone who has had an unhealthy childhood will only have that exacerbated during adolescence. Although his/her adolescent period will be marked by increased pressure for deviance, there are still possibilities for intervention. If we accept that adolescence is a second birthing process and that it will be stressful, then we realize that interventions exist, not to cure, but to normalize the process of transition. With these interventions, we can gain better access to teenagers, hopefully to teach them helpful adult lifestyles and how to better handle that extra stress.

Dr. Rossi wondered in which area Dr. MacKenzie would include the cultural aspect, since adolescence is somewhat muted in some cultural groups as measured by progression through developmental tasks.

Dr. MacKenzie replied that the cultural environment is included in his use of the word environment: "To carry on the metaphor of a second birthing process, it contributes to the amniotic fluid."

Dr. Charbonneau, addressing the issue of adolescents using problems as solutions, asked Dr. MacKenzie if clinicians are not prone to quick intervention, substituting as the teens' parents or using some other form of control. "Should they sit with teenagers and work it out with them, even if they feel uncomfortable, and be able to wait for them to change?"

For Dr. MacKenzie, teenagers choose their own lifestyles, even if they do not always have many options. In order to impart a sense of control and empowerment to the adolescents, the doctor can use the ABC method - He can make them Aware of their Behaviour and point out that they have options to Change. They should be encouraged to choose a new behaviour which satisfies the same developmental need as the negative behaviour being replaced. For example, a teenager may move into prostitution to satisfy a certain need, gain identity, or feel a sense of control. To tell him that he should not be involved in prostitution is obvious advice, but it will not be followed if one cannot show him why he is doing it and what other options he has to satisfy the needs that are being fulfilled by prostitution. This way, the clinician is active and interactive.

Drs. Charbonneau and MacKenzie agreed that this process is slow and takes time: "We do not always follow immediately the advice we receive, but at least we become empowered to make changes." Dr. MacKenzie also made a brief comment on decision making: "We often think that we are going to teach adolescents decision making. But most adults themselves usually make decisions impulsively. So we want to take teenagers, who are in a very impulsive stage of their life, and teach them rational decision making!"