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REVIEW articles

Pediatric vital signs: recording methods and interpretations

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Abstract

Recording pediatric vital signs can be an important part of the physical and emotional evaluation of the child dental patient. These records are accomplished easily if the practitioner understands the methods of recording, the normal standards, and the common causes of abnormal vital signs. This paper contains methods for measuring blood pressure, pulse, temperature, and respiratory rate in children and normative values for each at different ages. Some common causes for abnormalities and their relationship to dental treatment are discussed.

The period of life from birth through adolescence is one of rapid growth accompanied by considerable physical change. Increasingly, dentists are becoming concerned with the recognition and measurement of physical growth and thus have been able to play a significant role in providing for both interceptive and preventive health care in pediatric patients.

Physiological changes also are occurring during this period of rapid physical development. The measurement of a child's vital signs can be an important parameter in monitoring normal physical development and in detecting abnormalities. With increasing awareness of the need for preventive medicine, the dental profession has become involved more actively in measuring vital signs, particularly blood pressure, as part of a screening program for early detection of hypertension in adults.[1-3] Unfortunately, there has been little effort by dentists to provide the same service for pediatric patients; vital sign measurement usually is limited to hospital admissions, episodes of illness, or routine physical examinations.[4,5] Much adult hypertension, however, can be recognized in childhood, and children of adult hypertensives are especially at risk for high blood pressure. Thus, early detection and intervention is desirable.

This paper presents recording methods for pediatric vital signs and their interpretation, with the hope that these measurements will become routine in the dental office as part of the physical assessment of the child patient.

Blood Pressure

The possible onset of hypertension in childhood has encouraged more physicians to include blood pressure measurement as part of their examination of children older than two to three years of age. Similar arguments can be made for the routine measurement of blood pressure in dental practice as part of a more comprehensive approach to health care for the pediatric dental patient. This ideal, however, only can be accomplished through a broader understanding of the methods and interpretation of pediatric blood pressure.

Because blood pressure is a reflection of cardiac output, peripheral vascular resistance, blood volume, arterial elasticity, and other hemodynamic variables, abnormal readings are often the basis for further investigation of a number of systems.[6] Accurate readings are, therefore, important since an error in one direction may lead to neglect of an important underlying problem.[7]

Both human and instrumental errors in the estimation of blood pressure can occur in numerous ways.[8] Individually they may represent only a small deviation from the true reading, but collectively the inaccuracy could be considerable. Failure to recognize this is reflected in the casual and hurried manner in which blood pressure often is recorded.[12]

It generally is agreed that the indirect measurement of blood pressure is an estimate rather than a precise determination.[11] A number of physiological variations can occur. Systolic arterial pressure varies diurnally with an early morning low point and an early evening high point.

After meals, a minor increase in blood pressure is found in many children.[15] Sensory stimulation such as a distended urinary bladder, physical activity, or anxiety in a dental office can raise the arterial pressure.[13] Since the preceding physiological variables can influence blood pressure determination, it is important to control these

external factors whenever possible and to rely on multiple blood pressure recordings instead of a single measurement, especially where abnormal readings are encountered. A direct (intra-arterial) blood pressure measurement is occasionally necessary where serious doubt in the reading exists.[6]

Methods of Measuring Blood Pressure

The vast majority of blood pressure determinations are made indirectly using the ausculatory method. However, in infants and very young children vascular sounds are faint so other techniques such as utlrasound and the flush method often are used.[11] Because equipment is expensive and because most pediatric dental patients are older than two years, only the ausculatory method will be described.

The child should be comfortable and relaxed before attempting to record blood pressure. It is wise to wait some time before making a reading to allow the child to relax in the dental office or waiting room environment.

Theoretically, if the vasomotor reflexes are intact, it should make little difference whether the patient is recumbent or sitting. In some individuals, however, particularly those with hypertension, the sitting blood pressure is abnormally high.[6,11] In any event it is important to record the position of the patient with the values obtained, and regardless of the patient's position, it is imperative that the extremity (but not the manometer) be at the level of the heart.[11] The mercury manometer is preferred over the aneroid manometer because the latter is more sensitive to jolts and suffers from mechanical hysteresis.[11]

Although an index for proper cuff selection for children has not been established, it is safe to say that a cuff which covers about two-thirds of the upper arm length is the correct size.

To avoid error, certain precautions should become a matter of habit; the mercury column must be vertical, the eye of the examiner should be at the level of the meniscus, and most importantly in the pediatric age group, the appropriate cuff size must be used. A cuff which is too narrow may result in error on the high side, whereas one too wide may cause error on the low side.[15] Although an index for proper cuff selection for children has not been established, it is safe to say that a cuff which covers about two-thirds of the upper arm length is the correct size.[9]

With regard to the length of the cuff, there remains some controversy. In accordance with the latest recommendations of the American Heart Assocation, however, it should be at least long enough to halfway encircle the limb, with care taken to apply the bag directly over the artery.[7] It is important to apply the cuff snugly to the bare limb since a loosely applied cuff results in ballooning of the bag and a narrowing of the effective surface.[13] It should be inflated as rapidly as possible, but deflated slowly at a rate of between 2 and 5 mm Hg/sec.[13] Slow inflation may result in a period between systole and diastole during which all vascular sounds disappear (ausculatory gap).[11] This gap can result in a profound error in interpretation of either systolic or diastolic pressure, particularly in hypertensive subjects. This error can be avoided by rapid inflation to 30 mm Hg above estimated systolic values.[13] Too rapid a deflation rate can result in error in either direction.[11,13]

Preliminary palpation of the brachial artery at the antecubital fossa is particularly helpful in young children. After the cuff is snugly applied, firmly place the head of the stethoscope on the skin at the antecubital space. It should not be in contact with the lower edge of the cuff.[11]

The artery is occluded completely with cuff inflation above the peak pressure of the arterial pulse wave (approximately 130 mm Hg). With gradual deflation the vessel opens, the pressure pulse is transmitted to the periphery, and the vascular sounds of Korotkoff become audible.[11] These can be identified as occurring in four distinct phases:

Phase I.	The sudden appearance of faint sounds
Phase II.	Prolongation of sound into a murmur
Phase III.	Increased intensity of the sounds
Phase IV.	Muffling of the sounds
Phase V.	Complete disappearance of the sound.

There is universal agreement that Phase I is the index of systolic pressure. The index of diastolic pressure is less certain and rests between muffling and cessation of vascular sounds. Neither is an accurate index, however, since muffling tends to give high readings, while cessation gives readings that are too low.[7] Because of the continuted uncertainty regarding the best criterion, both diastolic readings should be recorded (e.g., 105/60/55) if there is a significant difference between muffling and cessation.[11] It is recommended that the average of at least two and preferably three readings of both systolic and diastolic pressure be accepted as the final estimate of blood pressure.[11]

Table 1 gives the mean blood pressure for boys and girls ages 5-15.[16] It also provides the range of values for blood pressure from the 5th to the 95th percentile. If a child's blood pressure is consistently in the upper ranges, then consulation and referral to the family physician is advised. Blood pressure readings do fluctuate, however, particularly in adolescents, and single abnormal readings may not necessarily reflect pathology.[16] As with height and weight, annual plotting of blood pressure data is therefore desirable. (Blood pressure charts prepared from

Table 1. Systolic/Diastolic Blood Pressures According to Age and Sex*

Age	*Mean* Boys	Girls	*Range* (5th-95th percentile) Boys	Girls
2-5 yrs.	96/90	96/61	78-112/48-79	78-112/48-79
6	98/63	97/62	80-116/48-80	80-114/49-80
7	101/65	101/64	81-118/50-81	82-118/50-80
8	104/67	104/66	82-122/52-83	85-121/52-82
9	106/69	107/70	86-126/54-84	87-125/53-83
10	109/71	110/72	88-130/56-86	90-128/55-84
11	112/72	112/73	91-132/57-87	92-130/57-86
12	114/73	115/74	94-136/58-88	95-133/59-87
13	117/74	117/75	97-139/59-90	96-136/61-88
14	120/75	119/76	98-142/60-91	98-138/62-90
15	122/76	121/77	101-145/60-92	99-140/62-91
16	124/76	122/78	102-148/60-93	100-142/62-92
17	127/77	122/78	103-150/61-93	101-143/62-93
18	129/78	122/78	106-152/61-94	101-145/62-94

*Abstracted from: Blumenthal, S., et al. Pediatrics 59:797-820, 1979.

National Institute of Health studies are available from the Government Printing Office.)

Abnormalities of Blood Pressure

Hypertension: The causes of elevated blood pressure in children fall into two categories. The first includes a large number of recognized diseases (Table 2) that have been known to elevate blood pressure.[10] Many of these are sufficiently serious to have been recognized before a visit to the dental office (particularly in older children). The second group is called transient or labile hypertension for which no underlying disease can be found. This group has received considerable attention recently because chronic adult hypertension is thought to have its origin in childhood. Additionally, there appears to be some evidence to suggest the existence of familial hypertension patterns.[4] A family history should be taken for pediatric dental patients to identify possible at-risk children.

The exact cause of hypertension in most children is unknown and therefore falls into the second group. Heredity, obesity, and excess salt intake may be important factors. It has been postulated that hemodynamic changes and hypertension are responses to renal defects causing retention of salt and water. The elevation of arterial pressure thus becomes necessary to help restore the normal balance between body fluid volume and urinary output.

Hypotension: In children older than one year, hypotension is defined as a persistent blood pressure below 95/60.[11] In a normal healthy child, who is not receiving therapy under general anesthesia or conscious sedation, low blood pressure is considered to be of little significance. It can, of course, be a good prognostic indicator for a healthy cardiovascular system. Sudden drop in blood pressure results in syncope (fainting), and failure to place the patient in the head down position or supine can result in significant cerebral anoxia. Blood pressure drop also can follow injury or hemorrhage due to hypovolemic shock. This also is associated over a longer period of time with excessive urination (e.g. diabetes), vomiting, or diarrhea. The latter are rarely diagnostic problems in the dental office.[13] Slow, insidious bleeding (e.g. from the G.I. tract) also can cause low blood pressure in a child

Table 2. Common Systemic Causes of Hypertension in Children

I. Renal
- Acute glomerulonephritis
- Bilateral obstructive uropathy
- Anaphylactoid purpura (Henoch-Schönlein) nephritis
- Acute renal failure
- Tumors of the kidney (Wilms' tumor, tuberous sclerosis)
- Collagen disease (periarteritis, lupus, dermatomyositis)
- Heavy metal poisoning
- Familial nephritis (Alport's syndrome, medullary cyctic disease)

II. Endocrine
- Pheochromocytoma
- Congenital adrenal hyperplasia
- 17-Hydroxylase deficiency
- Neuroblastoma
- Cushing's disease
- Hyperparathyroidism

III. Vascular System
- Polycythemia
- Anemia (systolic only)
- Patent ductus arteriosus (systolic only)
- Coarctation of the aorta
- Leukemia
- Subacute bacterial endocarditis

IV. Metabolic
- Diabetes mellitus (renal involvement)
- Acute intermittent porphyria
- Hypercalcemia

V. Neurologic
- Dysautonomia (Riley-Day syndrome)
- Neurofibromatosis
- Poliomyelitis
- Anxiety

VI. Drug Related
- Steroid administration (corticosteroids and DOCA)
- Heavy metals (mercury and lead)
- After giving sympathomimetic drugs (nose drops, cough medicines, etc.)
- Excessive ingestion of licorice
- Ingestion of birth control pills

VII. Miscellaneous
- Essential hypertension (associated with low, normal, and high renin activity)
- Stevens-Johnson syndrome
- Cyclic vomiting with dehydration

Table 3. Normal Values

	Heart Rate (per min. ± 2 SD)	Mean Blood Pressure (mm/Hg)	Temp. °F	Temp. °C	Respirations (per/min.)
Premature	125 ± 50	35-56 systolic (Birth - 7 days)	—		Not given
Full Term	140 ± 50	75/50	—		Not given
Infant					
1 - 6 mo.	130 ± 45	80/46	99.4	37.5	30 - 80
6 - 12 mo.	115 ± 40	96/65	99.5	37.5	30 - 80
Preschool					
1 - 2 yrs.	110 ± 40	99/65	99.7	37.7	20 - 30
2 - 4 yrs.	105 ± 35	100/60	99.0	37.2	20 - 30
4 - 6 yrs.	105 ± 35	100/60	98.6	37.0	20 - 30
School					
6 - 8 yrs.		105/60	98.3	36.8	20 - 30
8 - 10 yrs.	95 ± 30	110/60	98.1	36.7	20 - 30
10 - 12 yrs.		112/60	98.0	36.7	20 - 30
Adolescent					
12 - 14 yrs.		118/60	97.8	36.6	15 - 22
14 - 16 yrs.	82 ± 25	120/65	—		15 - 22
16 - 18 yrs.		120/65	—		15 - 22

who is otherwise healthy.

Pulse

Since cardiac rate, rhythm, and character may be of great concern to the dentist, an understanding of the normal pulse can be important to pediatric dental treatment planning. Normal pulse rate in children is higher than in adults and decreases from birth to adolescence when adult levels are reached (Table 3). Pulse rhythm and the character of the beat generally are regular in the normal child. However, most children have a sinus arrhythmia so occasional runs of premature beats or of extra systolies may alter the pulse rate, rhythm, and character.

Measurement of Pulse

Pulse can be determined either by placing a stethoscope or the first and second fingers on an artery. The examiner's thumb should not be used because it has a prominent pulse of its own and can confuse the reading.

Depending on the age of the child, the largest arteries are best used for this examination. The carotid artery, brachial artery, or radial artery are chosen most often. However, the facial artery as it passes over the lower border of the mandible is located easily. Often it is necessary to monitor the pulse more than once to determine accurately the heart rate.

Abnormalities of the Pulse

Abnormalities of pulse rhythm, character, and volume in children are rare in healthy individuals but can be an indicator of a congenital heart defect. Referral to a physician is certainly appropriate in these cases.

Tachycardia: In the normal child the pulse frequently is found to increase in the dental environment because of anxiety, fear, and/or excitement.[17,18] Monitoring the pulse rate during dental treatment may be helpful in determining the effectiveness of those anxiety-reducing procedures commonly employed in the dental treatment of children.[17,18] Under pathological conditions, the pulse rate can be altered and thereby reflect the degree of stress placed on the cardiovascular system.

Pulse rate usually is increased 7-10% for each degree rise in temperature and can be elevated significantly with respiratory disease.[11] A more complete list of pathological conditions and their effect on pulse rate is provided in Table 4.

Brachycardia: A slow heart rate (below 50 beats/minute) is often an indicator of a well-trained athlete,[11] but is not common in children. It can be an indicator of a heart block or an abnormality in the electrical conduction system in the heart and can be iatrogenically

Table 4. Common Causes of Abnormal Pulse Rate

Tachycardia	*Bradycardia*
1. Excitement, stress, anxiety	1. Well-trained individual
2. Toxicity, (e.g. local anesthetics, narcotics)	2. Sinus arrhythmia
3. Fever	3. Congenital or acquired (e.g., digitalis) heart block
4. Congenital or acquired heart disease	4. Severe sepsis
5. Hyperthyroidism	5. Increased intracranial pressure
6. Hypertension	6. Hypothyroidism
	7. Hypothermia
	8. Hypotension

produced by an overdose of digitalis or a heart-blocking drug. In severe cases this can lead to cerebral insufficiency and unconsciousness.[13] A vagal slowing of the heart rate reduces the blood pressure — thus, an association of low pulse rate with hypotension is usual. Reduced metabolic demands (e.g., with hypothyroidism or hypothermia) also slow the heart rate.[14] In very young children, brachycardia frequently is seen in cases with a cardiac defect or severe sepsis, but in older children is most common in sinus arrhythmia. Severe increased intracranial pressure also may cause brachycardia as well as hypotension and reduced respiratory rate associated with shock.[15]

Respiratory Rate

Measurement of Respiration

Respiratory rate is obtained by watching, palpating, or auscultating the chest. Respiration in the infant or very young child is largely diaphragmatic. As the child grows older, intercostal muscles provide the major component of chest movement. Only during obstruction or with a significant increase in the respiratory rate does the diaphragm play a large part in the respiratory pattern. In severe obstruction or respiratory difficulty, accessory muscles in the neck also aid in expanding and elevating the rib cage.

A slow respiratory rate is often an indicator of central respiratory depression which can be caused by sedatives or other drugs, alkalosis, poisons, or increased intracranial pressure.

Since the character and rate of respiration can be influenced by pathology as well as excitement, it is important for the dentist who treats children to understand normal respiratory standards and some of the causes for abnormal findings. Normal respiratory rates are given in Table 3.

Abnormalities of Respiration

Tachypnea: Increase in respiratory rates can have a variety of underlying causes. Certainly, excitement and/or fear are major reasons for an increase in respiratory rate in most healthy children, but respiratory obstruction from a foreign body or an infection can be common in this age group. Table 5 lists some of the causes of respiratory rate changes in the pediatric patient. Any condition which produces shock in a child such as poisoning, acidosis, or severe infection will produce tachypnea. It may be one of the earliest signs of an adverse reaction to a local anesthetic or an overdose of aspirin. Children with a rapid respiratory rate commonly have respiratory distress or a severe infection; children with a slow respiratory rate are usually free from respiratory difficulty.[15]

Bradypnea: A slow respiratory rate is often an indicator of central respiratory depression which can be caused by sedatives or other drugs, alkalosis, poisons, or increased intracranial pressure. A slow respiratory rate associated with shallow respirations signifies hypoventilation and almost always originates from central nervous system disease or a metabolic insult from a drug or an infection. A sleeping child often has a slow respiratory rate with irregularities in ventilation triggered by stimulation.[15]

Temperature

Recording temperature as a measure of pediatric vital signs usually is not necessary for the child dental patient; however, under certain conditions of pathology, its measurement is important. Since there is some variation in temperature related to development of the child, it is necessary for the dental practitioner to appreciate the range of normal values and to understand the recording and interpretation of this measurement. Normal temperature standards are given in Table 3.

If a dental patient is ill from oral and/or systemic disease, one degree more or less of fever does not mean one degree more or less of disease. As previously discussed, temperature elevation is important in normal respiratory and cardiovascular physiology. Febrile seizures are common in children with significant temperature elevations. Early treatment of the underlying disease and a reduction of the fever will in turn reduce the possibilities of seizure activity.

Measurement of Temperature

The mouth, rectum, and skin (groin and axilla) are the three sites of temperature measurement. In general, skin temperature is about two degrees lower than rectal and one degree lower than oral temperature.

Table 5. Common Causes of Respiratory Changes in Children

Tachypnea	*Bradypnea*
1. Excitement, stress, anxiety	1. Central nervous system depression
2. Medications (e.g., sedatives narcotics, salicylism)	2. Poisoning (alkalosis)
3. Congenital or acquired heart disease	3. Increased intracranial pressure
4. Respiratory disease (URI, pneumonia)	4. Medications (e.g., sedatives, respiratory depressants
5. Foreign body obstruction	
6. Fever and severe infection	
7. Poisoning (acidosis)	
8. Asthma	
9. CNS pathology (encephalitis, bulbar polio)	

If a rectal temperature is desired, the child is placed on his or her stomach and supported, if necessary, to prevent change in position. The thermometer is well greased and inserted one inch past the mercury bulb and held in place for approximately three minutes. Rectal temperature determinations are chosen for the young child or for those children with oral and/or skin lesions such as herpes simplex, Stevens-Johnson syndrome, etc.

Oral temperature is recorded with the thermometer inserted under the tongue and held in place by closing the lips but not the teeth. Skin temperatures can be obtained in young children by placing the thermometer in the axilla or groin, putting the arm or the leg along the patient's body and recording the temperature after three minutes.

Abnormalities of Temperature

Hyperthermia: Fever is a manifestation of increased metabolism and may be caused by many underlying disorders. A body temperature of 104-105° in the child corresponds roughly to a temperature of 101-102° in the adult. Table 6 gives some of the common causes of temperature elevations in pediatric patients.

Table 6. Common Causes of Abnormal Temperature in Children

Hyperthermia	*Hypothermia*
1. Exercise	1. Chilling
2. Diurnal variations	2. Infectious disease (e.g., some viruses)
3. Infectious disease (URI, otitis media)	3. Drug overdose (e.g., barbiturates, or alcohol)
4. Dehydration	4. Hypothyroidism
5. Ectodermal dysplasia (heat intolerance)	5. Bradycardia
6. Oncological causes (e.g., leukemia, Hodgkin's disease)	6. Leukemia (Hodgkin's disease)

Elevated temperature may be associated with orally related inflammation (e.g., cellulitis of dental origin or acute necrotizing ulcerative gingivitis). In these cases, the spread of the inflammation to a generalized systemic involvement may indicate the use of antibiotics and antipyretics. Elevation of temperature also can occur temporarily with activity and is commonly seen in a child who is crying and restless in the dental chair. The temperature usually subsides when the activity ceases.[13] A rise in temperature to about 104°F, especially if the elevation is rapid, is sometimes accompanied by convulsions. Slow cooling of the child with wet cloths or immersion in warm water is advocated to avoid this complication.[15] Malignant hyperthermia is a complication of general anesthesia, especially if succinylcholine is used. A family history may alert the dentist to this possible complication.

Hypothermia: Hypothermia usually is due to chilling secondary to abnormalities in heat production or abnormalities of thermostatic regulation.[14] Viral infections, in particular, commonly are associated with low body temperatures.[15] Overdose of barbiturates or alcohol frequently cause hypothermia.[14] Exposure to extremes of cold rarely causes hypothermia because the body usually shivers to exhaustion and eventual death.

Despite the potential for inaccurate readings discussed herein, recording pediatric vital signs is not a difficult or time-consuming task — even in a busy dental office.

Discussion

Despite the potential for inaccurate readings discussed herein, recording pediatric vital signs is not a difficult or time-consuming task — even in a busy dental office. With the exception of a few smaller-size blood pressure cuffs, the equipment costs are minimal. We have found that ancillary personnel easily can be trained to record vital signs accurately. Recording vital signs prior to oral examination and/or treatment visit can alert the dentist to the patient's anxiety level and potential for cooperativeness.

A child's vital signs often reflect underlying chronic or acute systemic disease. These records, in conjunction with the health history, can be valuable in formulating a treatment plan and may indicate the need for consultation with the child's physician.

Before beginning sedation with medication, preoperative recording of blood pressure, pulse, and respiratory rate is essential. Monitoring these vital signs will aid in determining the level of medication and its role in reducing the child's anxiety. Vital signs are most helpful in monitoring medication effects on the cardiovascular system and particularly in giving early warning of oversedation. With a significant depression of the vital signs, the dentist may choose to reverse the effect of medications or to observe the child closely until normal cardiovascular function resumes. If vital signs are not recorded under "normal" physiological conditions, the dentist loses a valuable tool essential to patient safety.

Since adult hypertension now is considered to have a possible early onset in childhood, the dentist can perform a useful service to all his patients by monitoring blood pressure in the pediatric age group. In most areas, recording blood pressure is no more difficult to perform in children than in adults, particularly as they become used to this routine procedure. Clearly, adult equipment and adult standards are not useful in this age group; the dentist must become familiar with the variation of normal values for the developing child. Once again, the dentist is in an ideal position to monitor routinely this development and thus provide invaluable service in disease prevention.

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Quotable Quote

Brevity breeds adherence to the first law of communication—your words should convey your meaning to your intended audience. Confucius, 2,400 years ago, said, "in language, clearness is everything." Nathaniel Hawthorne, 130 years ago, said, "The greatest possible merit of style is, of course, to make the words absolutely disappear into the thought."

Great writers and thinkers are great because they say great things in an easy-to-understand way. "I never think of the future. It comes soon enough," said Einstein. "I see one-third of a nation ill-clothed, ill-fed, ill-housed," said Franklin D. Roosevelt. "Give us the tools and we will finish the job," said Churchill in the early years of World War II. Use words everyone knows and everyone will know what you say.

Be brief, be clear, and telegraph your message. Make sure the most important thing you have to say is up front. People are impatient and you have only a few seconds to convince them your message is of value to them.

From: Amorosino, Chris John. Journal of Communication Management. Vol. 12, No. 4, 1982.

Quotable Quote

Sociobiology predicts, because paternity is always less certain than maternity, that grandparents will tend to invest more in the survival of their daughters' children than their sons' children. In order to test this principle, Martin S. Smith, a psychologist at Simon Fraser University in British Columbia, surveyed almost 600 grandparents in North America concerning their relationships with their grandchildren. He found that the subjects spent about 40% more time with their daughters' children than with their sons' children. Smith also found that grandparents, especially grandfathers, tend to spend more time with granddaughters — "a better reproductive bet," Smith suggests — than with grandsons. And in contrast to parenting patterns, grandfathers reported spending only slightly less time than grandmothers in grandparenting. When males are young, Smith speculates, they have other more profitable options for maximizing genetic fitness; as these options decrease, males turn to kin investment. "In the fitness game," Smith suggests, "a poor bet is better than no bet at all."

From: Science News, Vol. 122, No. 8, August 21, 1982.