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# Maturation of the Teen Brain:

Implications for parents, mentors, and society

How do we decide when a young person has developed adult judgment?

**How do we decide when a young person has developed adult judgment? Auto rental companies do not rent to drivers under age 25. The risk of damage and destruction of property is too great for the companies to expose the vehicles to younger immature drivers. So, what is maturity and how and when does it happen?**

Maturity is completeness of growth and development. There are three components to this process: physical, mental, and what might be called cognitive. Each of these has its own separate timetable of completion. Physical and mental maturity are fairly obvious to an outside observer, and can be measured – physical, by weight and height, and mental, by memory and technical or artistic work. Both of these are usually complete by the end of the teen years. Cognitive maturity is less well-understood and, until recently, its time of completion has been undetermined. As you will see, though, in this paper, understanding of adolescent cognitive development has huge implications for all of society, and recent breakthroughs in neuroscience will forever change our understanding of adolescents and the role adults play in their lives.

It is important to differentiate the terms "adolescent" and "teenager" from each other. The adolescent years are the period of time during which a person grows from puberty to cognitive maturity. This period extends well past the teen years. In fact, most college students are still adolescents. The purpose of this paper is to discuss the data proving that – of physical, mental and cognitive maturity – it is cognitive maturity that develops last, usually not reaching completion until the mid-twenties.

Physically most people become mature as teenagers, some startlingly so. LeBron James, of the Cleveland Cavaliers basketball team, straight out of high school, can run circles around some highly experienced NBA players.

Mentally, teenagers achieve great maturity of intelligence – their ability to calculate, memorize, and create is sometimes startling. The movie "Amadeus," about Mozart, graphically illustrated this. Despite his youthful mental prowess, because his cognitive maturity lagged behind, Mozart's capacity for making decisions that required judgment was strikingly immature. The primary message of recent groundbreaking neuroscience is that cognitive maturity develops last, after physical and mental maturity, for all adolescents. This research shows that cognitive

maturity occurs in the mid-twenties, and includes the following:

- Mature judgment
- Seeing into the future
- Seeing how behavior can affect future
- Associating cause and effect
- Moral intelligence
- Abstract thinking
- Seeing what is not obvious
- Planning and decision-making
- Rational behavior and decision-making
- Rules of social conduct
- Understanding rules of social conduct

Most individuals have never thought about when these abilities develop or where they originate. Ancient writings often say they come from the heart – clearly separating them from just the ability to think. Perhaps, in concept, they were not far off. Neuroscientists, led by Jay Giedd, MD, Chief of Brain Imaging at the National Institutes of Mental Health, are showing us that these capacities primarily reside within the pre-frontal cortex of the frontal lobes of the brain. MRI (magnetic resonance imaging) is a technology that uses strong magnets to take pictures of body parts. New MRI studies of the developing brains of normal adolescents clearly show that the physical development of the pre-frontal cortex is not complete until the mid-twenties. Before recent research revealed this startling new information, adolescent specialists had assumed that adolescents acted the way they do because of raging "hormones," heredity, bad or good environmental factors, or a host of other reasons, all hopelessly commingled into a stew of influences that could probably never be understood. It is not that these other factors don't influence adolescents; they do. The issue is that underlying all of this – the overriding influence – is an incompletely developed pre-frontal cortex that limits the ability of adolescents to independently make mature decisions.

## Anatomy and Physiology of the Brain

Before describing the new MRI findings, it is important to understand basic brain anatomy and physiology, and then some of the older (but still valid) information about brain function in adolescents. The brain at maturity weighs just three pounds, and is made up of 10 billion neurons, 100 billion support cells, and 100 trillion connections – far more than all the Internet connections in the world. If one looks at a brain, it appears to be divided down the middle from front to back. Each half is called a cerebral hemisphere (Figure 1a). The frontal sections (lobes) of each of the cerebral hemispheres are used for logical reasoning, emotions, judgment, and voluntary muscle movements. The prefrontal lobes play a role in higher-level thought processes (Figure 1b). The prefrontal lobes receive signals from all

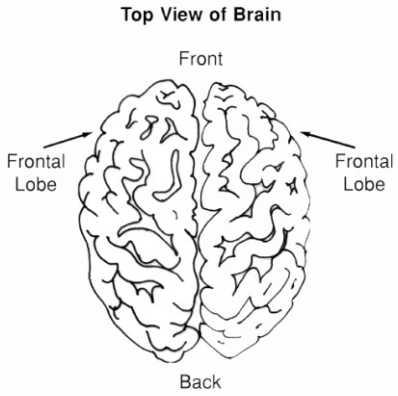



**Figure 1a. Lobes of the brain**

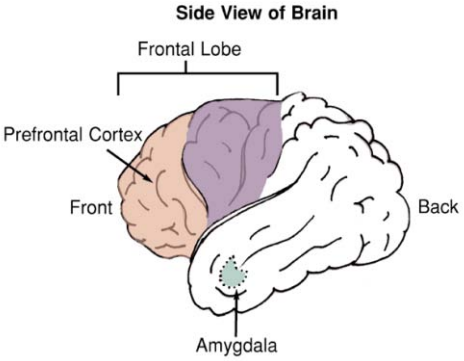



**Figure 1b. Lateral view of the brain**

areas of the brain, including the limbic system, the center of emotions. The structures of the limbic system play a role in regulating basic drives. These structures include the two amygdalae (Figure 1b) and the hypothalamus, which each play roles in emotion, and the hippocampus, which is responsible for storing short-term memory. The amygdalae (there is one amygdala on each side) are the centers for the identification of danger and for distinguishing between males and females by appearance and other characteristics. Of all living beings, humans have the largest number of connections between the prefrontal area and the limbic structures, which allows them to display the widest variety of feelings and emotions. Anyone who has observed teenagers expressing emotions is aware that emotions can partially or totally block logical reasoning.

At the microscopic level, there are two basic units of brain tissue, neurons and glial cells. The parts of the neuron include the cell body, axon, and dendrites (Figure 2). The cell body contains genetic information, axons are long extensions that carry chemical and electrical signals to neighboring neurons, and dendrites are short antennae-like projections that receive signals. Neurons do not actually "touch" one another. Instead, they communicate with the other by sending chemicals back and forth across tiny gaps called "synapses." The glial cells support and maintain the neurons. One of their support functions is to insulate the axons with a fatty covering called myelin. Once cells have been insulated in this fashion, they are referred to as myelinated cells. Electrical signals travel much faster through myelinated neurons, up to 100 times faster than in non-myelinated neurons.

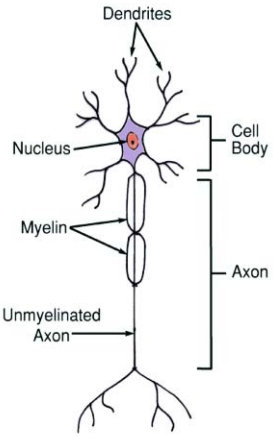



**Figure 2. Neuron**

Myelination causes gray brain matter to become white brain matter. More and more brain tissue becomes myelinated during the first 40 years of life. Some brain tissue never becomes myelinated; therefore, the brain is always made up of both gray and white matter.

## Earlier Studies of Adolescent Brain Function

Understanding this basic brain anatomy and physiology helps us to comprehend some of the earlier findings about adolescent brain function.

Early in life, most synapses produce "excitatory" signals. The brain, however, gradually prunes away many of these synapses so that by young adulthood, inhibitory synapses are more dominant. Research by Deborah Yurgelon-Todd, a neuropsychologist, illustrated this. She showed kids and adults photographs of faces expressing different emotions. She asked them to identify the emotions shown. Adults made few errors in assessing the photos. Kids made lots of mistakes, often seeing anger and hostility where there was none. She suggests that their mistakes result from the dominance of excitatory impulses in the teen brain. This is obviously important for the safety of a child – to run away if there is any question at all of a threat. However because of this, it is easy to see how a strong, physically mature teenager can misinterpret an expression and inappropriately react to a perceived threat by attacking a person. Because adults have a higher ratio of inhibitory to excitatory impulses, they are much more likely to evaluate situations in a calm and appropriate manner.

Brain cells are functionally mature when they are covered with myelin. Whereas the brain centers responsible for sensory and motor function – feeling, touch, lifting, etc – are completely myelinated by late childhood, the centers responsible for judgment are not fully myelinated until the mid-twenties.

Recent brain autopsies have shown that myelin doubles during the teen years, and continues increasing into the forties.

Production of the neurotransmitter dopamine increases dramatically in the prefrontal lobes during adolescence. This chemical has been shown to be necessary for an individual to choose between conflicting options, especially when a goal is not obvious – something necessary for mature judgment and impulse control.

The amygdalae are the part of the brain that process emotional information, especially information related to danger and threat in the environment. For example, the amygdalae become highly activated when a person sees a snake. During cognitive maturation a dramatic change occurs in the relationship between the amygdalae and the pre-frontal cortex. As the brain matures, the prefrontal lobes take over control of the amygdalae, facilitating a rational and reasoned response rather than an irrational or excessively emotional decision.

## Groundbreaking Research in Adolescent Brain Development

All of the above items are important for understanding adolescent decision-making. However, the greatest advances in our understanding of their ability to make mature decisions have come from the new imaging technology–MRI.

MRI technology is safe for growing kids because it uses no radiation, only strong magnets. It allows scientists to look through what, at times, seems to be very thick teenage skulls, and to actually watch the brains of adolescents as they grow from year to year. This new technology has given us startling new knowledge regarding adolescent behavior.

Dr. Jay Giedd's unprecedented but oft-confirmed discoveries of the past decade have shown us that there is sudden explosive growth and development of brain tissue during adolescent years, just as there was during fetal life. Prior to this discovery,

neuroscientists thought that proliferative brain growth was complete by the time a child began school (by age six, the brain has reached adult size) and that, from then on, the only active process that occurred was gradual maturing of the brain. Dr. Giedd's and others' work has also shown us that this newly discovered dramatic growth is not complete until the mid-twenties, and that the last portion of the brain to reach complete and mature growth is the pre-frontal cortex. Neuroscientists long have known that the source of cognitive thought is the pre-frontal cortex. This means that the area of the brain necessary for planning and decision making is physically incomplete and, therefore, cannot produce fully mature decisions until the mid-twenties.

During fetal life and again in adolescence, many more synapses develop than will actually be needed. Most unused synapses disappear, while often-used synapses are retained and strengthened (also known as the "use-it-or-lose-it" phenomenon).

The explosive brain development that occurs in fetal life and now, we know, in adolescent years has two elements: proliferation and pruning. It is the pruning, or cutting, of the interneuronal connections and the development of new connections that "sculpt" the brain. This increasingly complex network enables the brain to handle cognitive thought (abstract ideas), such as how present actions can affect one's future – also known as "cause and effect." In very young children and in adolescents, pruning and proliferation of synapses occur simultaneously. This process is essentially complete by the mid-twenties, with achievement of brain maturity.

If we look at sequential composite MRIs (each representing the average of many images) for 5-, 8-, 12-, 16-, and 20-year-olds, we can see how young brains – including the frontal lobes – gradually mature.

## The Brain is Plastic and Molded by Experience

Research carried out over the past decades has given us some astonishing information, especially when viewed in the light of this new information about the adolescent brain. As early as 1964, a group of researchers at UC Berkeley showed that experience could change the fundamental structure of the brain. After years of interviewing neuroscientists, Barbara Strauch concluded in her book *The Primal Teen* (Doubleday, 2003), "[T]o many, this idea of the brain responding to experiences, connecting up synapses as we go, is the take-home message about brains, overall."

This means that adolescents' activities or experiences actually mold their brains, causing some synapses to be cut, some to connect, and some to not connect. In essence, the brain responds to experiences by "connecting up" synapses as we go. An example is our language ability. Newborns can discern sounds in any language, but their brains become wired in such a way that they respond to sounds of their own language. This is why it is hard for a person who was raised speaking Japanese, which has no separate "L" and "R" sounds, to hear and speak these letters in English words.

The information discussed here shows that the adolescent's brain is 'plastic' and moldable, much like a baby's brain. Experiences that can mold an adolescent's brain may be unpleasant but beneficial – such as parental discipline. Others may be unpleasant and damaging, such as becoming a

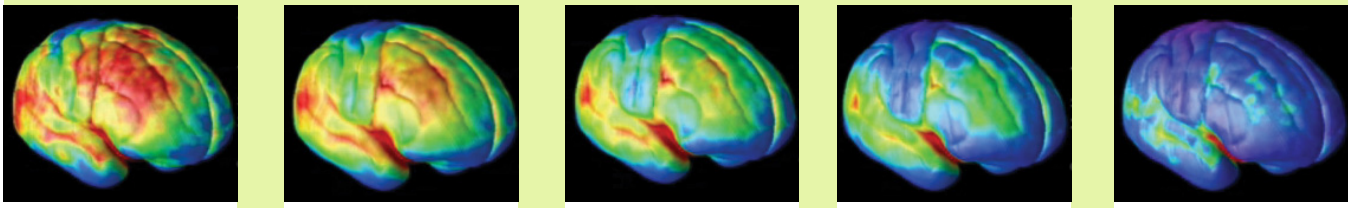



**Figure 3. Composite MRI studies of brains of persons aged 5 – 20 years**

Images courtesy of Dr. Jay Giedd, NIH

teen parent. Both types of experiences physically change and mold the adolescent brain, but one helps a young person's future and one hurts it.

## Societal Implications of These Neuroscientific Facts

The implications of this transformation are enormous. Adolescents' ability to make totally mature judgment calls based on abstract thinking, i.e., seeing how current behavior affects future outcomes, is limited. Therefore, their failures in this area are not necessarily moral. Quite literally, they do not have the brain cell connections to "do" judgment calculations. This means that, if parents, mentors, and the rest of society fails to give adolescents guidance (and, if necessary, discipline), if we fail to help them make the best decisions for themselves and for society, we abandon them to guidance by their own brains – brains which are incompletely developed and that are incapable of the truly mature judgment. Surprisingly, incomplete cognitive development of the brain lasts well through college years and, therefore, has enormous implications for the responsibility of parents and university administrators to that group.

We fail young persons when we give them "just the facts" and say "you decide" without guiding them to and supporting them in making the best decisions. We fail them when we expect them to control their impulses and avoid risk behaviors, when we abandon them at critical decision-points to their own minds – minds with a limited capacity for abstract thinking.

These two messages – that experiences actually shape the adolescent brain and that adults can and should fill in (in an ever-diminishing capacity) for adolescents' immature frontal lobes – should be of great encouragement to parents. In considering how his research has shaped the way he parents his own children, Dr. Jay Giedd says it has made him comfortable with the fact that giving guidance to his children, even through their college years, is not "butting in." He points out that trial and error and mistakes and successes are all a part of the process of brain molding that is supposed to happen. Parents need to understand this and take it into consideration as their adolescents mature, intervening to help prevent "irreversible" mistakes whenever possible.

Parents and mentors and all of society have a responsibility to adolescents. This new information allows adults to comfortably help our children develop

wisdom, avoid dangerous risk behaviors, and have the brightest futures.

## Take-Home Lessons

There are several take-home lessons for adults who want young people to have the very best chance of future health, hope, and happiness.

One of the most confusing "mine fields" for today's youth to negotiate is sexual decision making. The Medical Institute for Sexual Health has pointed out that, because of the problems of sexually transmitted infection, HIV, nonmarital pregnancy, and emotional damage from sexual involvement, healthy sexual decision-making is vital to a young person's future. Some suggestions that parents and other adults can use to help adolescents negotiate this mine field follow:

**Parents:** Connect with your children emotionally, with time and love. Be directive. Tell them what behavior is expected in your home and family, and insist that they abide by that. Frankly discuss the risks of alcohol and drug use as well as the risks and consequences of early sexual debut. Discuss the importance of sexual abstinence before marriage and faithfulness within marriage. Remember, the majority of teens say they want their parents' guidance, and parents are the biggest influence on their decision-making.

**Mentors:** Values and morality are best learned at home or, if not there, from adult mentors outside the home. Whether a young person has effective parenting or not, you can help to provide direction to young people. A mentoring role can be played by grandparents, aunts, uncles, friends, and teachers.

**Healthcare Providers:** You have a responsibility to understand and act on these scientific data. This suggests two activities: first, be directive to young people about the healthiest life choice. Frankly discuss the risks of alcohol and drug use and early sexual debut, just as you would discuss the risks of tobacco use. Discuss the importance of sexual abstinence before marriage and sexual activity only in marriage. Second, support parents' guidance to their children.

**University Administrators:** Health educators, student health center staff, deans of student life, and coaches: accept your responsibility for the young people who have been placed under your influence. Institute policies that realistically accommodate the limited abstract thinking of college-age young people. Strong drug control policies are essential. Prosecute date rape to the fullest. Develop powerful strategies for encouraging sexual abstinence or sexual activity only in marriage. Limit the availability of alcohol and discourage its use. Recent research is showing that, because the developing brain of the adolescent is undergoing such rapid proliferation, it is susceptible to damage from drugs such as alcohol or nicotine, just as it was during fetal development. Memory and learning are especially affected.

**Public Policy:** The primary role of public organizations, be they governmental or private, is to provide leadership and, where possible, the necessary resources including programs, research, and funding to direct young people away from risky behaviors and toward healthy behaviors. The publication of the Commission on Children at Risk, "Hardwired to Connect – the New Scientific Case for Authoritative Communities," uses the word "authoritative," they say, after considerable reflection. The Medical Institute agrees with their careful use of that word. They would agree with most of what has been said here, and they recommend that communities be appropriately authoritative. The Medical Institute believes it is unfair to put parents and their children out on point as they grow to maturity. Communities should surround them with appropriate directive and supportive help, as all our children become fully integrated adults.

The adolescent brain is proliferating – and it will proliferate for either good or for bad, Responsible parents and supportive communities can help those brains develop and grow, with the healthiest connections strengthened and the unhealthiest ones cut, giving our children true hope for the future.

# Response to Rep. Waxman's report, *The Content of Federally-Funded Abstinence-Only Education Programs*

In this article, the three significant problems with the Rep. Henry A. Waxman report.

**In December of 2004, Representative Henry A. Waxman published a report criticizing abstinence education programs. However, the report's assertions are cause for debate.**

There are three significant problems with the Waxman report entitled, *The Content of Federally-Funded Abstinence-Only Education Programs*.

• Waxman's report ignores the abject failure of school-based "comprehensive" sexuality education programs. All of these curricula are alleged to decrease sexually transmitted infection (STI), sexually transmitted disease (STD), and nonmarital pregnancy rates. However, almost no school-based comprehensive programs ever measure these outcomes, and of the handful that do, none have reduced these rates,

• Waxman's report ignores peer-reviewed literature describing community-based abstinence programs that significantly lowered nonmarital pregnancy rates, even claiming such do not exist,

• Waxman's criticism of the materials being used by the abstinence educators is filled with innuendos, errors, and half-truths.

The Medical Institute published an in-depth evaluation of comprehensive sexuality education programs in 2000, entitled *Building Healthy Futures*. This report and others describe the failure of "comprehensive" sexuality education programs. One program (*Contracept Rep.* 1994;5(2):10-2) often touted by supporters of comprehensive sexuality education, such as Henry Waxman, is a mentoring program in New York (this is actually not a school-based program since activities occur outside the classroom setting). This expensive (~$1,500 per adolescent per year) mentoring program provides Depo-Provera to young women. Not surprisingly, they seldom get pregnant. Unfortunately, Depo-Provera provides no protection against Sexually Transmitted Infections (STIs); in fact, a recent article in *Sexually Transmitted Disease* (Morrison, et al. *STD.* 2004;31:561-567) suggests that "[Depo-Provera] use… appear[s] to be significantly associated with increased acquisition of cervical chlamydial and gonococcal infections." STI rates have never been evaluated for this highly touted "pregnancy" prevention program in New York. Bone loss is also recognized as a possible side effect of Depo-Provera use. A recent (11/18/2004) Dear Healthcare Professional letter from the manufacturer states, "Women who use [Depo-Provera] may lose significant bone mineral density…It is unknown if use of [Depo-Provera] during adolescence or early adulthood…will reduce peak bone mass and increase the risk of osteoporotic fracture in later life." Although the New York program is highly regarded by comprehensive sexuality educators, it would not be acceptable to most parents, and it is prohibitively expensive (for instance, there are just under 10 million 15- to 19-year-old females in the United States. A program that cost only half as much as the original would still run about $7.5 billion per year. This $7.5 billion does not include the cost of treating STDs or their long-term effects such as infertility).

Over the past few decades, comprehensive sexuality educators have received the majority of federal

funds for sex education. They have employed legions of professional curriculum writers and educators. Money has been available for evaluative research. Despite the decades of dominance – particularly through the 1980s – these programs never produced any appreciable drop in STD, HIV, and nonmarital pregnancy rates. Given the continued failure of these programs, sexuality education ought to focus on the basic principles of public health – principles that promote risk avoidance (ie, abstinence) as the primary prevention against STIs and nonmarital pregnancy, as contrasted with mere risk reduction. In recognition of this fact, 150 international AIDS experts published a Common Ground statement on HIV prevention on World AIDS Day, 2004 (Halperin, et al. *Lancet North Am Ed.* 2002;574:1913-1914). In it they said, "…for [young people] who have not started sexual activity the first priority should be to encourage abstinence or delay of sexual onset, hence emphasizing risk avoidance as the best way to prevent HIV and other sexually transmitted infections as well as unwanted pregnancy. After sexual debut, returning to abstinence or being mutually faithful with an uninfected partner are the most effective ways of avoiding infection."

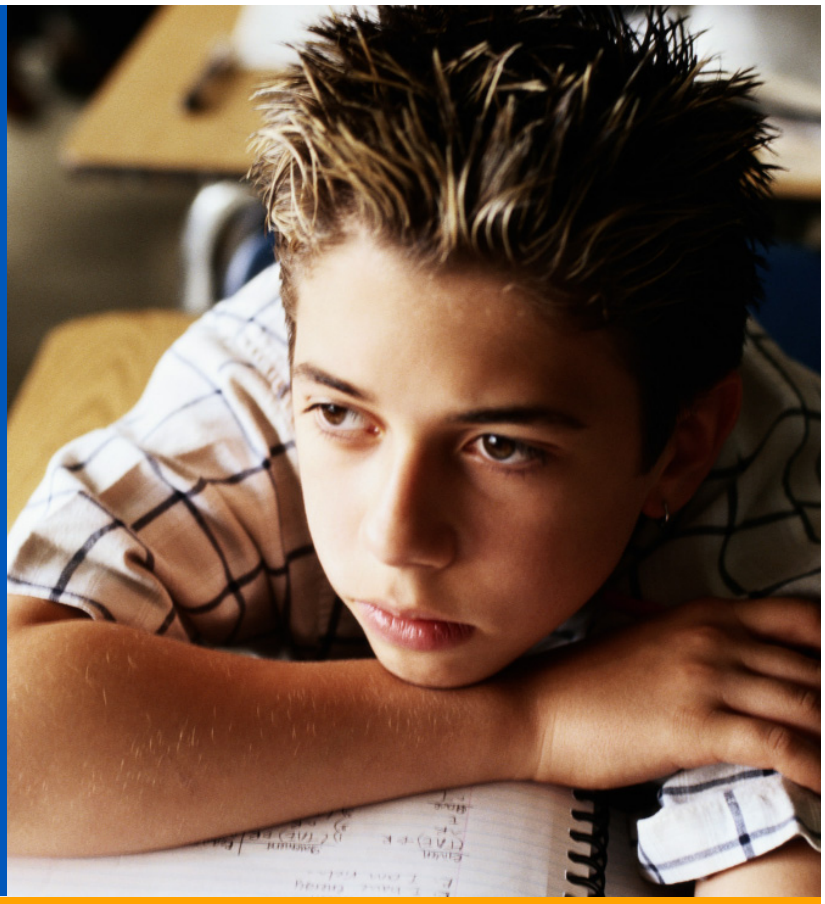

Fortunately, because of federal funding from 1996 to the present, some money is now available for abstinence educators to hire professional curriculum writers and well-trained education staff. As a result, excellent abstinence programs are being developed and evaluated. The fact that there are few published findings from such programs is understandable. First, the adolescents involved in these programs are young when they come in; many have not transitioned to sexual activity. To evaluate these programs, such youth must be followed for years. It then requires additional years to publish proper scientific (ie, longitudinal) studies.

However, as previously mentioned, there are two well-documented highly successful abstinence programs. In the 1980s, abstinence funds from the Office of Adolescent Pregnancy Prevention were used to develop a community-based abstinence program in Denmark, SC (Vincent, et al. *JAMA*. 1987;257:3382-3386). The half of the county that participated in this program had a dramatic drop in pregnancy rates. No such decrease was observed in the remainder of the county, or in adjacent comparison counties. In the 1990s, a second successful community-based abstinence program was implemented by a health department in Monroe County, NY in response to a high rate of teen pregnancy (Doniger, et al. *J Health Commun*. 2001;6:45-60). Following implementation, an appreciable drop was observed both in self-reported sexual activity and teen pregnancy rates for the county.

Waxman's criticism of an old version of The Medical Institute's Sexual Health Today medical slide program provides a good example of the distortion in his report. The Medical Institute provides reference materials for use by classroom educators. Despite the deference paid to us in the report, our slide show is no closer to a curriculum[1] than is a dictionary or an encyclopedia set. Our old *Sexual Health Today* slide show has about 100 slides. As a courtesy, it included ancillary background information for the educator in a "notes" section with each slide.

Waxman's report criticizes us on two counts. First, it says that we say that "touching another person's genitals" can result in pregnancy. This is a serious distortion of what we said. We said that "mutual masturbation is an activity which can spread STDs and can result in pregnancy." Our statement is accurate. A number of STDs (eg, herpes, human papillomavirus, and syphilis) can be spread by skin-to-skin contact. Additionally, if a man ejaculates on a woman's vulva, sperm can and do ascend through the vagina into the cervix on occasion, and cause a pregnancy. Most obstetricians have seen these types of cases. Although we thank Rep. Waxman's group for pointing out a small error in our old chlamydia material, this information had been deleted long before he notified us.

**The authors of the Waxman report did not evaluate "comprehensive" sexuality education materials with the same scrutiny they gave to abstinence oriented material.**



It is unfortunate that the Waxman report is so one-sided. The authors should have, but did not, evaluate "comprehensive" sexuality education information and the groups that publish such materials with the same scrutiny they gave to abstinence oriented material. A cursory look shows the following:

• SIECUS (SIECUS REPORT. 1998;27(1)): "Condoms are 98% effective in preventing pregnancy when used correctly – and up to 99.9% effective in reducing the risk of STD transmission when combined with spermicide." These numbers are both dangerous and erroneous; yet this was a widely circulated "scientific" report. The only groups of women ever to achieve such high rates are 1) older women who have used condoms for at least four years and who have had several children, 2) women who are over 40 and have had zero to two children. No peer-reviewed publication has ever asserted that condoms are 99.9% effective in reducing the risk of STD transmission, even with spermicide.

• Planned Parenthood: On a state-affiliate website (www.ppct.org/medical/services/bc_methods.shtml), Planned Parenthood says that condoms do "provide protection against sexually transmitted infections." This statement is misleading; condoms merely reduce the risk – they do not eliminate the risk. Indeed, they never totally protect a person from pregnancy, STDs or HIV.

• Campaign for Our Children (www.cfoc.org/TeenGuide/411AboutSex): The statement, "Condoms also protect both males and females from some STDs," is on their current website. In contrast, the highly respected NIH report (www.niaid.nih.gov/dmid/stds/condomreport.pdf) on condom effectiveness – and a report totally ignored by Waxman's paper – is the most reliable report about condom effectiveness. This report clearly points out that condoms reduce the risk of chlamydia transmission and syphilis transmission by approximately 50%. Subsequent reports have shown that condoms can reduce the risk of herpes transmission by about 50%, and a majority show no evidence of risk reduction for HPV transmission (although one recent report did suggest some risk reduction for HPV in men with 100% condom use).

Even the Centers for Disease Control must continually update their medical information. Until mid-2004 their website stated "[S]tudies found that, even with repeated sexual contact, 98 – 100% of those people who used latex condoms *correctly and consistently* [italics added] did not become infected." The equally important corollary – that, even with repeated sexual contact, 93% of those *people who used no condoms* at all did not become infected – was left unmentioned. Most people reading the first statement, and indeed the original authors of the CDC statement, seem to miss the real point. Efficacy for interventions such as condom use can only be scientifically estimated by comparing risk of disease in the exposed (always condom users) to risk in the unexposed (never condom users) (Rothman, et al. *Modern Epidemiology*. Philadelphia: Lippincott-Raven;1998). Recently, the CDC removed this statement from their website, presumably in deference to principles of modern epidemiology.

The comprehensive programs that primarily encourage the use of condoms do not take into account the emotional impact of sexual activity on young people. There is a well-documented increase in rates of depression and suicide attempt in young people who have transitioned from being virgins to being sexually active. The younger the age of sexual debut, the greater the number of eventual sex partners. An increased number of sexual partners is one of the biggest risks for sexually transmitted disease. All of these crucial considerations are taken into account by abstinence programs.

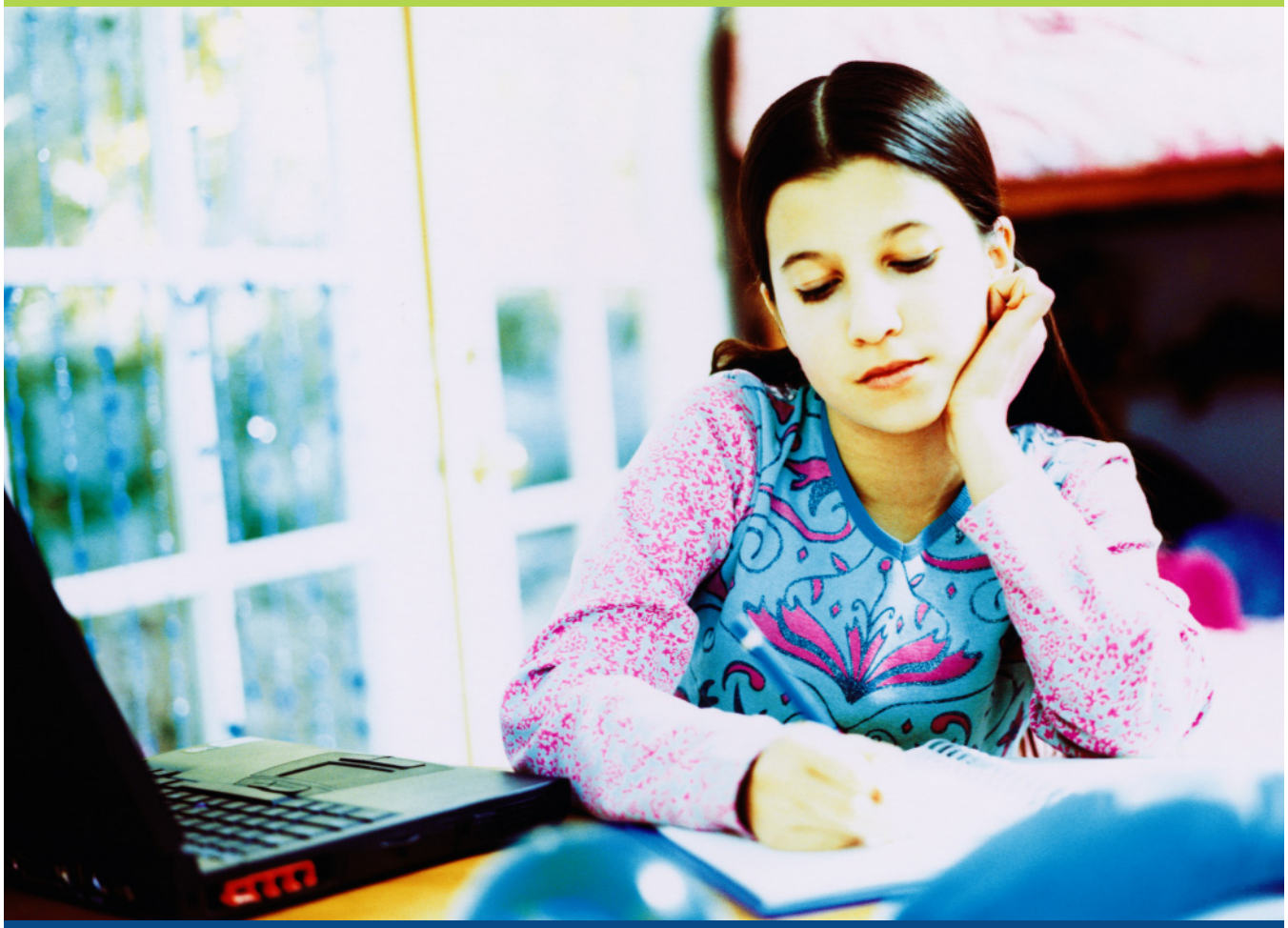
It is not unreasonable to conclude that "comprehensive" sexuality education programs have had their day in the sun. By any objective measure, they have failed. Today, 800,000 teen girls become pregnant each year, and 1 in 4 teens contracts an STI. This should be intolerable to all of us – whether parents, educators, or government servants. A recent study (Pardue, et al. *Heritage Foundation*, 2004; Backgrounder #1718) shows that the government spends $12 to promote contraception for every dollar spent to encourage abstinence ($1.73 billion vs. $0.14 billion in 2002). Something is not working. Giving up on teens is also intolerable. The "comprehensive" sex education programs have not produced the outcomes most parents want for their children.

So many data are available today which were unavailable ten years ago – data that are, in general, ignored by Representative Waxman. Rather than throwing mud, as has happened with Waxman's report, it would be better for people of different views to sit down in a spirit of cooperation and accountability and look at the data and agree on what is best for our young people. One of our favorite African proverbs says, "When elephants fight, it is the grass that gets hurt the most." In the arena of sexuality education, when adults are fighting, it is the kids who are getting hurt.

[1] According to the Centers for Disease Control, a curriculum has 1) learning objectives…, 2) a sequence of lessons or learning experiences intended to meet these objectives, 3) accompanying content that corresponds with the sequence of learning events and [are] intended to help teachers and students meet the learning objectives, and 4) assessment strategies to determine if students mastered the desired knowledge and skills.

# Closer Evaluation of the Texas A&M Abstinence Education Evaluation

Patricia Goodson, BE Pruitt et al. September 2004.
Texas A&M University.



What is being presented as a scientific study showing failure of abstinence education is actually not scientific at all.

**A comparison of the recent Texas A&M Abstinence Education Evaluation Phase 5 Report to its extensive press coverage underscores the pervasive media bias against abstinence education. What is being presented as a scientific study showing failure of abstinence education is actually not scientific at all. And a careful examination shows that it is the study, rather than abstinence education, that is a dismal failure. This "study" is riddled with methodologic flaws and data misinterpretations.**

This study involved fewer than 750 of the state's students, drawn from just 20 of the more than 3,200 schools in Texas. Though this might have been acceptable had the sample been well selected, the researchers totally ignored generally accepted scientific criteria requiring study participants to be randomly selected if the results are ever to be generalized. Following the lead of Alfred Kinsey, they chose the ad hoc approach of allowing participants to self-select. The not surprisingly unrepresentative nature of the sample is shown in Figure 1. As can be seen, the ethnic composition of the participants bears scant similarity to that of Texas schools.

However, the unrepresentative nature of the group and the self-selection of the participants are only a few of the factors that invalidate this evaluation.

The already-mentioned errors are further compounded by the astonishing absence of any control group. Because behaviors are expected to change over time, it is standard practice to compare a group that has been exposed to an intervention to a group that is not exposed to the intervention. Generally, the groups are compared before the intervention begins (pre-test) and at least once after the intervention (post-test). The A&M researchers did not do this. Instead they simply compared pre- and post-tests for the "intervention" group. Though simple pre-and post-tests with no control group are commonly used in small-scale self-evaluations of programs because they are relatively cheap and simple, such a design has no place in a scientific external evaluation.

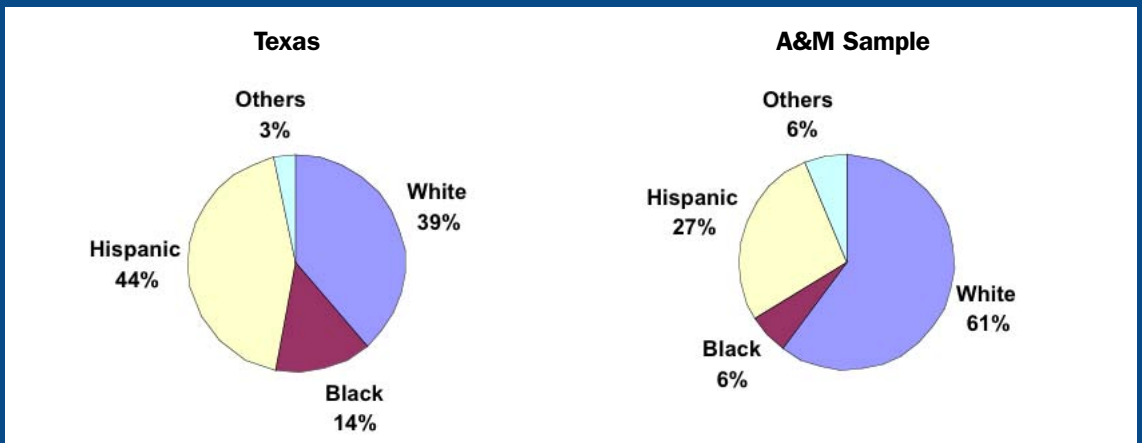



**Figure 1. Ethnicity of Middle School students**

It is instructive to compare the authors' written statements in their Technical Report to their statements quoted in the press. For instance, in the summary section of their report,[1] the authors' correctly state

1) The most significant limitation relates to its *design* [italics added]…no controls were identified for the high school group,

2) …"cases" and controls were already substantially different at pre-test, and therefore, not comparable,

3) …both the middle school and high school samples are non-probability samples, ie, they were not randomly selected.

They are correct. These were significant design flaws – on the order of a civil engineer saying that he got the arch upside down on a bridge design. Nevertheless, despite their stated misgivings, the authors were far less circumspect about the limitations of their study in their statements to the press. They were, in fact, prone to make conclusions neither discussed in nor supported by their report. Some of these statements were

1) Science is losing to politics.
2) We need to get over our fear of research.
3) We didn't find strong evidence of program effect.

It would appear that it is the authors – abstinence educators – who are actually afraid of research.

**Figure 2.**

**Percentage of student who have "ever had sex" at the beginning of the study**

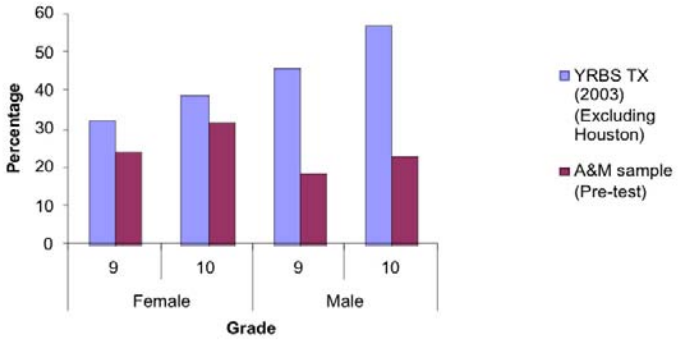
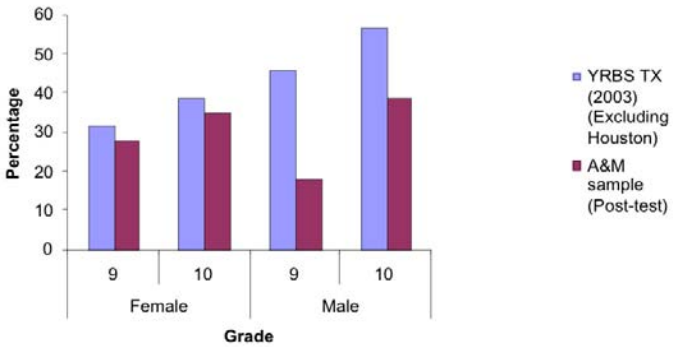



**Figure 3.**

**Percentage of student who have "ever had sex" at the end of the study**



Notwithstanding the numerous shortfalls in the study design, some findings would seem to merit a second look. For instance, following exposure to an abstinence program, post-test responses of participating students were two to three times more likely to have changed in a direction that was favorable rather than unfavorable toward abstinence.

Abstinence programs are not the default in most school districts in the US. They are generally adopted only in communities where parents and community leaders feel strongly about these values and want them reinforced in school. It is interesting to note (Figures 2 & 3) that, at both the beginning and end of the study, the young participants appear to be far less sexually active than their peers statewide.

[1]Goodson P, Pruitt BE, Buhi E, Wilson KL, et al. Abstinence Education Evaluation Phase 5 Technical Report. College Station, TX: Department of Health and Kinesiology; Texas A&M University; 2004 September.

It is not surprising that this highly flawed and limited sample supports published peer-reviewed studies,[2,3] that demonstrate the value of community-based abstinence programs. What needs to be emphasized at the community level are consistent behavior change messages promoting abstinence before marriage and fidelity within marriage. Communities that consistently encourage their young people to make the healthiest behavior choice – to remain abstinent until marriage – can expect to reap the rewards of both reduced nonmarital pregnancy and STD rates.

[2]Vincent ML; Clearie AF; Schluchter MD. Reducing adolescent pregnancy through school and community-based education. *JAMA*. 1987;257(24):3382-3386.
[3]Doniger AS, Adams E, Utter CA, Riley JS. Impact evaluation of the "not me, not now" abstinence-oriented, adolescent pregnancy prevention communications program, Monroe County, New York. *J Health Commun*. 2001 Jan-Mar;6(1):45-60.

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