

This Week's Citation Classic

Tanner J M, Whitehouse R M & Takaishi M. Standards from birth to maturity for height, weight, height velocity, and weight velocity: British children, 1965. I & II. *Arch. Dis. Child.* 41:454-71; 613-35. 1966. [Department of Growth and Development, Institute of Child Health, University of London, London. England]

The paper introduces standards for children's rate of growth in addition to the conventional standards for size attained. It emphasises the difference in construction between 'longitudinal' standards suitable for following individuals as they grow, and 'cross-sectional' standards suitable for once-off surveys, and presents both types. [The SC[®] indicates that part one was cited over 310 times and part two over 240 times since 1966.]

J.M. Tanner
Institute of Child Health
Department of Growth
and Development
University of London
London WC1N 1EH
England

August 15, 1979

"I am delighted, of course, that this long and not particularly easy paper should have been cited so often. I suppose this is chiefly because, like so many other 'Citation Classics,' it is a paper introducing a method—or rather two. The standard growth curve is itself a method which clinicians, nutritionists, and others may use to estimate the degree of health of a child, or of progress under treatment. Much more important, however, the paper discusses the methodology of the construction of such standards and it is in this respect that it may lay claim to some originality. I suspect that most of the citations simply refer to the use of the paper's standard curves, just as many of the citations of biochemical papers simply refer to the use of a method in a given research study. However, I hope I am wrong, and that other researchers and clinicians find the methodology of standards interesting. The evidence is somewhat contrary, for so far relatively few papers have appeared in which

the new things in our paper—the velocity standards and the longitudinal-type approach—have been used.

"As usual, the paper represents a long-continued preoccupation with its subject. In 1948 Reg Whitehouse, then academically innocent and fresh from nine years of administrative duties in the Royal Army Medical Corps, joined me and we began the Harpenden Growth Study, a longitudinal study of individual children from early childhood to maturity. While we were waiting for results, we embarked on a theoretical analysis of growth patterns. In 1952 this resulted in a paper on the construction of standards for height and weight which I sent to the editor of the *Archives of Disease in Childhood*, since it was aimed at pediatricians, who were at that time woefully ignorant of anything concerning growth.¹ To my surprise the editor replied that though neither he nor his referees could understand the paper, he thought the subject very important and would publish the paper in full.

"Thus encouraged, and with the help of Michael Healy, now professor of statistics at the London School of Hygiene, and in 1963-65 of Masahiro Takaishi, now in charge of the department of maternal and child health of the Tokyo Institute of Public Health, we carried the analysis further, and used our longitudinal data to devise standards which truly represented the growth of individuals. This the current standards failed to do (now as then) because they averaged out children who matured early and those who matured later. The problem had been pointed out by Boas long ago and again by Shuttleworth in the 1930s but nobody had ever provided a very practical solution.²⁻⁴ I hope the citation record shows that we have succeeded in doing so."

1. **Tanner J M.** The assessment of growth and development in children. *Arch. Dis. Child.* 27:10-33, 1952.
2. **Boas F.** The growth of children. *Science* 19:256-7. 1892.
3. **Boas F.** The growth of children. *Science* 20:351-2. 1892.
4. **Shuttleworth F K.** *Sexual maturation and the physical growth of girls age 6-19.* Chicago, IL: Society for Research in Child Development, 1937. 253 p.