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Calculating Damages for Loss of Parental Nurture Through Multiple Regression Analysis

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I. Introduction

> Mr. [Leon] Rogow was a well educated man of considerable intellectual achievement. He was obviously well equipped to provide his children with training and guidance of educational value to them. Had he lived they would have received the benefit of his training and guidance for many years.[1]

> Mrs. [Regina] Spangler was unstintingly devoted to her family [H]er loyalty was expressed in an incessant activity, tireless energy, and never-flagging concern Mrs. Spangler was obviously one of those wife-mothers who give heart, body, and soul to the family [2]

Few would envy the task of compensating a child for the loss of a parent like Mr. Rogow or Mrs. Spangler.[3] Yet wrongful death statutes in virtually every American jurisdiction provide that a child who sues for the wrongful death of a parent can receive compensatory damages for loss of parental nurture.[4] Generally, wrongful death statutes restrict compensation

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1. Rogow v. United States, 173 F Supp. 547, 562 (S.D.N.Y 1959).

2. Spangler v Helm's N.Y -Pittsburgh Motor Express, 153 A.2d 490, 492-93 (Pa. 1959).

3. *See* Rodriquez v. United States, 823 F.2d 735, 749 (3d Cir. 1987) (noting that child losing parent suffers irreplaceable and intangible loss); Triay v Seals, 109 So. 427, 431 (Fla. 1926) (noting that court cannot say elements of damages for loss of parental nurture have monetary value); Davidson Transfer & Storage Co. v State, 22 A.2d 582, 587 (Md. 1941) (noting that child losing parent suffers loss for which no compensation exists).

4. *See* STUART M. SPEISER ET AL., RECOVERY FOR WRONGFUL DEATH AND INJURY § 3:48, at n.14 (3d ed. 1992) (listing by state major decisions allowing recovery for loss of parental nurture). Several states have codified damages for loss of parental nurture. *See* ALASKA STAT. § 09.55.580 (1962); HAW REV STAT. § 663-3 (1985); KAN. STAT. ANN. § 60-1904 (1983); MD. CODE ANN., CTS. & JUD. PROC. § 3-904 (1989); MASS. GEN. LAWS ANN. ch. 229, § 2 (West 1985). Moreover, federal courts have held that various federal statutes, such as the Federal Employers' Liability Act, provide for loss of parental nurture.

to the plaintiff's actual pecuniary losses.[5] Although most courts recognize parental nurture's pecuniary value,[6] courts have difficulty calculating the

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See Norfolk & W Ry. v. Holbrook, 235 U.S. 625, 629-30 (1915) (concluding that damages in wrongful death action include loss of parental nurture); Michigan Cent. R.R. v. Vreeland, 227 U.S. 59, 71 (1913) (same); Metcalfe v. Atchison, Topeka & Santa Fe Ry., 491 F.2d 892, 898 (10th Cir. 1974) (same); Giles v. Chicago Great W Ry., 72 F Supp. 493, 496 (D. Minn.) (same), *appeal dismissed*, 163 F.2d 631 (8th Cir. 1947); *see also* Solomon v. Warren, 540 F.2d 777, 788, & n.12 (5th Cir. 1976) (holding that Death on High Seas Act, like Federal Employers' Liability Act, allows child to recover damages for lost parental nurture), *cert. dismissed*, 434 U.S. 801 (1977); Edwards v. United States, 552 F Supp. 635, 640 (M.D. Ala. 1982) (holding that losses recoverable under Federal Torts Claims Act include loss to child of parental care, counsel, training, and education); *cf.* Sea-Land Servs., Inc. v. Gaudet, 414 U.S. 573, 585 (1974) (allowing child's recovery of damages for lost parental nurture under nonstatutory maritime law).

5. *See* Green v. Bittner, 424 A.2d 210, 213 (N.J. 1980) (noting that development of case law under wrongful death statutes suggests allowing pecuniary damages for lost parental nurture); *see also* Oakes v. Maine Cent. R.R., 49 A. 418, 419 (Me. 1901) (holding that wrongful death statute allows plaintiff to recover only pecuniary damages); Alfone v Sarno, 403 A.2d 9, 12 (N.J. Super. Ct. App. Div. 1979) (same), *modified*, 432 A.2d 857 (N.J. 1981); Tilley v Hudson River R.R., 29 N.Y. 252, 285 (1864) (same).

6. *See, e.g.*, Michigan Cent. R.R. v. Vreeland, 227 U.S. 59, 74 (1913) (recognizing lost parental nurture as pecuniary damage); Law v. Sea Drilling Corp., 510 F.2d 242, 250-51 (5th Cir. 1975) (noting distinction between loss of parental love and affection and loss of parental nurture, training, and guidance); Moore-McCormack Lines v. Richardson, 295 F.2d 583, 593 n.9a (2d Cir. 1961) (stating that child gains definite practical and financial value from parental guidance that court may subject to pecuniary estimate), *cert. denied*, 368 U.S. 989, *and cert. denied*, 370 U.S. 937 (1962); Briscoe v. United States, 65 F.2d 404, 406 (2d Cir. 1933) (stating that parental nurture has pecuniary value); Omaha Water Co. v. Schamel, 147 F 502, 509 (8th Cir. 1906) (same); Brown v. United States, 615 F Supp. 391, 400 (D. Mass. 1985) (holding that claim for loss of parental nurture cannot include damages for emotional loss), *rev'd on other grounds*, 790 F.2d 199 (1st Cir. 1986), *cert. denied*, 479 U.S. 1058 (1987); First Nat'l Bank v. National Airlines, Inc., 171 F Supp. 528, 537 (S.D.N.Y 1958) (finding that jury may consider decedent's provision of intellectual, moral, and physical training to minor children in calculating pecuniary damages in wrongful death action), *aff'd*, 288 F.2d 621 (2d Cir.), *cert. denied*, 368 U.S. 859 (1961); Umphrey v Deery, 48 N.W.2d 897, 908 (N.D. 1951) (noting that child's loss of parent includes losses law views as pecuniary); Lazelle v. Town of Newfane, 41 A. 511, 512 (Vt. 1898) (stating that child losing "intellectual and moral training and proper nurture" suffers pecuniary losses). *But see* Ortega v Plexco, 793 F Supp. 298, 300 (D.N.M. 1991) (categorizing lost parental guidance with loss of society and companionship). *See generally* Burlington N., Inc. v. Boxberger, 529 F.2d 284, 291 (9th Cir. 1975) (finding that FELA restricts pecuniary damages to plaintiff's reasonable expectation of financial benefit had decedent lived); Union Oil Co. v. Hunt, 111 F.2d 269, 277-78 (9th Cir. 1940) (stating that plaintiff cannot recover pecuniary damages when court uses speculation or conjecture to determine whether plaintiff sustained damages); Heath v. United States, 85 F Supp. 196, 202 (N.D. Ala. 1949) (stating that court must measure pecuniary loss by some standard); Currie v Fiting, 134 N.W.2d 611, 623 (Mich.

value of a parent's care and guidance.[7] Although compensatory awards by definition should "compensate the injured party for the injury sustained, and nothing more,"[8] courts frequently ignore the purpose of compensatory

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1965) (noting that courts should not allow jury award to exceed plaintiff's actual pecuniary loss).

7 *See* Briscoe v. United States, 65 F.2d 404, 406 (2d Cir. 1933) (noting impossibility of calculating damages for lost parental nurture); Faust v. South Carolina State Highway Dep't, 527 F Supp. 1021, 1034 (D.S.C. 1981) (noting that courts cannot calculate parental nurture's value with mathematical certainty), *rev'd,* 721 F.2d 934 (4th Cir. 1983), *cert. denied,* 467 U.S. 1226 (1984); Mascuilli v. United States, 343 F Supp. 439, 442-43 (E.D. Pa. 1972) (noting that no mathematical formula can convert value of parental nurture into dollars), *rev'd on other grounds,* 483 F.2d 81 (3d Cir. 1973); Rogow v. United States, 173 F Supp. 547, 561-62 (S.D.N.Y. 1959) (stating that court knows of no precise mathematical formula that court may employ in determining value of lost parental guidance and training); Green v. Bittner, 424 A.2d 210, 213 (N.J. 1980) (noting that courts allow nurtural damages despite difficulty in assessing parental nurture's dollar value); Tilley v. Hudson River R.R., 29 N.Y 252, 287 (1864) (finding that loss of parental education and training are indefinite elements by which to estimate actual pecuniary damage); Palmer v. New York Cent. & Hudson River R.R., 138 N.Y.S. 10, 11 (App. Div. 1912) (holding that court cannot mathematically calculate damages for lost parental nurture); O'Doherty v Postal Tel.-Cable Co., 118 N.Y.S. 871, 873 (App. Div. 1909) (observing that court mostly speculates in establishing pecuniary value of father's advice and care); Knutsen v. Dilger, 253 N.W 459, 464 (S.D. 1934) (noting that no exact standard exists by which to measure damages for lost parental nurture); Union Transp., Inc. v. Braun, 318 S.W.2d 927, 938 (Tex. Civ. App. 1958) (noting that court cannot measure value of mother's nurture with mathematical or legal certainty); Kramer v. Portland-Seattle Auto Freight, Inc., 261 P.2d 692, 698 (Wash. 1953) (noting that court considers lost parental nurture nebulous pecuniary loss); *cf.* Buechel v United States, 359 F Supp. 486, 489 (E.D. Mo. 1973) (holding that exact mathematical calculations need not restrict jury in determining pecuniary damages for loss of child's education, care, maintenance, and support); Umphrey v. Deery, 48 N.W.2d 897, 909 (N.D. 1951) (quoting 5 SUTHERLAND ON DAMAGES 4892-94 (4th ed. 1916)) (stating that mathematical calculations need not confine jury in determining damages for lost parental nurture).

8. BLACK'S LAW DICTIONARY 390 (6th ed. 1990); *accord* Northwestern Nat'l Casualty Co. v. McNulty, 307 F.2d 432, 434 (5th Cir. 1962) (quoting RESTATEMENT (FIRST) OF TORTS § 903); *cf.* Burlington N., Inc. v. Boxberger, 529 F.2d 284, 291 (9th Cir. 1975) (stating that compensatory damages should restore injured person to status they would have had in absence of injury); Cerretti v. Flint Hills Rural Elec., 837 P.2d 330, 341 (Kan. 1992) (same); Steitz v. Gifford, 19 N.E.2d 661, 665 (N.Y. 1939) (holding that court cannot speculate in measuring compensatory damages, but court need not measure compensatory damages with mathematical certainty; court merely required to measure damages with reasonable certainty); Broadway Photoplay Co. v. World Film Corp., 121 N.E. 756, 758 (N.Y. 1919) (stating that court imposes no requirement that plaintiff prove exact amount of damages, but court requires plaintiff to show some basis for computing damages as well as reasonable certainty that damages will occur); San Antonio & Ark. Pass. Ry. v. Long, 27 S.W 113, 117 (Tex. 1894) (requiring that plaintiff prove damages with reasonable degree of certainty when practicable).

damages by engaging in sheer speculation when calculating damages for loss of parental nurture.[9] As a result, damage awards for lost parental nurture appear speculative and arbitrary [10]

A legal system should strive for certainty in calculating damages[11] to avoid under- or over-compensating a plaintiff.[12] Because current efforts to

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But cf. Bethel v Janis, 597 F Supp. 56, 61 (D.S.D. 1984) (stating that uncertainty in calculating damages does not bar plaintiff's recovery); Brady v. Erlanger, 177 N.Y.S. 301, 303-04 (App. Div 1919) (noting that law will resort to some just and practical means of proving damages when no ordinary standards exist), *aff'd,* 132 N.E. 889 (N.Y 1921); Spangler v Helm's N.Y -Pittsburgh Motor Express, 153 A.2d 490, 492 (Pa. 1959) (noting that tortfeasor will not escape liability merely because courts lack mathematical calculations necessary to precisely assess damages).

9. *See* Rodriquez v United States, 823 F.2d 735, 749 (3d Cir. 1987) (defining lost parental nurture as intangible loss); Shu-Tao Lin v. McDonnell Douglas Corp., 574 F Supp. 1407, 1414 (S.D.N.Y. 1983) (admitting that court speculates when assessing damages for loss of father), *aff'd in part and rev'd in part,* 742 F.2d 45 (2d Cir. 1984); Green v. Bittner, 424 A.2d 210, 213 (N.J. 1980) (noting that courts allow damages for lost parental nurture despite total lack of proof of nurture's dollar value); O'Doherty v Postal Tel.-Cable Co., 118 N.Y.S. 871, 873 (App. Div 1909) (observing that court speculates in estimating pecuniary value of father's nurture).

10. Shu-Tao Lin v McDonnell Douglas Corp., 742 F.2d 45, 52 (2d Cir. 1984).

11. *Cf.* Heller v Boylan, 29 N.Y.S.2d 653, 679 (Sup. Ct.) (noting that court acting arbitrarily in assessing monetary value represents antithesis of justice), *aff'd,* 32 N.Y.S.2d 131 (Sup. Ct. App. Div 1941); FRIEDRICH A. VON HAYEK, THE ROAD TO SERFDOM 78 (1944) (arguing that law's uncertainty and arbitrariness have led populace to disrespect law); Jason S. Johnston, *Uncertainty, Chaos, and the Torts Process: An Economic Analysis of Legal Form,* 76 CORNELL L. REV 341, 341 (1991) (noting that certainty represents one of modern jurisprudence's central concerns); Nancy Levit, *Ethereal Torts,* 61 GEO. WASH. L. REV 136, 136-37 (1992) (noting that law involves search for order and predictability); Roscoe Pound, *Justice According to Law,* 13 COLUM. L. REV 696, 705 (1913) (arguing that society administers justice according to law by fixing standards that individuals may determine prior to controversy and that reasonably guarantee all individuals like treatment); Fred Leeson, *Judge Edwin Peterson Retires From Bench,* OREGONIAN, Dec. 25, 1993, at D1 (noting that former Oregon Supreme Court Chief Justice Edwin Peterson considers certainty important factor in law). *But cf.* JAMES G. COZZENS, BY LOVE POSSESSED 566 (1957) (noting that law cannot hope to reach its aim of certainty because law is inexact science); Allan Hutchinson & Patrick Monahan, *The "Rights" Stuff: Roberto Unger and Beyond,* 62 TEX L. REV 1477, 1508-09 (1984) (presenting Critical Legal Studies deconstructionist view that law is inherently uncertain).

12. *See* DIG. 1.10 (Ulpian, Rules, Book 1) (noting that justice's basic principle renders to each his own); Lon L. Fuller & William R. Perdue, Jr., *The Reliance Interest in Contract Damages: 1,* 46 YALE L.J. 52, 56 (1936) (noting that to Aristotle, justice maintains equilibrium of goods among society's members); Joseph H. King, Jr., *Causation, Valuation, and Chance in Personal Injury Torts Involving Preexisting Conditions and Future Consequences,* 90 YALE L.J. 1353, 1354, 1356 (1981) (stating that under tort system of accident

assess the value of parental nurture produce capricious awards, courts should apply precise mathematical techniques for calculating nurtural damages.[13] Mathematical techniques exist that, if properly applied, can increase certainty in calculating damages for loss of parental nurture.[14]

This Note argues that because current efforts at compensating plaintiffs for loss of parental nurture result in injustice for both plaintiffs and defendants, courts should improve the method of calculating damages by applying statistical techniques to determine damages for lost parental nurture. Part II of this Note analyzes courts' contemporary efforts at calculating damages for loss of parental nurture and concludes that courts have awarded plaintiffs speculative and arbitrary damages for lost parental nurture. Part III examines the injury that courts designed nurtural damages to remedy and suggests the child's loss of future income as the standard by which to measure damages for lost parental nurture. Part IV discusses courts' use and acceptance of multiple regression analysis. Finally, Part V describes a general statistical method for calculating damages for loss of parental nurture as a portion of a child's future income.

II. Current Efforts at Calculating Damages for Loss of Parental Nurture

A review of awards for loss of parental nurture suggests an imbalance in the scales of justice.[15] For example, in *Rodriquez v United States*,[16] the United States District Court for the District of New Jersey awarded two separate families $500,000 each for loss of parental nurture when a plane accident killed the head of each family [17] Although the district court found

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compensation, court makes awards in effort to make whole each particular plaintiff and that court should only charge tortfeasor with interest tortfeasor destroyed); *see also* Hudgins v Serrano, 453 A.2d 218, 225 (N.J. Super. Ct. App. Div 1982) (noting that wrongful death statute has purpose of providing plaintiff with amount plaintiff could have reasonably expected to receive had decedent lived).

13. *Cf. supra* note 11 (discussing importance of certainty in assessing damages).

14. *See infra* notes 167-287 and accompanying text (discussing statistical techniques for estimating lost parental nurture).

15. *Cf.* H.L. Mencken, *Note on Justice,* BALTIMORE EVENING SUN, Nov 19, 1925, *reprinted in* THE GIST OF MENCKEN 443 (Mayo DuBasky ed., 1990) (noting that scales of justice do not balance and that courts cannot make scales balance).

16. 823 F.2d 735 (3d Cir. 1987).

17 Rodriquez v. United States, 823 F.2d 735, 746 (3d Cir. 1987). In *Rodriquez,* the Third Circuit reviewed the United States District Court for the District of New Jersey's award of damages for lost parental nurture under the Federal Tort Claims Act. *Id.* at 737-39. The survivors of two pilots brought the *Rodriquez* litigation after a mid-air collision killed the

that each father was devoted to his family, made repairs around the house, valued education, and had moved to the United States during early adulthood,[18] the district court also found that several of the decedents' characteristics varied dramatically [19] For example, the first decedent was survived by his wife and two children (aged two and three years) and had received vocational training as a machinist.[20] By contrast, the second decedent was survived by six children (aged two to sixteen) and held a bachelor's degree in engineering and master's degrees in computer science and business administration.[21] Despite these dramatic differences in the decedents' vocational training and number of children, the district court awarded identical sums to each decedent's family for loss of parental nurture.[22]

In reviewing awards for loss of parental nurture, courts have constructed various quantitative tests to determine the accuracy of an award, although scientific data does not provide the basis for any of these tests.[23] In *Hudgins v Serrano*,[24] for example, the New Jersey Superior Court determined that an award for loss of parental nurture shocked the judicial conscience if the award exceeded ten percent of the father's salary multiplied by the aggregate remaining years of the children's minority [25] The court

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pilots. *Id.* After finding the United States liable for the crash because of the aircraft controller's negligence, the district court awarded the pilots' children damages for lost parental nurture. *Id.* at 746. In reviewing the damages for lost parental nurture, the Third Circuit first noted that under New Jersey law, the plaintiff does not need to demonstrate specific evidence of parental nurture other than the parent-child relationship. *Id.* at 749. The Third Circuit further stated that New Jersey law regularly allows nurtural damages despite the total lack of proof of parental nurture's dollar value. *Id.* at 750. The court then reviewed the circumstances surrounding each particular family, and although the court found that each family differed in several characteristics, the court concluded that New Jersey courts would uphold each family's award. *Id.* at 750-51. Consequently, the Third Circuit upheld the award for damages on the ground that the evidence supported the award under New Jersey law. *Id.* at 751.

18. *Id.* at 750-51.

19. *Id.*

20. *Id.* at 750.

21. *Id.* at 751.

22. *Id.*

23. *See infra* notes 24-34 and accompanying text (discussing various methods that courts use to calculate damages for lost parental nurture).

24. 453 A.2d 218 (N.J. Super. Ct. App. Div. 1982).

25. Hudgins v Serrano, 453 A.2d 218, 227 (N.J. Super. Ct. App. Div 1982). In *Hudgins,* the Superior Court of New Jersey considered the propriety of a $1,150,000 award

constructed the calculation without reference to any demographic evidence pointing to the accuracy of the formula.[26] Moreover, by limiting the calculation to the children's remaining years of minority, the New Jersey Superior Court's mathematical formula failed to reflect the New Jersey Supreme Court's view that the calculation of damages for loss of parental nurture need not cease after a child reaches majority [27]

Similarly, in *Red Star Towing & Transportation Co. v "Ming Giant,"*[28] the United States District Court for the Southern District of New York overturned a $550,000 jury award to the decedent's two children for loss of parental nurture on the grounds that the award was attributable to jury sympathy and to improper summation by plaintiff's counsel.[29] In making this assessment, the district court divided the total award by the aggregate years of the children's minority and found that the award amounted to $44,000 per

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in a wrongful death action. *Id.* at 220. In finding the award excessive, the court initially observed that the court will only overturn a jury award in a wrongful death action if the award shocks the judicial conscience. *Id.* at 224-25. Further, the court noted that New Jersey strictly limits compensation in wrongful death actions to pecuniary damages. *Id.* at 225. The court recognized damages for lost parental nurture, but rejected the plaintiff's method of calculating nurtural damages. *Id.* at 227 n.5. Instead, the court invented a method of calculating damages for lost parental nurture, but the court did not describe why its method was better than the plaintiff's method. *Id.* To calculate nurtural damages, the court multiplied the aggregate number of the decedent's children's remaining years of minority by 10% of the decedent's annual income. *Id.* at 227 Because the jury award exceeded the court's calculations by 200%, the court overturned the award on the ground that the jury award shocked the judicial conscience. *Id.*

26. *Id.* Perhaps the court recognized that the formula lacked a scientific basis by stating that the court did not construct the formula as a model nurtural damages calculation. *Id.* at 227 n.5.

27 Green v. Bittner, 424 A.2d 210, 213 (N.J. 1980).

28. 552 F Supp. 367 (S.D.N.Y 1982).

29. Red Star Towing & Transp. Co. v "Ming Giant," 552 F Supp. 367, 377-78 (S.D.N.Y. 1982). In "*Ming Giant*," the United States District Court for the Southern District of New York considered whether the evidence supported a damage award under the Death on the High Seas Act. *Id.* at 369. A tug's mate's widow and children brought the "*Ming Giant*" litigation after a collision between a tug boat and a steamship killed the tug's mate. *Id.* at 369-70. In finding that the evidence did not support a $550,000 jury award for lost parental nurture, the court noted that the evidence presented at trial established that the decedent's nurture benefitted the children most during their formative years. *Id.* at 377 The court added that most psychologists agree that parents exert their greatest influence over children during adolescence. *Id.* at 378. The court valued the jury's damages award at $73,000 per year of pre-adolescence and concluded that the evidence did not support an award of $73,000 per year. *Id.* The court then held that $150,000 properly compensated the plaintiffs for the loss of the decedent's nurture, although the court did not describe how it arrived at this amount. *Id.*

year.[30] Further, the court expressed the belief that a child profits most from parental nurture prior to adolescence.[31] Thus, the court recalculated its assessment of the damages by dividing the award by the aggregate years of the children's pre-adolescence.[32] Because the recalculated award amounted to $73,000 per year, the court ruled that the evidence did not support the jury's award.[33] The court did not support any of its assumptions or calculations with scientific evidence. In fact, the district court's assumption that a child profits most from parental nurture prior to adolescence conflicts with that court's observation in an earlier case that parental nurture becomes more effective as children approach majority [34]

Some courts have attempted to establish ranges within which damages for loss of parental nurture must fall.[35] In *De Centeno v Gulf Fleet Crews,*[36] for example, the United States Court of Appeals for the Fifth Circuit set limits on damages in a wrongful death action under the Jones Act.[37] Noting that the Fifth Circuit had approved nurtural damages awards ranging from $360 per year per child to $2,000 per year per child,[38] the court ruled that the record would not support an award greater than $2,000 per year per

30. *Id.* at 378.

31. *Id.*

32. *Id.*

33. *Id.*

34. *See* Rogow v United States, 173 F Supp. 547, 562 (S.D.N.Y 1959) (noting that value of father's parental nurture increases as children mature and approach their careers).

35. *See infra* notes 36-39 and accompanying text (providing example of court setting ranges of recovery for lost parental nurture).

36. 798 F.2d 138 (5th Cir. 1986).

37 46 U.S.C. app. §§ 761-768 (1988).

38. De Centeno v Gulf Fleet Crews, Inc., 798 F.2d 138, 142 (5th Cir. 1986). In *De Centeno,* the Fifth Circuit considered whether the evidence supported a verdict of $776,000 for wrongful death under the Jones Act. *Id.* at 141. A Honduran seaman's survivors brought this litigation after the seaman died of cardiac arrest that resulted from negligent medical attention while aboard ship. *Id.* at 140. After disposing of other aspects of the plaintiff's damages claim, the Fifth Circuit considered the jury's award for lost parental nurture. *Id.* at 141. The court found that the decedent had three surviving children and had worked 12 months a year, leaving little time for parental nurture. *Id.* The Fifth Circuit then noted that in previous loss of nurture cases, courts had approved damages ranging from $360 per year per child to $2,000 per year per child. *Id.* at 142. Because the record showed that the decedent could not spend much time with his children, the Fifth Circuit refused to allow an award larger than $2,000 per year per child. *Id.* Thus, the Fifth Circuit held that the evidence did not support the damage award, in part because the Fifth Circuit's limit on nurtural damages prevented damage awards exceeding $2,000 per year per child. *Id.* at 142-43.

child.[39] Unfortunately, the Fifth Circuit established this range by relying on decisions that did not calculate damages for loss of parental nurture with any degree of mathematical certainty.[40] Moreover, assessing a plaintiff's damages by using past awards as a benchmark is inconsistent with the principle of trying each case on its own merits.[41]

Frustrated by the inability to calculate damages for loss of parental nurture, some courts have constructed tests unrelated to the loss the children sustain.[42] In *Shu-Tao Lin v McDonnell Douglas Corp.*,[43] the United States District Court for the Southern District of New York sustained a $100,000 per child jury verdict for loss of parental nurture on the ground that each child would require approximately that amount of money to pay for psychiatric services to replace the father's nurture.[44] The

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39. *Id.* at 142.

40. *See* Solomon v. Warren, 540 F.2d 777, 788 (5th Cir. 1976) (stating that court could not calculate award for lost parental nurture with mathematical certainty), *cert. dismissed*, 434 U.S. 801 (1977); Neal v. Saga Shipping Co., 407 F.2d 481, 489 (5th Cir.) (stating that court could not compute damages for lost parental nurture by mathematical formulae), *cert. denied*, 395 U.S. 986 (1969).

41. *See* Griscti v State, 314 N.Y.S.2d 932, 933 (App. Div. 1970) (noting that court finds little use for comparisons with other cases because each case depends on its merits), *aff'd*, 285 N.E.2d 318 (N.Y. 1972); Riley v Capital Airlines, 247 N.Y.S.2d 427, 445 (Sup. Ct. 1963) (stating that prior adjudications offer court some guidance but that each case must stand on its merits); *see also* Giles v Chicago Great W Ry., 72 F Supp. 493, 496 (D. Minn.) (noting that verdicts from other cases are poor criteria for appraising verdict in instant case), *appeal dismissed*, 163 F.2d 631 (8th Cir. 1947); Brabeck v. Chicago & N.W Ry., 117 N.W.2d 921, 925 (Minn. 1962) (refusing to rule on verdict by comparison with other awards).

42. *See infra* notes 43-49 and accompanying text (describing court-constructed test to determine whether evidence supports damages for lost parental nurture).

43. 574 F Supp. 1407 (S.D.N.Y 1983).

44. Shu-Tao Lin v McDonnell Douglas Corp., 574 F Supp. 1407, 1414 (S.D.N.Y 1983), *aff'd in part and rev'd in part*, 742 F.2d 45 (2d Cir. 1984). In *Shu-Tao Lin*, the United States District Court for the Southern District of New York considered whether the evidence supported a $7 million verdict for the wrongful death of a neuroradiologist killed in an airline crash. *Id.* at 1413. The court first noted that the award, which provided each family member with more than $1 million each, was excessive in its entirety. *Id.* The court chose to assess each portion of the verdict independently and admitted particular difficulty in calculating damages for lost parental nurture. *Id.* at 1414. Because of the damages' speculative nature, the court argued that regular psychiatric visits compensate the loss of a parent, although the court admitted that a psychiatrist could not genuinely replace a parent. *Id.* The court reasoned further and without proof that the plaintiffs could obtain a psychiatrist for $100 an hour with a reasonable schedule of treatment set twice a week for ten years. *Id.* Given the assumed costs and schedule of treatment, the court reasoned that an award of $100,000 per child adequately compensated the children for the loss of their father's nurture. *Id.* Partially

court acknowledged that some of the children would need to receive more psychiatric help than others,[45] but did not attempt to compensate each child individually [46] In overturning the district court, the United States Court of Appeals for the Second Circuit sympathized with the district court's decision to speculate about the value of parental nurture,[47] but found no support for the district court's analogy between parental nurture and the cost of psychiatric services.[48] Noting the difficulty in calculating damages for lost parental nurture, the Second Circuit added that unfounded assumptions do not add accuracy to the calculation of damages.[49]

Courts have responded to the perceived inability to calculate damages for loss of parental nurture by assuming that the jury will render a "sound"[50] and "intelligent" verdict.[51] Unfortunately, courts have failed to provide juries with clear instructions for calculating nurtural

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because of the court's calculation of parental nurture's value, the court held that the evidence did not support the $7 million award. *Id.*

45. *Id.*

46. *Id.*

47 Shu-Tao Lin v McDonnell Douglas Corp., 742 F.2d 45, 52 (2d Cir. 1984). On appeal in *Shu-Tao Lin*, the Second Circuit considered whether a trial judge may use his own calculations of damages upon remittiur. *Id.* at 49. After a jury trial, the district court held that a number of errors entitled the defendants to a new trial unless the plaintiffs accepted a remittitur reducing the verdict by $2,735,500. *Id.* at 47 The plaintiffs accepted the remittitur and the defendants appealed. *Id.* In holding that the pecuniary damages were excessive, the Second Circuit initially noted that numerous errors during the trial denied the defendants a fair trial. *Id.* at 49. The Second Circuit then examined the trial judge's calculation of damages for conformity with New York state law. *Id.* In examining the trial judge's conclusion that the court could calculate damages for lost parental nurture as the cost of obtaining biweekly therapy with a psychiatrist, the Second Circuit held that it saw no reasonable analogy or basis in fact for the district court's calculation of damages. *Id.* at 52. Moreover, the Second Circuit found that the district court's calculation generated an exceptionally large recovery for the plaintiffs. *Id.* Thus, although the Second Circuit upheld the district court on damages for pain and suffering, the Second Circuit remanded the case to the district court with instructions to retry the issue of pecuniary damages. *Id.* at 54.

48. *Id.* at 52.

49. *Id.*

50. *See* Peters v Great N. Ry., 66 F Supp. 385, 388 (D. Minn. 1946) (stating that jury's common sense and sound judgment must determine damages in wrongful death action).

51. *See* Bradley v. Ohio River & Charleston R.R., 30 S.E. 8, 9 (N.C. 1898) (Douglas, J., concurring) (noting that courts must trust jury to render intelligent and honest verdict for loss of parental nurture); *cf.* Knutsen v. Dilger, 253 N.W 459, 464 (S.D. 1934) (stating that jury does not use exact standard to measure damages for parent's loss of child's future support, but court expects fair and intelligent jury verdict).

damages[52] and have given juries little guidance as to how to compensate a plaintiff's injury [53] As a check on juries, courts will reverse a jury verdict as excessive when the verdict appears to have no support in the evidence.[54] For example, in *Richardson v Lutheran Hospital,*[55] the New York Supreme Court Appellate Division overturned a $470,000 jury verdict for loss of parental nurture on the ground that the verdict overvalued the parental nurture supplied to three children.[56] The court did not provide any guidance as to how to ascertain the actual value of parental nurture to the three children.[57]

Courts have not developed uniform standards by which to calculate damages for loss of parental nurture.[58] Moreover, the standards that courts have developed to calculate nurtural damages have no basis in science[59] and little basis in law [60] By contrast, several early and recent holdings provide

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52. *See* Joseph A. Page, *Damages for Wrongful Death--Broadening View of Pecuniary Loss, in* DAMAGES IN PERSONAL INJURY AND WRONGFUL DEATH CASES 383, 387 (Sol Schreiber ed., 1965) (noting that most courts require plaintiff to prove parental nurture existed, while leaving calculation of damages to jury); *see also* Clark v. Prime, 12 A.2d 635, 636 (N.J. 1940) (instructing jury that plaintiffs deserve "fair and just compensation" for lost parental nurture); Eames v. Town of Brattleboro, 54 Vt. 471, 472-73 (1882) (instructing jury that "you as well as anyone know" parental nurture's value).

53. *Cf.* Wentling v. Medical Anesthesia Servs., 701 P.2d 939, 948 (Kan. 1985) (noting that court presumes trier of fact's own experience will provide basis for converting losses into pecuniary award).

54. *See* Melendez v. Rodde, 422 A.2d 1047, 1048-49 (N.J. Super. Ct. App. Div. 1980) (overturning $50,000 jury award for lost parental nurture because plaintiff failed to present proof that decedent nurtured or financially supported children); *see also* Umphery v Deery, 48 N.W.2d 897, 909 (N.D. 1951) (quoting 5 SUTHERLAND ON DAMAGES 4892-94 (4th ed. 1916)) (noting that court grants jury considerable discretion in assessing damages for lost parental nurture).

55. 417 N.Y.S.2d 526 (App. Div. 1979).

56. Richardson v. Lutheran Hosp., 417 N.Y.S.2d 526, 527 (App. Div. 1979). In *Richardson,* the New York Supreme Court Appellate Division considered whether the evidence supported a $470,000 jury verdict for wrongful death. *Id.* The court determined that the jury could have based the award only on lost parental nurture because the court found no evidence to support the plaintiff's claims for loss of support, decedent's pain and suffering, and loss of consortium. *Id.* The court then held, without presenting its reasoning, that lost parental nurture cannot support a $470,000 verdict and remanded the issue of damages for new trial. *Id.*

57 *Id.*

58. *Cf. supra* note 7 (discussing courts' difficulties in calculating nurtural damages).

59. *See supra* note 7 (discussing courts' difficulties in calculating nurtural damages).

60. *See infra* notes 69-110 and accompanying text (arguing that courts designed nurtural

the legal basis for calculating nurtural damages,[61] as discussed in Part III.

III. Future Income as the Sole Basis for Calculating Damages for Loss of Parental Nurture

Courts' failures to articulate a meaningful standard for valuing parental nurture reflects a lack of knowledge about the importance of parental nurture in influencing a child's chances of future success.[62] Courts appear unsure of the pecuniary injury that nurtural damages are designed to compensate.[63] In response to uncertainty regarding the purpose of nurtural damages, courts typically require that the plaintiff prove that nurture exists, and leave the method of calculating damages to the jury.[64] Several factors indicate, however, that courts created damages for loss of parental nurture to

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damages to compensate child for lost future income).

61. *See infra* notes 69-84 and accompanying text (discussing holdings that provide legal basis for calculating nurtural damages as child's lost future income).

62. *Cf. supra* note 7 and accompanying text (discussing courts' difficulties measuring damages for lost parental nurture); *cf. also* NORMAN G. SHIDLE, CLEAR WRITING FOR EASY READING 9 (1951) (noting that people have little trouble making articulate statements when they know what they want to say).

63. *See infra* notes 69-110 and accompanying text (discussing purpose of nurtural damages). Damages for lost parental nurture seem to ride the line between pecuniary and nonpecuniary damages. *See* DeVito v United Airlines, 98 F Supp. 88, 99 (E.D.N.Y 1951) (allowing recovery although court does not consider nurtural damages pecuniary); Bradley v Ohio River & Charleston R.R., 30 S.E. 8, 9 (N.C. 1898) (Douglas, J., concurring) (noting that court cannot calculate damages for loss of parental training and thus court does not consider nurtural damages pecuniary). Thus, the courts' inabilities to enunciate clearly the purpose of nurtural damages may stem from the general discomfort that courts exhibit in awarding incorporeal damages. *See generally* Levit, *supra* note 11 (arguing that courts tend to ignore intangible damages). On the other hand, courts normally compute damages as the value of replacing that which the plaintiff lost. *See* Bethel v. Janis, 597 F Supp. 56, 62 (D.S.D. 1984) (noting that plaintiffs normally prove damages by showing cost of replacing services). Thus, courts may believe that the value of a replacement parent fully compensates the plaintiff for lost nurture. *See infra* notes 86-90 and accompanying text (discussing courts that measure lost parental nurture as cost of replacement parent).

64. *See* Page, *supra* note 52, at 387 (noting that most courts require plaintiff to prove parental nurture's existence, while leaving damages calculation to jury); *see also* Duke v St. Louis & S.F R.R., 172 F 684, 689 (W.D. Ark. 1909) (noting that courts cannot ascertain parental nurture's value and must leave issue to jury's sound discretion); Allendorf v Elgin, Joliet & E. Ry., 133 N.E.2d 288, 296 (Ill.) (stating that plaintiff need not prove lost parental nurture's financial value), *cert. denied*, 352 U.S. 833 (1956); Wentling v. Medical Anesthesia Servs., 701 P.2d 939, 945 (Kan. 1985) (noting that court assumes trier of fact can convert losses into monetary equivalents); *cf. supra* notes 50-51 and accompanying text (noting that courts assume status quo produces informed and reasoned jury verdicts).

compensate the child for the reduction in future income the child will suffer as a result of losing a parent.[65]

Most jurisdictions allow recovery of damages for loss of parental nurture as part of a wrongful death act or federal statute.[66] Wrongful death statutes generally require that courts measure damages in terms of the plaintiff's economic loss.[67] Courts created nurtural damages in an attempt to determine the range of economic losses compensated by wrongful death acts.[68]

In *Tilley v Hudson River Railroad*,[69] the New York Court of Appeals considered whether a decedent mother's ability to bestow training and education upon her children constituted sufficient grounds for damages under New York's wrongful death act.[70] In ruling that the loss of nurture

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65. *See infra* notes 69-84 and accompanying text (discussing assertion that courts constructed damages for lost parental nurture to compensate child's lost future income).

66. *See supra* note 4 (listing statutes and cases under wrongful death act or federal statute providing for nurtural damages).

67 MICHAEL L. BROOKSHIRE & STAN V SMITH, ECONOMIC/HEDONIC DAMAGES § 12.2(B) (1990); *see also* Michigan Cent. R.R. v. Vreeland, 227 U.S. 59, 69-70 (1913) (concluding that Employers' Liability Act of 1908, 45 U.S.C. §§ 51-60, limits plaintiff's recovery to pecuniary losses); Nygaard v. Peter Pan Seafoods, Inc., 701 F.2d 77, 80 (9th Cir. 1983) (holding that Jones Act, 46 U.S.C. app. § 688, limits plaintiff's recovery to pecuniary losses); Thomas v. S.H. Pawley Lumber Co., 303 F.2d 604, 609 (7th Cir. 1962) (noting that Indiana wrongful death statute limits plaintiff's recovery to pecuniary losses); Edwards v United States, 552 F Supp. 635, 639 (M.D. Ala. 1982) (holding that Federal Tort Claims Act, 28 U.S.C. § 2674, limits plaintiff's recovery to pecuniary losses); Higginbotham v Mobil Oil Corp., 360 F Supp. 1140, 1149 (W.D. La. 1973) (holding that Death on High Seas Act, 46 U.S.C. § 762, limits plaintiff's recovery to pecuniary losses), *aff'd in part and rev'd in part*, 545 F.2d 422 (5th Cir.), *and cert. denied*, 434 U.S. 830 (1977); Meehan v Central R.R., 181 F Supp. 594, 611 (S.D.N.Y. 1960) (noting that New Jersey courts limit recovery under New Jersey wrongful death act to plaintiff's pecuniary loss); Armstrong v. Berk, 96 F Supp. 182, 186 (E.D. Pa. 1951) (noting that Pennsylvania wrongful death act limits plaintiff's recovery to pecuniary losses).

68. *See infra* notes 69-77 and accompanying text (supporting argument that early decisions constructed damages for lost parental nurture to compensate child for lost future income); *cf.* Board of Comm'rs v. Legg, 93 Ind. 523, 530-31 (1883) (holding that courts established nurtural damages on principle that parental training and education increase children's abilities to "make their way in the world"); May v. West Jersey & Seashore R.R., 42 A. 163, 164 (N.J. Sup. Ct. 1899) (concluding that in action for loss of decedent mother's advice and counsel, plaintiff son must demonstrate mother had ability "to advise and counsel in business affairs").

69. 29 N.Y 252 (1864).

70. Tilley v. Hudson River R.R., 29 N.Y 252, 285 (1864). In *Tilley*, the New York Court of Appeals considered whether a jury can hear a plaintiff's evidence asserting damages

constitutes a pecuniary injury to the child, the Court of Appeals noted that parental training and education favorably affect a child's pecuniary interests[71] because moral culture will prepare a man for a more useful and "prosperous career, for worldly success as well as social consideration."[72] The court added that the plaintiff need not show that pecuniary benefits will result from parental training and education, but merely that children may, and often do, derive benefits from parental education.[73]

Two early Maine decisions also support the argument that courts created nurtural damages to compensate children for lost future income.[74] In *McKay v New England Dredging Co.*,[75] the Supreme Judicial Court of Maine concluded that a child receives "actual and commercial value" from parental training and education because nurture helps the child "obtain an income or estate."[76] Two years later, the same court held that a jury assessing damages

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for lost parental nurture. *Id.* In holding that the plaintiff may submit evidence of damages for lost parental nurture to a jury, the Court of Appeals first noted that the law limits damages in a wrongful death action to the plaintiff's pecuniary injuries. *Id.* The court then speculated that a mother's nurture will not only prepare a child for the next world, but will aid a child's "worldly prospects" and "pecuniary interests," and that parental nurture has the purpose of providing for the child's "temporal welfare." *Id.* 285-86. The court added that "even in a pecuniary or mercenary point of view," "health, knowledge, a sound bodily constitution and ample intellectual development" are better than "a feeble constitution, impaired health, intellectual ignorance and degradation and moral turpitude." *Id.* at 286. The court noted that the jury considers whether the aforementioned attributes would benefit the child's pecuniary interests and that the plaintiff need only prove that pecuniary advantages are a probable result of parental nurture. *Id.* at 286-87 The court added that damages for lost parental nurture may include damages for nurture that the mother would have given the child after the child reached majority if the jury finds evidence that the mother's nurture would have assisted the child during majority *Id.* at 287-88. Thus, the court held that because parental nurture reflects favorably upon a child's future income, the trial court properly submitted evidence proving lost parental nurture to the jury as evidence of the plaintiff's pecuniary injury *Id.* at 298.

71. *Id.* at 286.

72. *Id.* at 287

73. *Id.*

74. *See infra* notes 75-77 and accompanying text (discussing Maine decisions indicating that courts designed damages for lost parental nurture to compensate child's lost future income).

75. 43 A. 29 (Me. 1899).

76. McKay v New Eng. Dredging Co., 43 A. 29, 30 (Me. 1899). In *McKay,* the Supreme Judicial Court of Maine considered whether the evidence justified damages of $2,000 accruing to a decedent's parents for a sporadically employed laborer's wrongful death. *Id.* at 29-30. First, the court noted that Maine law requires the plaintiff to demonstrate an actual pecuniary injury. *Id.* at 30. The court listed several examples of nonpecuniary and pecuniary

for lost parental nurture could consider the loss of the mother's training that would have made the decedent's child "a better man, and capable of acquiring more money "[77]

Several recent decisions also support the position that courts created damages for loss of parental nurture to compensate plaintiffs for lost future income.[78] In *Solomon v Warren,*[79] the United States Court of Appeals for the Fifth Circuit refused to uphold a district court's award of damages for a child's post majority loss of parental nurture.[80] Initially, the court observed that the intellectual, moral, and physical training a parent provides a child during the formative years of minority "should result in preparing the child to make a life and living of his own."[81] The court concluded that the plaintiff's failure to present evidence that the children would suffer from the

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injuries, including the loss of parental nurture as a pecuniary injury. *Id.* Next, the court defined a pecuniary injury as the loss of a reasonable probability of pecuniary benefit from the continuing life of another. *Id.* Finally, the court viewed the decedent's sporadic employment as proof that the decedent could not afford to send a large amount of money home to his parents. *Id.* at 31. Thus, the court held that the evidence did not justify the damages award and required the plaintiff to remit $1,250. *Id.*

77 Oakes v Maine Cent. R.R., 49 A. 418, 419 (Me. 1901).

78. *See infra* notes 79-84 and accompanying text (discussing recent decisions supporting position that courts created damages for lost parental nurture to compensate child for lost future income).

79. 540 F.2d 777 (5th Cir. 1976).

80. Solomon v. Warren, 540 F.2d 777, 790 (5th Cir. 1976), *cert. dismissed,* 434 U.S. 801 (1977). In *Solomon,* the Fifth Circuit considered whether the evidence supported a $714,998 damage award for the wrongful deaths of a husband and wife. *Id.* at 781. Harold Solomon, in the dual capacity of administrator of the decedent's estate and guardian of the decedent's 16-, 19-, and 20-year old children, brought the action after authorities declared the aircraft carrying the decedents lost at sea. *Id.* at 780. In considering the district court's $50,000 damage award to each child for loss of parental nurture after majority, the Fifth Circuit initially noted the general acceptance of damages for lost parental nurture. *Id.* at 788. Next, the Fifth Circuit noted that although courts cannot calculate damages for lost parental nurture with mathematical certainty, courts do require the plaintiff to provide some proof of pecuniary loss. *Id.* The court then considered whether nonminor children can sustain damages for lost parental nurture. *Id.* at 789. After a study of other cases failed to shed light on whether adult children may recover damages for lost parental nurture, the Fifth Circuit reasoned that although parental nurture prepares a child to make a living and decreases in value as a child reaches majority, parental nurture does not lose all value to a child at any definite age. *Id.* Despite approving damages for post majority loss of parental nurture, the Fifth Circuit held that the district court erred in awarding damages for post majority lost parental nurture because the plaintiff failed to show specific post majority pecuniary loss. *Id.* at 789-90.

81. *Id.* at 789.

loss of their parents during their majorities precluded recovery for lost parental nurture.[82] Similarly, in *Rogow v United States*,[83] the United States District Court for the Southern District of New York implied that courts measure the value of parental nurture in terms of the child's future monetary success when it noted that a father's parental nurture increases in value as his children mature and approach their careers.[84]

By contrast, some courts have suggested that the trier of fact measure loss of nurture as the cost of purchasing parental nurture in the marketplace.[85] In *Maryland Casualty Co. v Alford,* [86] the United States Court of Appeals for the Tenth Circuit commented in dictum on the propriety of instructing the jury that "the law permits the moral effect upon [a child's] general character to be considered in determining the amount of damages" for the loss of a parent.[87] Although the Tenth Circuit did not open

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82. *Id.* at 789-90.

83. 173 F Supp. 547 (S.D.N.Y 1959).

84. Rogow v United States, 173 F Supp. 547, 562 (S.D.N.Y 1959). In *Rogow*, the Southern District of New York considered whether a child suffers a pecuniary loss in losing a loving and devoted father. *Id.* at 561. In holding that the child suffered a pecuniary loss, the court first quoted Tilley v. Hudson River R.R., 24 N.Y 471 (1862), as stating that a child who loses a parent suffers a pecuniary injury under New York law. *Rogow*, 173 F Supp. at 561. Next, the court, after reflecting on the decedent's accomplishments as a father and a professional writer, noted that the decedent's children would have increasingly benefitted from the decedent's counsel. *Id.* at 562. Finally, the court noted that although the court could not mathematically calculate the value of the decedent's nurture, the decedent's nurture had a high value. *Id.* In light of the nature of the decedent's qualifications, the court upheld damages of $20,000 per child as a reasonable award for lost parental guidance. *Id.*

85. *See infra* notes 86-90 and accompanying text (discussing decisions contrary to notion that courts created damages for lost parental nurture to compensate child for lost future income).

86. 111 F.2d 388 (10th Cir. 1940).

87 Maryland Casualty Co. v. Alford, 111 F.2d 388, 391 (10th Cir.), *cert. denied*, 311 U.S. 668 (1940). In *Alford*, the Tenth Circuit considered whether an instruction allowing a jury to award damages for lost parental nurture in a wrongful death case authorizes the jury to award damages for nonpecuniary losses. *Id. Alford* arose from a collision between the decedents' car and a car negligently driven by an Oklahoma Bureau of Criminal Identification and Investigation agent in the course of duty *Id.* at 389-90. In dismissing the defendant's contention that the instruction authorized awards of nonpecuniary damages, the Tenth Circuit explained that the court could not review the instruction after stipulation. *Id.* at 391. The Tenth Circuit went on to state, however, that the instruction correctly stated the law and that courts should calculate damages for lost parental nurture as the cost of obtaining similar nurture from others. *Id.* Thus, while the court approved the instruction in dictum, it upheld the instruction on the ground that counsel for the defendant failed to object to the instruction during trial. *Id.*

the instruction to review,[88] the court noted the instruction's propriety and stated that a child losing parental nurture suffers a pecuniary injury [89] The court went on to state, in dictum and without citing authority, that the jury should measure loss of nurture by the cost of securing "such nurture and training from others."[90]

Much of the confusion regarding whether courts should measure nurtural damages as the cost of obtaining substitute services arises from the United States Supreme Court's decision in *Michigan Central Railroad v Vreeland.*[91] In *Vreeland,* the Supreme Court established damages for loss of parental nurture under the Employers' Liability Act of 1908.[92] The Court noted that the Act originated from the English common law and Lord Campbell's Act, which established a right of action for persons suffering a pecuniary loss due to the death of another.[93] The Court next defined "a

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88. *Id.*

89. *Id.*

90. *Id., see also* Thomas v Conemaugh Black Lick R.R., 133 F Supp., 533, 543 (W.D. Pa. 1955) (computing damages for lost parental nurture as cost of hiring replacement services), *aff'd,* 234 F.2d 429 (3d Cir. 1956); Brabeck v. Chicago & N.W Ry., 117 N.W.2d 921, 925 (Minn. 1962) (same); *cf.* Bethel v. Janis, 597 F Supp. 56, 62 (D.S.D. 1984) (noting that cost of replacing services provides limited basis for computing parental nurture's value); Alabama Great S. R.R. v. Cornett, 106 So. 242, 248 (Ala. 1925) (declaring that pecuniary damages for lost parental nurture include only cost of purchasable care, training, and education); Hoadley v. International Paper Co., 47 A. 169, 171 (Vt. 1899) (noting that child requires money to obtain nurture from replacement parents).

91. 227 U.S. 59 (1913).

92. Michigan Cent. R.R. v. Vreeland, 227 U.S. 59, 63 (1913). In *Vreeland,* the Supreme Court considered the appropriateness of a damages award for lost parental nurture under the Employers' Liability Act of 1908. *Id.* The action arose as the result of the decedent's accidental death in the course of his job at a railroad company. *Id.* In holding that the Act supported damages for lost parental nurture, the Court first noted that the Act descended from England's Lord Campbell's Act, which provided a decedent's relatives a cause of action for pecuniary injuries arising from the decedent's death. *Id.* at 69-70. Next, the Court distinguished pecuniary injuries from injuries without pecuniary value, such as loss of society and companionship, and noted that the Act allowed compensation for only pecuniary loss. *Id.* at 71-73. The Court added that parental nurture has a pecuniary value and will support damages under the Act because one can obtain nurtural services on the market for compensation. *Id.* Unfortunately for the plaintiff, the Supreme Court found that the trial court's instruction did not properly state the law because the instruction allowed the jury to consider the plaintiff's loss of society and companionship in assessing damages for lost parental nurture. *Id.* at 72-74. Although the Supreme Court noted that the Act allowed pecuniary damages for lost parental nurture, the Court held that the trial court's jury instruction overstated the law. *Id.*

93. *Id.* at 69-70.

pecuniary loss" as including damages "for the loss of that care, counsel, training, and education" that a child might "have reasonably received from the parent, and which can only be supplied by the service of another for compensation."[94]

Although the Court never explained how to measure damages for loss of parental nurture, the Court's confusing language may imply that the cost of replacing the parent's services adequately measures damages for lost parental nurture.[95] For example, the Court pointed out the difficulty in measuring loss of society, then noted in the next sentence that a mother has a duty to nurture minor children "such as when obtained from others must be for financial compensation."[96] The Court seemed to suggest, however, that the market value of the parent's services is merely the standard for establishing a prima facia case for lost parental nurture by stating: "In such a case it has been held that the deprivation is such as to admit a definite valuation, if there be evidence of the fitness of the parent and that the child has been actually deprived of such advantages."[97] Moreover, the Court argued that an instruction allowing jurors to evaluate the value of parental nurture "from their own experiences as men" inadequately measured lost parental nurture because the instruction allowed the jury to consider the widow's loss of society and companionship.[98] As the above language suggests, the Court appeared more concerned with limiting the factors the jury may consider in wrongful death cases than with establishing a methodology for measuring nurtural damages.[99]

Two years later, in *Norfolk & Western Railway v Holbrook*,[100] the Supreme Court again attempted to limit the elements that the jury could consider in assessing damages for lost parental nurture. In *Holbrook*, the Court commented on the validity of an instruction charging the jury to "take into consideration the care, attention, instruction, training, advice and

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94. *Id.* at 71.

95. *See infra* notes 96-98 and accompanying text (examining language from *Vreeland* suggesting that cost of replacing services formerly supplied by decedent parent properly measures lost parental nurture).

96. *Vreeland*, 227 U.S. at 73.

97 *Id.*

98. *Id.* at 74.

99. *See supra* notes 96-98 and accompanying text (discussing scope and purpose of *Vreeland*); *see also* Page, *supra* note 52, at 387 (noting that most courts have broadened strict standards established in *Vreeland*).

100. 235 U.S. 625 (1915).

guidance" the decedent gave his children during their minority and "the pecuniary benefit therefrom to said children."[101] The Court noted the instruction's propriety, but reversed the lower court on other grounds.[102] Although the Court approved the instruction limiting the children's recovery to the parental nurture that the children would have received during minority, most courts ignore this dictum because the Court did not specifically rule on the validity of that portion of the instruction.[103]

Despite the Supreme Court's failure to articulate a clear standard, most courts agree that the market value of a replacement parent inadequately measures the value of parental nurture.[104] First, no scientific evidence exists that a plaintiff can buy parental nurture from professionals.[105] Second, if the courts established nurtural damages to replace parental nurture, one might reasonably argue that a parent's death that improves a child's nurture mitigates the damages. Courts,

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101. Norfolk & W Ry. v Holbrook, 235 U.S. 625, 628 (1915). In *Holbrook*, the Supreme Court considered the validity of a wrongful death instruction charging the jury that the pecuniary injury to a widow and infants exceeded the pecuniary injury to dependent adults who were mere next of kin. *Id.* at 627 The action arose after a passing train killed the decedent while he worked as a bridge carpenter. *Id.* at 626. The decedent's widow brought the action under the Employers' Liability Act of 1908 on behalf of herself and the decedent's five children. *Id.* at 626-27 In holding that the law did not support the instruction, the Court first recognized the validity of the portion of the instruction regarding the elements the jury should take into account when assessing damages for lost parental nurture. *Id.* at 629. The Court took exception to the portion of the instruction that required the jury to compare damages to the widow and children to damages to other adult dependents. *Id.* The Court reasoned that the hypothetical portion of the instruction allowed the jury to engage in conjecture rather than to weigh the facts of the specific case. *Id.* at 630. Because the facts brought out at trial seemed to encourage the jury to sympathize with the plaintiff, the Court held invalid any instruction that allowed the jury to go outside the evidence and thus reversed the judgment of the trial court. *Id.*

102. *Id.* at 629-30.

103. *See* Boller v. Pennsylvania R.R., 185 F Supp. 505, 506-07 (N.D. Ind. 1960) (noting that because Supreme Court did not decide *Holbrook* on issue of nurtural damages for adult child, no evidence exists that Supreme Court would prohibit damages for adult child's lost parental nurture). *See generally* Page, *supra* note 52, at 385-86 (discussing latitude of *Holbrook* holding).

104. *Cf. supra* notes 43-49 and accompanying text (noting that cost of obtaining psychiatric services as replacement for father's nurture inadequately measures parental nurture's value).

105. *Cf.* Shu-Tao Lin v McDonnell Douglas Corp., 742 F.2d 45, 52 (2d Cir. 1984) (noting that plaintiffs presented no evidence that psychiatric services could adequately replace parent's nurture).

however, have rejected this argument.[106] Third, many courts have granted damages for lost parental nurture even after the child reaches majority [107] Post majority damages seem consistent with the view that courts designed nurtural damages to compensate for lost future income because parental nurture after the child reaches majority takes the form of career assistance rather than general education.[108] Finally, courts that measure nurtural damages by the market value of replacement services might have confused loss of services with loss of nurture. Several cases have distinguished loss of parental services from loss of parental nurture.[109] This distinction indicates that replacing services does not necessarily replace nurture.[110]

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106. *See* Dubil v. Labate, 245 A.2d 177, 180 (N.J. 1968) (holding that surviving spouse's remarriage does not mitigate surviving spouse's and dependent children's damages in wrongful death action); *cf.* Reynolds v Willis, 209 A.2d 760, 763-64 (Del. 1965) (following majority rule that remarriage does not mitigate widow's damages in wrongful death action and holding same); Philpott v. Pennsylvania R.R., 34 A. 856, 857 (Pa. 1896) (affirming that remarriage does not mitigate widow's damages in wrongful death action).

107 *See* Page, *supra* note 52, at 385-86 (noting that under majority rule, court may award adult children damages for lost parental nurture); *see also* McKee v Colt Elecs. Co., 849 F.2d 46, 51 (2d Cir. 1988) (stating that New York law allows children of any age to recover damages for lost parental nurture); Solomon v Warren, 540 F.2d 777, 789 (5th Cir. 1976) (concluding that no definite age exists at which parental nurture lacks value to child), *cert. dismissed*, 434 U.S. 801 (1977); Green v Bittner, 424 A.2d 210, 213 (N.J. 1980) (noting that New Jersey cases suggest that courts may continue to calculate damages for lost parental nurture after child reaches majority); Wood v State, 492 N.Y.S.2d 481, 484 (App. Div 1985) (holding that decedent parents' assistance to adult children justified children's $25,000 wrongful death recovery for lost parental nurture); *cf.* Butte Elec. Ry. v. Jones, 164 F 308, 309 (9th Cir. 1908) (upholding instruction not confining jury to period of child's minority in calculating damages in wrongful death action). *But see* Maryland v Thomas, 173 F Supp. 568, 573 (D. Md. 1959) (holding that jury may consider only period of child's minority when assessing damages for lost parental nurture); *cf.* Bumpurs v New York City Hous. Auth., 527 N.Y.S.2d 217, 218-19 (App. Div. 1988) (holding that adult children cannot advance claim for lost parental nurture).

108. *See* McKee v Colt Elecs. Co., 849 F.2d 46, 52 (2d Cir. 1988) (recognizing that adult children in modern society rely on parents and rejecting defense counsel's assertion that adult child's recovery of damages for lost parental nurture countenances influence peddling).

109. *See* Edwards v United States, 552 F Supp. 635, 640 (M.D. Ala. 1982) (distinguishing between loss of parental services and loss of parental nurture); Faust v South Carolina State Highway Dep't, 527 F Supp. 1021, 1048 (D.S.C. 1981) (same), *rev'd*, 721 F.2d 934 (4th Cir. 1983), *cert. denied*, 467 U.S. 1226 (1984); Alfone v. Sarno, 403 A.2d 9, 12 (N.J. Super. Ct. App. Div., 1979) (same), *modified*, 432 A.2d 857 (N.J. 1981).

110. *See* Spangler v Helm's N.Y -Pittsburgh Motor Express, 153 A.2d 490, 492 (Pa. 1959) (stating that mother renders some services that housekeeper cannot supply).

Courts that estimate damages for lost parental nurture as the replacement value of the parent's services probably do so out of frustration over the inability to measure parental nurture's pecuniary value.[111] Generally, courts and attorneys will use expert testimony to assist the jury in reaching a just result.[112] In *Wentling v Medical Anesthesia Services*,[113] however, the expert misinformed the court on the issue of nurtural damages.[114] The *Wentling* defendant admitted liability, and the trial proceeded on the issue of damages only [115] The plaintiff's expert, a professor of economics, calculated the value of the decedent's services to the decedent's husband and children.[116] The expert then informed the court that he could not calculate the value of the decedent's nurture of her children, even though the expert stated that parental nurture contributes to a person's ability to obtain a productive occupation.[117] Apparently, the expert did not know of

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111. *See supra* note 63 (discussing reasons courts have trouble defining nurtural damages).

112. *See* Donald J. Zoeller & Thomas P Lynch, *Expert Testimony Introduction and Overview, in* USING TECHNICAL AND ECONOMIC EXPERTS IN LITIGATION 7, 13 (Donald J. Zoeller ed., 1981) (noting that Federal Rules of Evidence authorize using experts to explain to jury principles outside ordinary realm of knowledge); *see also* FAUST F ROSSI, EXPERT WITNESSES at xiii (1991) (noting that courts' uses of experts has grown dramatically over last several decades).

113. 701 P.2d 939 (Kan. 1985).

114. Wentling v. Medical Anesthesia Servs., 701 P.2d 939, 948 (Kan. 1985). In *Wentling*, the Supreme Court of Kansas considered whether the plaintiff in a wrongful death action had to present the jury with actual dollar estimates of loss to support damages. *Id.* at 942. The defendant admitted liability for the decedent's death and only contested on appeal the jury's nurtural damages award, which the plaintiff's expert claimed he could not calculate. *Id.* at 942, 947 In holding that the evidence supported the jury's award of nurtural damages, the court first noted that the plaintiff need only establish a reasonable basis for an expectation of pecuniary gain. *Id.* at 943. Next, the court distinguished this case, which concerned the plaintiff's loss of parental nurture, from cases involving the plaintiff's loss of a child. *Id.* at 944-45. The court then reviewed the expert's testimony and found that although the expert failed to calculate the dollar value of the decedent's nurture, the expert did contend that parental nurture has pecuniary value. *Id.* at 947 The court noted that based on the expert's contention that parental nurture has pecuniary value, the court presumes the jury capable of establishing the value of the losses based on their own experience. *Id.* at 948. Finally, the court accepted the expert's contention that no one can place an economic value on parental nurture. *Id.* Thus, the court concluded that the state wrongful death statute did not require a plaintiff to prove the economic value of damages suffered due to the death of another. *Id.*

115. *Id.* at 940.

116. *Id.* at 947

117 *Id.*

studies that have estimated parental nurture's value in terms of a child's future income and occupation.[118] If the expert had used the techniques described in these studies, the expert could have calculated the value of parental nurture.[119]

Many decisions establishing nurtural damages point to parental nurture's prominent influence on a child's eventual station in life.[120] Recently, demographers have confirmed that parental nurture contributes to a child's future success.[121] Thus, if courts begin to calculate nurtural damages as the future income the plaintiff loses because of the parent's death, courts will establish a clear standard for measuring nurtural damages.[122] Conversely, if courts perpetuate the status quo, nurtural damages awards will remain arbitrary and courts will fail to distribute justice in wrongful death cases.[123]

IV Courts' Acceptance and Use of Multiple Regression Analysis

After overcoming an initial period of resistance,[124] courts increasingly have turned to statistics to solve a variety of difficult issues.[125] When

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118. *See infra* note 208 (listing studies assessing effect of parental nurture on child's future income and occupation).

119. *See infra* Part V (describing technique for estimating damages for lost parental nurture as portion of child's future income).

120. *See supra* notes 69-77 and accompanying text (discussing evidence that early decisions constructed damages for lost parental nurture to compensate child's lost future income).

121. *See* Nan M. Astone & Sara S. McLanahan, *Family Structure, Parental Practices and High School Completion*, 56 AM. SOC. REV 309, 309 (1991) (noting that numerous studies confirm that children growing up in single parent families are less likely to complete high school or attend college); *see also infra* note 208 and accompanying text (listing studies using statistical techniques to estimate parental nurture's value).

122. *See infra* note 166 and accompanying text (noting that courts' uses of modern statistical techniques in assessing damages for lost parental nurture would increase certainty in wrongful death cases).

123. *See supra* note 10 and accompanying text (noting that awards for lost parental nurture appear speculative and arbitrary).

124. *See* People v Risley, 214 N.Y. 75, 85 (1915) (criticizing as speculative statistician's testimony on probability).

125. *See* Oliver W Holmes, *The Path of the Law*, 10 HARV L. REV 457, 469 (1897) (noting that future of law belongs to master of statistics and economics rather than master of black letter law); *see, e.g.*, Hazelwood Sch. Dist. v United States, 433 U.S. 299, 308-09 n.14 (1977) (using statistics to establish systemic discrimination); Castaneda v Partida, 430 U.S. 482, 496-97 n.17 (1977) (describing statistical technique for measuring discrimination in grand

predicting inflation, the United States Court of Appeals for the Ninth Circuit found that imperfections in the science of computing future inflation do not justify ignoring available statistical refinements.[126] Moreover, some courts even have suggested the use of specific findings based on statistical techniques in an effort to minimize disputes among litigants.[127]

Courts have found multiple regression analysis useful in a variety of contexts.[128] For instance, courts have used multiple regression analysis in determining whether a college practices gender discrimination in paying salaries,[129] in forecasting the exhaustion of a natural resource,[130] in predicting the value of a baseball player's contract,[131] in estimating the amount of effluent petroleum products discharge,[132] in assessing the amount of profits lost to a distributor because of a manufacturer's price fixing conspiracy,[133] and in determining whether an achievement test had a disproportionate effect on African-American students.[134] Moreover, one court has found multiple regression analysis particularly useful in determining lost or future earnings.[135]

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jury selection); Brown v. Board of Educ., 347 U.S. 483, 494-95 n.11 (1954) (using statistical evidence to establish segregation's effects); Cassell v. Texas, 339 U.S. 282, 285 (1950) (using statistical evidence to establish jury discrimination). *See generally* DAVID W BARNES & JOHN M. CONLEY, STATISTICAL EVIDENCE IN LITIGATION § 1.3 (1986) (discussing recent trends in statistical evidence).

126. United States v English, 521 F.2d 63, 71 n.7 (9th Cir. 1975).

127 *See* Doca v. Marina Mercante Nicaraguense, S.A., 634 F.2d 30, 40 (2d Cir. 1980) (authorizing use of 2% discount rate for inflation in computing present value of lost future wages), *cert. denied*, 451 U.S. 971 (1981).

128. *See generally* Cimino v Raymark Indus., 751 F Supp. 649 (E.D. Tex. 1990) (discussing various decisions based on statistical techniques, including regression analysis); BARNES & CONLEY, *supra* note 125 (discussing judicial decisions utilizing regression analysis).

129. Presseisen v. Swarthmore College, 442 F Supp. 593, 608-11 (E.D. Pa. 1977), *aff'd*, 582 F.2d 1275 (3d Cir. 1982).

130. South Dakota Pub. Util. Comm'n v. Federal Energy Regulatory Comm'n, 643 F.2d 504 (8th Cir.), *rev'd*, 668 F.2d 333 (8th Cir. 1981).

131. Selig v. United States, 565 F Supp. 524, 537-39 (E.D. Wis. 1983), *aff'd*, 740 F.2d 572 (7th Cir. 1984).

132. Shell Oil Co. v Costle, 595 F.2d 224, 226 (5th Cir. 1979).

133. Spray-Rite Serv. Corp. v. Monsanto Co., 684 F.2d 1226, 1240-41 (7th Cir. 1982), *aff'd*, 465 U.S. 752 (1984).

134. Anderson v Banks, 520 F Supp. 472, 487 (S.D. Ga. 1981).

135. Cimino v Raymark Indus., 751 F Supp. 649, 662 (E.D. Tex. 1990).

Two prominent objections might arise to using statistical evidence to prove damage for lost parental nurture.[136] The first objection is that statistical evidence establishing a link between a child's future income and parental nurture has a basis in theory rather than in fact.[137] However, scientists base every observation upon a theory that may not prove accurate.[138] Scientists call the laws of physics "laws" only because the laws of physics have the power to explain and predict certain events.[139] Social science theories also have the power to explain and predict certain events.[140] Moreover, social scientists can quantify the percentage of an event that their theory explains.[141] Just as an eyewitness can describe the part of the event she saw, a social science theory can describe the portion of the event that falls within the theory's limitations.

The second objection to proving nurtural damages through multiple regression analysis is that courts need expert assistance to explain statistical evidence,[142] and, thus, multiple regression analysis's acceptance presents the risk that experts will manipulate courts.[143] However, the adversarial system,

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136. *See infra* notes 137, 142, and 143 and accompanying text (discussing possible objections to calculating nurtural damages through multiple regression analysis).

137 *Cf.* Basic Inc. v. Levinson, 485 U.S. 224, 254 (1988) (White, J., dissenting in part) (arguing that while economists' theories supporting fraud-on-market presumption in rule 10b-5 cases are mathematically certain, they are merely theories that may not prove accurate).

138. William J. Carney, *The Limits of the Fraud on the Market Doctrine*, 44 BUS. LAW 1259, 1265 (1989).

139 *Id.*

140. *See* Paul Lees-Haley, *Earnings Regression Analysis: Proving a Child's Lost Earnings*, TRIAL, Feb. 1986, at 37, 37 (noting that earnings regression analysis can predict child's future income).

141. *See infra* notes 252-54, 267, and 268 and accompanying text (demonstrating explanatory power of multiple regression analysis).

142. *See* CHRISTOPHER B. MUELLER & LAIRD C. KIRKPATRICK, EVIDENCE UNDER THE RULES 732 (2d ed. 1993) (calling mathematical evidence realm in which expert is indispensable).

143. *See* Edward J. Imwinkelried, *The Standard for Admitting Scientific Evidence: A Critique from the Perspective of Juror Psychology*, 28 VILL. L. REV 554, 562 n.58 (1982-83) (criticizing courts' admissions of certain types of statistical evidence); Daniel H. Lowenstein & Jonathan Steinberg, *The Quest for Legislative Districting in the Public Interest: Elusive or Illusory?*, 33 UCLA L. REV 1, 141-42 n.272 (1985) (arguing that expert's unsavory regression analysis misled federal court); *see also* Troyen A. Brennan, *Causal Chains and Statistical Links: The Role of Scientific Uncertainty in Hazardous-Substance Litigation*, 73 CORNELL L. REV 469, 500 n.167 (1988) (questioning whether courts possess ability to understand regression analysis); *cf.* Basic Inc. v. Levinson, 485 U.S. 224, 253 (1988) (White, J., dissenting in part) (noting that courts lack staff economists necessary to understand

diligent policing by other statisticians, and careful judicial scrutiny reduce the danger of manipulation.[144]

First, cross-examination inherent in the adversarial system reduces the danger that experts might manipulate courts.[145] Even in the difficult area of statistics, expert witnesses have failed to withstand skilled cross-examination.[146] Lawyers who willingly take on medical and engineering experts need not fear statisticians.[147] As Part V will demonstrate, lawyers can understand the mathematical calculations used in regression statistics, and the most important sources of error in statistical calculation involve two concepts litigators thoroughly comprehend: causation and cross-examination.[148] Moreover, liberal federal rules governing discovery give the litigator access to ample information regarding expert witness testimony and the basis of the expert's opinion.[149] The practitioner can use the information obtained during discovery to effectively cross-examine the statistician.[150]

Statisticians also will protect courts from unethical expert witnesses.[151] The Federal Rules of Evidence allow either side to hire expert witnesses.[152]

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mathematical microeconomic theories).

144. *See infra* notes 145-60 and accompanying text (discussing methods of protecting courts from manipulation).

145. *See* Pointer v Texas, 380 U.S. 400, 404 (1965) (noting cross-examination's value in discovering truth); LOUIS NIZER, MY LIFE IN COURT 366 (1961) (noting variety of ways in which cross-examination elicits truth); 2 JOHN H. WIGMORE, A TREATISE ON THE SYSTEM OF EVIDENCE IN TRIALS AT COMMON LAW 1697 (1904) (calling cross-examination "greatest legal engine ever invented" for discovering truth).

146. *See* McNeil v. City of Springfield, 658 F Supp. 1015, 1029 (C.D. Ill.) (questioning expert's credibility because expert's opinions did not withstand cross-examination), *appeal dismissed*, 818 F.2d 565 (7th Cir. 1987); City of Port Arthur v United States, 517 F Supp. 987, 1007 n.136 (D.D.C. 1981) (noting that expert testimony failed to withstand scrutiny of cross-examination), *aff'd*, 459 U.S. 159 (1982).

147 *Cf.* BARNES & CONLEY, *supra* note 125, § 1.0, at 2 (noting that statistics are nothing more than descriptive method).

148. *See infra* notes 213, 214, and 250 and accompanying text (discussing similarities between litigation techniques and survey analysis).

149. *See* FED. R. CIV P 26(b)(4)(A) (governing discovery of expert witnesses); *see also* STEPHEN C. YEAZELL ET AL., CIVIL PROCEDURE 573 (3d ed. 1992) (noting that modern rules of discovery give lawyer access to enormous amounts of information).

150. *See* BROOKSHIRE & SMITH, *supra* note 67, § 10.6(A) (noting importance of discovery in preparing lawyer to cross-examine statistician).

151. *See infra* notes 152-54 and accompanying text (discussing methods of statistical policing).

152. *See* FED. R. EVID. 702 (governing expert testimony). Experts usually can calculate damages in tort cases at a modest expense. ROSSI, *supra* note 112, at 339.

The trier of fact then can assess the experts' credibility based upon the weight of the evidence.[153] Moreover, scholars maintain a watchful eye and will use legal and statistical publications to expose fellow statisticians' questionable methodologies.[154]

Careful judicial scrutiny of expert testimony will also reduce the likelihood of an expert manipulating the court.[155] Courts can reduce the danger of manipulation by requiring evidence of an expert's qualifications,[156] by requiring the expert to explain regression analysis,[157] and by reviewing an expert's testimony in other judicial proceedings.[158] Courts also can require an expert to write out testimony before trial, so that both sides thoroughly understand the issue that the expert will convey to the jury [159] Finally, if a court feels uncomfortable with the parties' expert witnesses, the Federal Rules of Evidence allow the court to appoint its own expert.[160] Courts admit statistical evidence in various other contexts.[161] The objections

153. *See* Dow Chem. Co. v. Blum, 469 F Supp. 892, 907 (E.D. Mich. 1979) (accepting expert's criticism of Environmental Protection Agency study but ruling for EPA based on broad discretion Congress gave EPA).

154. *See* Lowenstein & Steinberg, *supra* note 143, at 141-42 n.272 (providing example of statistical policing by explaining how expert misled federal court with multivariate regression models in McCord v. City of Fort Lauderdale, 617 F Supp. 1093 (S.D. Fla. 1985), *aff'd*, 787 F.2d 1528 (11th Cir.), *and reh'g granted and vacated*, 804 F.2d 611 (11th Cir. 1986)).

155. *See* McNeil v. City of Springfield, 658 F Supp. 1015, 1029 (C.D. Ill.) (criticizing expert's regression analysis), *appeal dismissed*, 818 F.2d 565 (7th Cir. 1987); Key v. Gillette Co., 104 F.R.D. 139, 140 (D. Mass. 1985) (finding serious flaws in expert testimony on regression analysis), *aff'd*, 782 F.2d 5 (1st Cir. 1986); City of Port Arthur v United States, 517 F Supp. 987, 1007 n.136 (D.D.C. 1981) (critically evaluating expert witnesses' testimony), *aff'd*, 459 U.S. 159 (1982).

156. *See* FED. R. EVID. 702 (governing expert testimony).

157 *See Key*, 104 F.R.D. at 140 (stating that expert should describe regression analysis to court); *see also* FED. R. EVID. 705 (allowing court to require that expert give basis for expert opinion).

158. BARNES & CONLEY, *supra* note 125, § 9.7 4, at 539 (noting that experts testify in substantial number of cases and generate substantial amount of written material); *see also* FED. R. EVID. 801(d)(1)(A) (admitting prior inconsistent statements made under oath as substantive evidence).

159. George C. Pratt, *A Judicial Perspective on Opinion Evidence Under the Federal Rules;* 39 WASH. & LEE L. REV 313, 322-23 (1982) (discussing advantages and disadvantages of requiring expert to write out testimony in advance of trial).

160. FED. R. EVID. 706 (governing court-appointed experts).

161. *See supra* notes 125-35 and accompanying text (noting that courts find statistical evidence useful in variety of contexts).

to using multiple regression analysis to estimate damages for lost parental nurture do not apply to nurtural damages alone.[162] The general trend among courts is to accept statistical evidence.[163] Unfortunately, this trend has not extended to nurtural damages, despite the develoment of statistical techniques for calculating nurtural damages discussed in Part V

V Calculating Damages for Loss of Parental Nurture Through Multiple Regression Analysis

Although a number of courts have expressed the view that courts cannot mathematically calculate damages for lost parental nurture,[164] a proposition does not become true through repetition.[165] Statisticians have developed mathematical calculations that can estimate parental nurture's value in terms of a child's future income, and thus increase equitable awards in wrongful death cases.[166] Evaluating these techniques' abilities and limitations, however, requires at least a cursory familiarity with regression analysis and correlation. Subpart A discusses the regression equation and multiple regression analysis. Subpart B discusses the techniques used to gather data used in multiple regression analysis. Subpart C provides a simplified comparison between a nurtural damage award calculated by a court and a nurtural damage award calculated by multiple regression analysis. These subparts cannot hope to fully educate the reader about regression analysis or survey methodology The author merely hopes that these subparts will: 1) help the reader understand that the answer multiple regression analysis provides is subject to certain assumptions; and 2) provide a source of

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162. *Cf. supra* notes 125-35 and accompanying text (noting that courts find statistical evidence useful in variety of contexts).

163. *See supra* note 125 and accompanying text (noting general trend among courts to accept statistical evidence).

164. *See supra* note 7 and accompanying text (noting courts' repeated statements that courts cannot mathematically calculate nurtural damages).

165. *Cf.* Wallace v. Jaffree, 472 U.S. 38, 99 (1985) (Rehnquist, J., dissenting) (noting that historical fallacies do not become true through repetition).

166. *Cf.* United States v. English, 521 F.2d 63, 74 n.13 (9th Cir. 1975) (noting that absence of expert witnesses' testimony forecasting future inflation rates will reduce precision of jury's calculation of future inflation); Cimino v. Raymark Indus., 751 F Supp. 649, 662 (E.D. Tex. 1990) (noting multiple regression analysis's usefulness in determining lost earnings); Lees-Haley, *supra* note 140, at 37 (noting that earnings regression analysis provides best available prediction of child's future income); John Leubsdorf, *Remedies for Uncertainty*, 61 B.U. L. REV 132, 150-53 (1981) (arguing that expectation values remedy uncertainty in predicting outcomes).

information that the reader may use when confronting a problem involving multiple regression analysis. Readers who wish to avoid a lengthy discussion of the mathematics of regression analysis and of the methodology of data collection should ignore subparts A and B.

A. An Overview of the Regression Equation

Regression analysis determines the nature of the relationship between two variables, so that a researcher may estimate the value of one variable if the researcher knows the value of the other variable.[167] For example, if a relationship exists between the variables "dollars of income" and "years of education," a researcher may estimate an individual's income by knowing that individual's years of education.[168] Regression analysis will not demonstrate whether education causes income or vice versa; it will only explain a relationship between the variables.[169] The researcher simply assumes that more education causes a higher income based on the temporal order of the variables.[170]

To better conceptualize the problem, assume that a data base contains a range of dependent variables corresponding with each fixed value of the independent variable.[171] In the education example, each year of education (independent variable) has a range of incomes (dependent variable) earned by individuals with the corresponding years of education.[172] Thus, people with ten years of education might make between $10,000 and $20,000 a year, people with twelve years of education might make between $15,000 and $50,000 a year, and so on.[173] Each range of values for each year of education has a mean[174] that a researcher can plot on a graph as the mean

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167 HUBERT M. BLALOCK, JR., SOCIAL STATISTICS 381 (rev 2d ed. 1979).

168. *Cf. id.* at 381-82 (discussing explanatory power of regression equation involving variables of education and income).

169. *Id.* at 383; WAYNE C. CURTIS, STATISTICAL CONCEPTS FOR ATTORNEYS 154 (1983).

170. PETER M. BLAU & OTIS D. DUNCAN, THE AMERICAN OCCUPATIONAL STRUCTURE 166 (1967).

171. BLALOCK, *supra* note 167, at 384. Graph One provides a graphic representation of the regression equation. *See infra* p. 299.

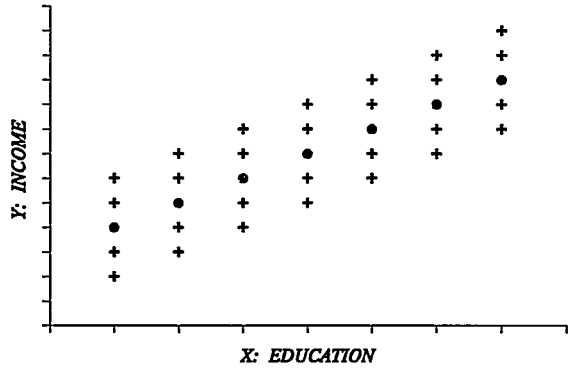
172. *Cf.* BLALOCK, *supra* note 167, at 384 (explaining regression's use of range of data).

173. *Cf. id.* (explaining regression's use of range of data). Unlike the more precise physical sciences, social science data generally has considerable variability in the range of values for each independent variable. *Id.* at 385.

174. *Id.* at 384. The mean is the numerical average of a data set. RICHARD A. WEHMHOEFER, STATISTICS IN LITIGATION § 2.16, at 21 (1985). To calculate the mean (X_μ),

income for each year of education.[175] The resulting path through these means on the graph is the regression equation of education on income (see Graph One).[176]

Graph One: Model Regression Equation



On Graph One, each plus represents the amount of income an individual receives plotted against that individual's level of education, X_1 being equal to one year of education, X_2 equal to two years, and so on. The circles represent the mean level of income for each level of education. The regression line will pass directly through the circles. Note the data's even distribution about each mean and that the variance about each circle equals the variance about every other circle. Unfortunately, social scientists rarely gather enough data to give them a range of dependent variable values (Y) for each independent variable value (X).[177] Often, the collected data set provides only one value of Y for each value of X.[178] When only one value of Y exists for each value of X, the researchers must find an equation that approximates the curve that best represents the available data.[179] If a researcher plots the data on a graph, a straight line that minimizes the sum of the squares of the vertical distances between each data

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add all of the values in the data set and divide the result by the number of observations (N). *Id.* Statisticians mathematically express the mean as:

$$X_{\mu} = \frac{X_1 + X_2 + X_3 + \ldots + X_n}{N}$$

Id.

175. *Cf.* BLALOCK, *supra* note 167, at 384 (explaining regression's use of mean value of range of data).

176. *Cf. id.* (defining regression equation as path through means of ranges of data).

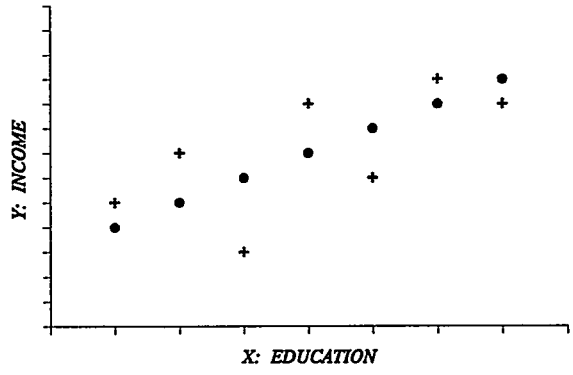
177 *Id.* at 389.

178. *Id.*

179. *Id.* at 390.

point and the line represents the regression equation (see Graph Two).[180] The researcher can use the equation to give an expected value to one variable by locating the point on the graph where the other variable's value intersects with the line.[181]

Graph Two: Actual Regression Equation



The least squares equation minimizes the sum of the squares of the vertical distances of

180. *Id.* In a sense, regression presumes that the researcher can determine the mean independent variable (*X*) for each dependent variable (*Y*) from the small amount of data the researcher collects, although most researchers would prefer to determine the mean of *X* from a range of values for each *Y*, as discussed previously *See supra* notes 171-76 and accompanying text (discussing regression analysis's use of ranges of values). Mathematically, statisticians express the regression equation as:

$$Y = a + bX + e_i.$$

BLALOCK, *supra* note 167, at 387 Where:

$$e_i = 0.$$

Id. at 391.

$$a = Y\mu - (bX\mu).$$

See id. at 390.

$$b = \frac{N\Sigma XY - (\Sigma X)(\Sigma Y)}{N\Sigma X^2 - (\Sigma X)^2}$$

Id. at 393. Graph Two above provides a graphic representation of the regression equation. The above discussion refers only to linear least squares equations where a straight line best represents the path through the data. *See* BLALOCK, *supra* note 167, at 389-90. When a curve best fits the data, the researcher uses another equation. *See infra* notes 191-93 and accompanying text (discussing non-linear regression).

181. *See* BLALOCK, *supra* note 167, at 393-96. Researchers use regression analysis to give expected values by plugging the known value into the regression equation and computing the answer. Thus, if a researcher wishes to find the expected value of the dependent variable (Y_p) for a single case and the researcher knows the value of the independent variable (*X*) for a single case, the researcher plugs the value of *X* into the equation ($Y_p = a + bX + e_i$) (recall that the researcher has previously computed *a* and *b* and that e_i drops from the equation because the researcher assumes $e_i = 0$). *See supra* note 180 (computing values of *a*, *bX*, and e_i).

the data points from the regression line. The circles represent the regression line, and the pluses represent the actual data the researcher gathered. When drawing the regression line, the researcher assumes that if the researcher had collected data for the entire population, the graph would look like Graph One.

Because the regression equation can only estimate results, the regression equation will not issue expected values with perfect accuracy [182] The correlation coefficient tests the strength of the relationship between the variables, so that researchers can determine the regression equation's predictive ability [183] Recall that in most cases the regression equation merely minimizes the vertical distance between each data point and the line rather than passing through each data point.[184] The correlation coefficient (r) measures the accuracy with which the line resembles the actual data by measuring the amount of spread around the line on a scale of 1.0 to -1.0.[185] Statisticians mathematically express the correlation coefficient as the covariance (or joint variation from the line) in X and Y divided by the square root of the product of the variation in X and of the variation in Y.[186] When the data points fall directly on a line that slopes up from left to right, the correlation coefficient equals 1.0 (see Graph Three).[187] When the data points fall directly on a line that slopes down from left to right, the correlation coefficient equals -1.0 (see Graph Four).[188] When the data points are scattered randomly about the regression equation, the correlation coefficient equals 0.0 (see Graph Five).[189] A correlation coefficient of zero means that no

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182. *See* BLALOCK, *supra* note 167, at 396.

183. *Id.*

184. *Id.* at 391.

185. *Id.* at 396-97

186. *Id.* at 398. Statisticians mathematically express the correlation coefficient as:

$$r = \frac{N\Sigma XY - (\Sigma X)(\Sigma Y)}{\sqrt{([N\Sigma X^2 - (\Sigma X)^2][N\Sigma Y^2 - (\Sigma Y)^2])}}$$

Id. at 400. Because r measures variation from the regression line, a few extreme values for variables have a strong influence on r *Id.* at 401. For example, if a researcher uses American city size as a variable, the inclusion of New York City in the data base may influence r because New York so greatly exceeds in size every other American city that the researcher cannot counter New York's variation from the regression line. *Id.* at 403.

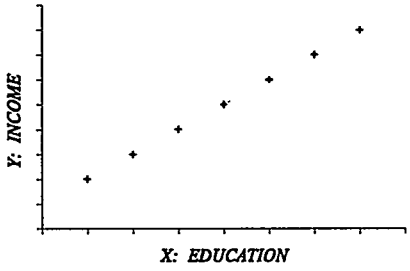
187 *Id.* at 397 Graph Three provides a graphic representation of a correlation coefficient equal to 1.0. *See infra* p. 302.

188. BLALOCK, *supra* note 167, at 397 Graph Four provides a graphic representation of a correlation coefficient equal to -1.0. *See infra* p. 302.

189. BLALOCK, *supra* 167, at 397 Graph Five provides a graphic representation of a correlation coefficient equal to 0.0. *See infra* p. 302.

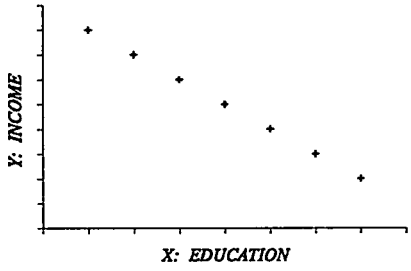
demonstrable linear relationship exists between the variables, so that no straight line fits the data.[190]

Graph Three: Correlation = 1.0



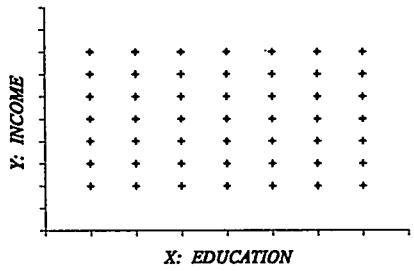
When a correlation reaches 1.0, all of the data points sit directly on the regression line and slope up from left to right.

Graph Four: Correlation = -1.0



When a correlation reaches -1.0, all of the data points sit directly on the regression line and slope down from left to right.

Graph Five: Correlation = 0.0



When a correlation is zero, the data points are scattered equally around the graph.

190. BLALOCK, *supra* note 167, at 397-98. Note that a curved line may fit the data perfectly *See infra* notes 191-93 and accompanying text (discussing non-linear regression analysis).

If no straight line fits the data perfectly, a curve may provide a better fit.[191] Because non-linear relationships can take numerous forms, however, no single equation can describe non-linear relationships.[192] Eta tests the strength of a non-linear relationship and approximates the correlation coefficient (r) used to analyze the strength of linear relationships.[193]

With a slight change in semantics and calculations, regression analysis and correlation expand to estimate the effects of more than one independent variable on a dependent variable.[194] With the knowledge of the value of several independent variables, multiple regression analysis allows a researcher to estimate the value of a single dependent variable.[195] The regression equation expands to become the path of the means of the dependent variable for all possible combinations of the independent variables.[196] In the three-variable case, one can obtain a graphic picture of multiple regression by imagining the corner of a room.[197] The line where the walls meet represents the Y axis, while the lines where each wall meets the floor represent the X_1 and X_2 axis.[198] Planes extending perpendicular from each axis represent the regression equations, and a researcher can provide an estimated value of the dependent variable if the researcher knows the value of the independent variables by using the line at which the planes intersect.[199] The regression equation is virtually impossible to conceive of graphically when the number of independent variables exceeds two because representing each additional independent variable on a graph requires an additional dimension in space.[200]

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191. BLALOCK, *supra* note 167, at 398.

192. *Id.* at 426. Because an infinite number of non-linear regression equations exist, a discussion of non-linear relationships exceeds the scope of this Note.

193. CHRISTOPHER JENCKS, WHO GETS AHEAD? 28 (1978).

194. BLALOCK, *supra* note 167, at 452.

195. *Id.*

196. *See id.* The multiple regression equation merely adds independent variables to the original regression equation, so that:

$$Y = a + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + \ldots + b_nX_n + e.$$

Id. at 452. The b's ("partial coefficients") represent the slope of the regression line of Y on each X while holding the other values stable. *Id.* at 453. Thus, a researcher can obtain b_1 by holding $X_2, X_3, X_4, \ldots, X_n$, constant. Id.

197 Dr. James McCann, Department of Sociology, University of Washington, uses this example in his statistical methods course.

198. *Id.*

199. *Id.*

200. BLALOCK, *supra* note 167, at 453.

The multiple regression model also measures the degree of the relationship between the dependent variable and the independent variable through partial correlations.[201] As previously noted, the regression equation is not a perfect fit, but a best fit between variables because the data does not necessarily fall directly on the regression equation.[202] Deviations from the regression line represent error and the presence of other, unmeasured factors.[203] By adding variables to the model, the researcher seeks to minimize the number of unmeasured factors and thus bring the data closer to the regression line. Unfortunately, not even the most conscientious researcher can measure all the factors that cause changes in the dependent variable.[204] Thus, some data will deviate from the regression line. Deviations from the regression line, which statisticians call residuals, represent the amount of the dependent variable left unexplained by each independent variable.[205] By correlating the residuals, a researcher can obtain a partial correlation between two variables. A partial correlation summarizes the isolated relationship between two variables by holding constant the other variables in the equation.[206] Thus, a partial correlation between Y and X_1 indicates what percentage of the change in Y is due to the presence of X_1.[207]

Researchers have demonstrated that multiple regression analysis can estimate a child's future income based on the characteristics of the parents.[208]

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201. *Id.* at 455.

202. *Id.* at 390.

203. *Id.* at 456-57

204. JENCKS, *supra* note 193, at 31.

205. BLALOCK, *supra* note 167, at 457

206. *Id.* Statisticians compute partial correlations after calculating r for each combination of variables. *See supra* notes 185-90 and accompanying text (discussing calculation of r). The researcher can then apply the following formula to calculate the partial correlation between dependent variable Y and independent variable X, while controlling for independent variable Z ($r_{xy.z}$):

$$r_{xy \cdot z} = \frac{r_{xy} - (r_{xz})(r_{yz})}{\sqrt{[1 - r_{xz}^2]}\ \sqrt{[1 - r_{yz}^2]}}$$

BLALOCK, *supra* note 167, at 459. If additional variables exist, the researcher uses the same formula, but adds successive control variables starting with the partial correlation involving one less variable than desired. *Id.* at 461.

207 *Id.* at 457-58.

208. *See, e.g.*, BLAU & DUNCAN, *supra* note 170, at 163-205 (discussing process of stratification); JENCKS, *supra* note 193, at 50-84 (discussing effects of family background); WILLIAM H. SEWELL & ROBERT M. HAUSER, EDUCATION, OCCUPATION, AND EARNINGS 43-

A 1978 study conducted by demographer Christopher Jencks illustrates the data base, methodology, and outcomes of studies that provide expected values for children's future income.[209] Lawyers will recognize several familiar concepts in reviewing Jencks's methodology [210]

B. The Jencks Study as an Example of Data Collection Methods and Applied Regression Analysis

Jencks used five national surveys and six special-purpose samples to assess the effects of family background and other factors on a man's success.[211] The eleven surveys collected data on a variety of issues and often

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88 (1975) (discussing effects of socioeconomic background on ability and achievement); Karl L. Alexander & Bruce K. Eckland, *Sex Differences in the Educational Attainment Process*, 39 AM. SOC. REV 668-82 (1974); Ivan D. Chase, *A Comparison of Men's and Women's Intergenerational Mobility in the United States*, 40 AM. SOC. REV 483-505 (1975); David L. Featherman & Gillian Stevens, *A Revised Socioeconomic Index of Occupational Status: Application in Analysis of Sex Differences in Attainment, in* SOCIAL STRUCTURE AND BEHAVIOR 141-81 (Robert M. Hauser et al. eds., 1982); Robert M. Hauser et al., *A Model of Stratification with Response Error in Social and Psychological Variables*, 56 SOC. EDUC. 20-46 (1983); Robert M. Hauser et al., *High School Effects on Achievement, in* SCHOOLING AND ACHIEVEMENT IN AMERICAN SOCIETY 309-41 (William H. Sewell et al. eds., 1976); Christopher Jencks et al., *The Wisconsin Model of Status Attainment: A National Replication with Improved Measures of Ability and Aspiration*, 56 SOC. EDUC. 3-19 (1983); William H. Sewell et al., *Sex, Schooling, and Occupational Status*, 86 AM. J. SOC. 551-83 (1980); William H. Sewell & Vimal P Shah, *Social Class, Parental Encouragement, and Educational Aspirations*, 73 AM. J. SOC. 559-72 (1968). Courts can use these studies as the basis for calculating a child's future income based on variables such as the father's occupation, the mother's occupation, the father's first job, the father's education, the mother's education, parental encouragement to do well in school, and a host of other variables.

209. Although Jencks restricted his analysis to male children, researchers have performed similar analyses of female children. *See, e.g.*, Alexander & Eckland, *supra* note 208, at 668-82; Chase, *supra* note 208, at 483-505; Sewell et al., *supra* note 208, at 551-83.

210. *See infra* notes 213-15, 231-34, and 250 (discussing similarities between litigation techniques and survey analysis).

211. JENCKS, *supra* note 193, at 4. Jencks utilized the following surveys: the 1962 Occupational Changes in a Generation sample collected by the U.S. Current Population Survey; the 1965 Productive Americans sample collected by the University of Michigan Survey Research Center; the 1970 Census of Population's 1/1,000 Public Use sample; the 1971-72 wave of the Panel Study of Income Dynamics collected by the University of Michigan Survey Research Center; and the 1973 U.S. Current Population Survey replication of the 1962 Occupational Changes in a Generation sample. *Id.* at 4-5. Jencks also used six special-purpose samples that covered more restricted populations but provided data not available in the surveys. *Id.* at 5. Jencks used the following special purpose samples: the 1973-74 NORC Brothers sample, conducted at Jencks's request; the 1966-67 wave of the Census Bureau's

used different methods.[212] Lawyers will find data collection similar to cross-examining hundreds of witnesses.[213] As with cross-examination in the courtroom, the answer a questioner obtains depends on the form of the question--or whether a question is asked at all.[214]

National Longitudinal Survey of Older Men; the 1964 U.S. Current Population Survey's Veterans sample, restricted to veterans under the age of 35; Project Talent's 1960-72 representative subsample, a subsample from the full Talent sample covering students that researchers interviewed while juniors in high school in 1960 and surveyed again 12 years later; Project Talent's 1970-72 brothers sample, a subsample that included pairs of brothers who were seniors and juniors in high school in 1960 and returned a mail-back questionnaire in 1971-72; and Michael Olneck's 1928-74 Kalamazoo Brothers sample, covering men who were in the sixth grade in Kalamazoo, Michigan between 1928 and 1950 with brothers in these same schools and were contacted by Olneck again in 1973-74. *Id.* The surveys either interviewed respondents once, asking them to recall aspects of their family background and education while reporting their current income and occupation, or the surveys interviewed respondents twice: once when the respondents were young and again many years later in life when the respondents had started or completed their careers. *Id.* at 4-5. In the 1962 Occupational Changes in a Generation sample, researchers collected the information on the subject's income and background through an interview with either the subject or the most knowledgeable adult at home when the interviewer reached the household, often the subject's wife. *Id.* at 18. The other surveys attempted to directly interview the subject. *Id.* at 18-19.

212. *See infra* notes 218-27 and accompanying text (discussing methods of data collection in Jencks's surveys).

213. *But see* FED. R. EVID. 802 (prohibiting courts' admission of hearsay evidence). Several important distinctions exist between cross-examination and survey methodology First, because researchers generally ask a standard set of questions that do not require detailed explanations, the cross-examination of a respondent superficially imitates a lawyer's cross-examination of a witness. *Cf.* MUELLER & KIRKPATRICK, *supra* note 142, at 116-17 (noting that absence of cross-examination partially justifies rule excluding hearsay). Second, researchers rarely consider the respondents' demeanor in answering questions, while lawyers scrutinize a witness's demeanor in the courtroom. *Cf. id.* at 117 (noting that absence of demeanor evidence partially justifies rule excluding hearsay). Third, researchers generally will not put respondents under oath, while courts require an oath or affirmation to impress upon the witness's mind the solemnity of the duty to tell the truth. *Cf. id.* (noting the lack of oath or affirmation partially justifies rule excluding hearsay). Thus, surveys are subject to all four hearsay risks: (1) that the respondents will misunderstand the questions or subjects of their answers; (2) that the respondents' memories will lapse; (3) that the respondents will give ambiguous answers; and (4) that the respondents will lie. *Cf. id.* at 118-19 (discussing four risks of hearsay evidence); *cf. also infra* notes 231-35 and accompanying text (discussing types of errors inherent in data collection).

214. *See* BARNES & CONLEY, *supra* note 125, § 2.2.2. (noting that study's methodology heavily influences study's results); *cf.* JENCKS, *supra* note 193, at 251-70 (reporting that researchers obtained different results with different surveys). For example, the two surveys analyzed by Jencks in which researchers told the interviewer to guess the respondent's race produced different results than the other surveys in which interviewers asked the respondent

Like litigators trying to elicit the best answer from a witness, researchers attempt to phrase questions in a manner that will provide the most accurate information about the variable that the researcher seeks to measure.[215] Unfortunately, financial and other concerns often limit researchers to asking respondents only one question about an issue. Moreover, no general consensus exists among researchers as to how to measure variables.[216] Thus, many of Jencks's surveys used different questions to measure the same variable.[217] For example, the surveys used several different methods of measuring a respondent's age.[218]

The surveys also asked a variety of questions to determine whether both parents raised the respondent,[219] to assess the respondent's family background,[220] to determine whether the respondent grew up on a farm,[221] and to

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what race the respondent considered himself. *Id.* at 19.

215. *See* EARL R. BABBIE, THE PRACTICE OF SOCIAL RESEARCH 393 (1986) (noting difficulty of constructing measures of variables); TRAVIS HIRSCHI & HANAN C. SELVIN, DELINQUENCY RESEARCH 205 (1967) (noting importance of defining measures of variables precisely); *see also* FRANCIS L. WELLMAN, THE ART OF CROSS-EXAMINATION 40 (1903) (noting importance of carefully constructing questions in cross-examination).

216. JENCKS, *supra* note 193, at 25.

217 *Id.*

218. *Id.* at 22. Most surveys asked the respondents how old they were, with two surveys specifying "on your last birthday." *Id.* One survey asked for date of birth and another merely asked the respondents "in what year were you born?" *Id.*

219. *Id.* at 19. To determine whether both parents raised the respondent, several of the surveys asked the respondent "With whom were you living when you were 15?" *Id.* Other surveys asked "Were you living with both parents most of the time up to age 16?" *Id.* Some surveys did not ask for any information regarding the presence of the respondent's parents. *Id.* Several of the surveys asked the respondents who indicated that their fathers were absent to report on the individual who "headed" their household. *Id.*

220. *Id.* To determine each respondent's family background, all of the surveys but one asked the respondents, "What is the highest grade of school or college your father completed?" *Id.* Some surveys recorded the exact number of school years completed while other surveys grouped responses into categories such as "some high school," "high school graduate," and so on. *Id.* at 19-20. Most surveys asked each respondent what his father did when the respondent was 15 or 16 years old. *Id.* at 20. Two surveys asked respondents where their fathers grew up, while other surveys asked respondents where their fathers were born. *Id.* at 21. Three surveys did not collect information on where the father was born. *Id.* Some of the surveys also collected data about the number of siblings in each respondent's household while the respondent grew up. *Id.* One survey asked the respondents to include step siblings and foster siblings, while another survey requested that the respondents not include step and foster siblings. *Id.* Three surveys did not ask about siblings. *Id.*

221. *Id.* at 21. Only some of the surveys asked questions that allowed Jencks to determine if the respondent grew up on a farm. *Id.* Other surveys contained information that

determine the respondent's region of origin.[222] The surveys used various methods to measure the respondent's intelligence,[223] education,[224] experience,[225] occupation,[226] and income.[227] The surveys often used different methods of recording the data.[228] Jencks attempted to construct variables that measure certain traits by employing a variety of methods to define the variables.[229]

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allowed the researchers to infer whether a respondent did or did not grow up on a farm. *Id.* One survey did not provide any information on whether the respondent grew up on a farm. *Id.*

222. *Id.* at 21-22. Three surveys asked where the respondent was born and other surveys asked where the respondent grew up. *Id.* at 22.

223. *Id.* at 22. To measure intelligence, four surveys tested the respondents utilizing either a large battery of tests or a single intelligence quotient (IQ) test, such as the Terman IQ test, the Otis Group IQ test, or the Armed Forces Qualification Test. *Id.*

224. *Id.* Several surveys attempted to determine the respondent's educational attainment by asking each respondent for the highest grade he had attended and whether he had completed that grade. *Id.* Two surveys asked each respondent about the highest grade he had attended through high school and whether he had attended or completed college or graduate school. *Id.* One survey asked about years of schooling and how many degrees the respondent had obtained. *Id.*

225. *Id.* at 22-23.

226. *Id.* at 23. In collecting data about the respondents' occupations, several surveys asked, "For whom do you work?," "What kind of business or industry is this?," and "What kind of work are you doing? (Please describe duties as specifically as possible)." *Id.*

227 *Id.* at 23-24. Most surveys asked the respondents to report their earnings for the calendar year prior to the survey. *Id.* at 24. One survey asked some of the respondents how much they expected to earn during that year, and asked respondents surveyed later how much they actually earned that year. *Id.* One survey asked for hourly, weekly, or monthly earnings at the time of the survey. *Id.* Some surveys grouped the responses into large categories. *Id.*, *see also infra* note 228 (noting effect of grouping responses into large categories).

228. *Cf.* JENCKS, *supra* note 193, at 23 (discussing various methods of categorizing occupational data). In recording the data on education, some surveys grouped responses into categories such as "some high school" and "high school graduate," and other surveys recorded the respondents' education in years or grades. *Id.* When researchers record the data in categories, the effect of collapsing several data points into a single category reduces the standard deviations and thus reduces the variance and increases the correlations artificially The correlations increase artificially because variation decreases when researchers record data in categories (e.g., a researcher recording education in single years makes grades one, two, three, four, five, and six separate data points, but a researcher recording grades one through six as "grade school" will group six different grades together as a single data point) and thus the data more likely fits the regression line.

229. *See id.* at 23 (defining occupation by category). For example, to measure the value of occupation, Jencks converted each respondent's occupation into a numerical "Duncan score" on the Duncan Socio-Economic Index. *Id.* The Duncan Socio-Economic Index rates

Sampling error may occur in surveys when expense prevents a random sample.[230] Jencks points out three broad categories of measurement error that occur even in random surveys.[231] The first type of measurement error arises if a researcher assumes that a given measurement adequately measures a variable.[232] The second type of error occurs when respondents report

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occupations from 0 to 96, with an occupations' score dependent on the percentage of men working in the occupation who have completed high school and who have an income of $3,500 or more a year in 1950 dollars. *Id.* at 8. Several researchers have demonstrated that Duncan's Socio-Economic Index best captures both inter- and intra-generational occupational stability. *See* David Featherman & Robert Hauser, *Prestige or Socioeconomic Scales in the Study of Occupational Achievement*, 41 SOC. METHODS & RES. 403 (1976); David Featherman et al., *Assumptions of Social Mobility Research in the U.S.. The Case of Occupational Status*, 4 SOC. SCI. RES. 329 (1975).

To measure the effect of region of upbringing, Jencks divided the nation into South and non-South, defining "the South" as all states south of the Mason-Dixon line and the Ohio River, plus Arkansas, Louisiana, Oklahoma, and Texas. JENCKS, *supra* note 193, at 22. Defining the South as all states south of the Mason-Dixon line and the Ohio River including Arkansas, Louisiana, Oklahoma, and Texas comports with the Census Bureau's definition of the South. BUREAU OF THE CENSUS, U.S. DEP'T OF COMMERCE, STATISTICAL ABSTRACT OF THE UNITED STATES Fig. 1 inside front cover (1991). If Jencks attempted to measure attributes unique to the South, the Census Bureau's definition may include states that do not possess genuinely "Southern" qualities. *See* ANN BARRETT BATSON, HAVING IT Y'ALL 15-16 (1993) (criticizing Census Bureau definition and defining "Genuine Southland" as including only Arkansas, Louisiana, Mississippi, Alabama, Georgia, Tennessee, Kentucky, South Carolina, North Carolina, and Virginia).

Jencks also used the data compiled from the surveys to construct a measure of "experience," defined as "the number of years the respondent has been out of school since the age of fourteen." JENCKS, *supra* note 193, at 22. In calculating "experience" from the data, Jencks assumed that each respondent entered first grade at age six and advanced one grade each year. *Id.* at 22-23. Jencks acknowledged that calculating experience as "the number of years the respondent has been out of school since the age of 14" resulted in a fair amount of error. *Id.* at 23.

Jencks defined earnings as "income from wages, salaries, and self-employment," and family income as "the sum of the respondent's earnings, his income from assets and transfer payments, and the income from all sources of all other family members." *Id.* at 23-24. Several surveys provided information sufficient for Jencks to calculate the variable of family income. *Id.* at 24-25.

230. *See* JENCKS, *supra* note 193, at 37-39 (discussing sampling error). *But see* BLALOCK, *supra* note 167, at 553 (noting that other respectable methods of gathering data exist besides random sampling).

231. JENCKS, *supra* note 193, at 34-37 Lawyers can easily identify the three types of measurement error in surveys because the problems that researchers experience with respondents in the field mirror the problems lawyers experience with witnesses in the courtroom. *See* notes 232-34 (discussing analogy between researchers and attorneys).

232. JENCKS, *supra* note 193, at 34. For example, in a case reviewed by the Third

misconceptions rather than realities.[233] The third type of measurement error occurs when a respondent gives disparate answers to the same question on different days, scores differently on two tests designed to measure the same attribute, or provides inconsistent answers in two different surveys.[234] Measurement errors may cause the survey researcher to under- or over-estimate the inaccurately measured independent variable's effect on the dependent variable.[235]

Researchers can estimate the reliability of the data by comparing the responses given in different surveys for items purporting to measure the same trait.[236] Because the phrasing of the questions and the method of gathering data can heavily influence a survey's outcome, practitioners and courts ought to become familiar with research methodology [237] Despite the conflict over how to measure the variables, Jencks's study does seem to include variables for many accepted elements of proof for lost parental

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Circuit, a witness in the district court stated that the payroll listed him as a "rigger." Edward G. Budd Mfg. v NLRB, 138 F.2d 86, 90 n.6 (3d Cir. 1943), *cert. denied*, 321 U.S. 778 (1944). When asked to define a "rigger," the witness replied: "I don't know; I am not a rigger." *Id.* As the example indicates, the court may correct conceptual errors in the courtroom through cross-examination. In survey research, however, researchers rarely ask a respondent to elaborate on an answer. *See supra* note 226 (describing survey questions designed to measure occupation).

233. JENCKS, *supra* note 193, at 35. For example, in a drunk driving hearing, a witness reported pulling the defendant out of the left-hand car window after the accident, indicating that the defendant was driving. Barry Winston, *Stranger Than True*, HARPER'S, Dec. 1986, at 70-71. Later in the hearing, however, the witness realized that the defendant was not driving because the car was upside down, and what the witness thought was the car's left-hand window was the right-hand window when the car was turned upright. *Id.* at 71. Thus, the court discovered the error only because the witness realized that he had incorrectly perceived the situation.

234. JENCKS, *supra* note 193, at 35. For example, an assault victim wrote out a sworn statement naming the defendant as her assailant under penalty of perjury State v. Smith, 651 P.2d 207, 208 (Wash. 1982). At trial, however, the victim testified that another person attacked her and that the defendant had rescued her. *Id.* at 208-09. In trials and surveys, the questioner can discover inconsistencies by interviewing the declarant twice.

235. JENCKS, *supra* note 193, at 34.

236. *Id.* at 35. A researcher can roughly estimate the reliability of the measures by correlating two independent estimates of the same trait. *Id.* Measurement errors lower the percentage of total variance in the dependent variable that the independent variable explains (R^2). *Id.* at 36. A researcher can correct R^2 for measurement errors by dividing R^2 by the estimated reliability *Id.*

237 *See* BARNES & CONLEY, *supra* note 125, § 2.2.2 (noting that study methodology heavily influences study results); *see also* JENCKS, *supra* note 193, at 251-70 (reporting that researchers obtained different results with different surveys).

nurture.[238]

After assembling the data, Jencks applied regression analysis to test the relationships between the variables.[239] Jencks used the logarithmic

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238. *Cf.* 4 AM. JUR. PROOF OF FACTS ANNOTATED, Death, Actions for, 134-35 (1st ed. 1960) (providing elements of proof for lost parental nurture). Jencks's surveys seem to include many elements of proof for damages for lost parental nurture:

> Where there is a right to recover damages for loss of parental care, attention, advice, instruction, and guidance in an action for wrongful death, the following are important items of evidence which, alone or in combination, tend to prove the nature and extent of such loss:
>
> - Relationship of parent and child between claimant and deceased
> - Ability of deceased to furnish the training and education for which damages are sought, as shown by
> - occupation of deceased
> - age of deceased
> - training or education of deceased
> - community or school affiliations of deceased
> - special skills or qualifications of deceased
> - religious affiliation of deceased
> - Disposition of deceased to furnish the training and education for which damages are sought, as shown by
> - salary and contributions to family
> - church attendance with family and interest in religious questions
> - participation, encouragement, and interest in school activities and problems
> - encouragement and participation in athletic activities
> - participation and interest in outdoor life activities
> - appreciation and encouraged participation in cultural activities
> - interest and participation in extracurricular activities and hobbies
> - patience and interest in emotional and adolescent problems
> - imparting of special skills or training to children.

Id., *see also* SPEISER, *supra* note 4, § 4:17 (listing elements of proof for lost parental nurture).

239. One method of testing the relationship between two variables uses the unstandardized coefficients to measure the variance that the independent variable causes in the dependent variable. JENCKS, *supra* note 193, at 25-26. The unstandardized regression equation takes the form:

$$Y_i = B_0 + B_1X_i + E_i$$

where Y_i is the dependent variable, X_i is the independent variable, B_0 is the expected value of Y_i for individuals for whom the value of X_i is zero, B_1 is the average increase in Y_i associated with the increase of one unit of X_i, and E_i is the error term. *Id.* For example, if Y_i is earnings and X_i is education, B_0 is the expected value of earnings (Y_i) for individuals with no education (X_i is zero), B_1 is the average increase in earnings (Y_i) associated with the increase of one year of education (one unit of X_i), and E_i is all the things that the researcher has not measured. *Id.* The researcher assumes E_i equals zero. *Id.*

Generally, a researcher should standardize variables for comparison with other

coefficient to estimate the percentage increase in the dependent variable caused by an increase in one unit of the independent variable.[240] For the most part, Jenck's bivariate coefficients measure the linear association between variables.[241] Jencks tested each relationship for non-

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variables. *Id.* A researcher standardizes variables by subtracting a variable's mean from each observation and then dividing by the standard deviation. *Id.* Jencks's standardized equation took the form:

$$y_i = r_{yx}x_i + e_i$$

where r_{yx} is the correlation between Y and X and $e_i = E_i/s_y$ (where E_i is the error term and s_y is the standard deviation of Y). *Id.* The researcher computes the standard deviation (s) by subtracting the mean from each score, squaring each difference, summing the results, dividing by the number of observations, and taking the square root. BLALOCK, *supra* note 167, at 79. Thus:

$$S=\sqrt{[\Sigma(X_i-X\mu)^2/N]}$$

Id., *see also* WEHMHOEFER, *supra* note 174, § 2.25.

To compare the standardized coefficient with the unstandardized coefficient, note that:

$$B_1 = (s_y/s_x)\, r_{yx}$$

where s_y is the standard deviation of Y, s_x is the standard deviation of X and r_{yx} is the correlation between Y and X. JENCKS, *supra* note 193, at 25-26. When r_{yx} is squared, it presents the ratio of explained to total variance because:

$$r_{yx}^2=\frac{B_1^2 s_x^2}{s_y^2}$$

Id. at 26-27 Thus, r_{yx} states that two individuals who differ by one standard deviation on Y will differ by r_{yx} standard deviations on X. *Id.* Meanwhile, r_{yx}^2 tells the researcher the percentage of variance in Y explained by X. *Id.* at 27

240. JENCKS, *supra* note 193, at 27 The logarithmic coefficient logs to the base e, where $e = 2.71828$. *Id.* Mathematically, statisticians express the logarithmic coefficient as:

$$lnY_i = B_0 + B_1X_i + E_i$$

Id.

241. *Id.* at 28. Researchers sometimes observe non-linear relationships between variables. *Id.* When a non-linear relationship between variables exists, the value of B_1 in the equation will vary as the value of the independent variable (X_i) varies. *Id.* Recall that B_1 is the average increase in the dependent variable (Y_i) associated with the increase of one unit of X_i. *Id.* at 25-26; *see also* BLALOCK, *supra* note 167, at 427-28 (giving example of non-linear relationship).

Dr. Avery M. Guest, Center for Demography and Ecology, University of Washington, uses the following example of a non-linear relationship in his statistical methods course: A researcher might find that the relationship between income and years of education becomes non-linear because university professors depress the earning curve as education reaches the highest levels. Income tends to rise with each additional year of college, but lawyers with seven years of higher education generally earn more than professors with nine to thirteen years of higher education. *Compare* BUREAU OF LABOR STATISTICS, U.S. DEP'T OF LABOR, BULLETIN NO. 2350, OCCUPATIONAL OUTLOOK HANDBOOK 97-99 (1990-91 ed. 1990) (noting

linearity[242] and, when necessary, used the simplest non-linear equation that satisfied the relationship.[243] When Jencks wished to test the relationship between more than two variables, or the relationship between two variables while holding constant one or more other variables, Jencks used multiple regression analysis.[244] Jencks held constant other variables that influenced the relationship between the independent and dependent variable.[245]

As noted above, even the most conscientious researcher cannot discover or measure all variables that might have an effect on the relationship between the independent and the dependent variable.[246] To reduce the impact of unmeasured variables, Jencks compared pairs of brothers with difference equations, which substitute the differences between brothers for the measured values in the regression equation.[247] By analyzing difference equations, Jencks could measure indirectly many previously unmeasurable family influences,[248] as well as half of the influence of geno-

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that law school requires seven years of full time study after high school with average starting salary for new associates of $34,000 per year and average salary for experienced attorneys of $110,000 per year) *with id.* at 128-29 (noting that doctoral programs take 9 to 13 years of full time study after high school with average salary for assistant professors of $31,160 per year and average salary for full professors of $50,420 per year).

242. JENCKS, *supra* note 193, at 28. To test for non-linearity, Jencks divided each continuous worker characteristic into 6 to 10 categories and calculated eta^2, which is the percentage of the total variance in the dependent variable (for Jencks, education, occupational status, and earnings) attributable to variation in the means of the categories. *Id.*

243. *Id.*

244. *Id.* at 31.

245. *Id.* To control for third variables, the researcher rewrites the regression equation to include the third variable (Z) so that the equation measures the relationship between the independent and dependent variables where Z is held constant:

$$Y = B_0 + B_1Z + B_2Z^2 + B_xX + e.$$

Id. For example, the above equation allows the researcher to test the effect of being raised by both parents (X) on income (Y) in men with the same level of education (Z). *Id.*

246. *Id.* Leaving variables out of the regression equation usually biases the effect of the independent variable upward, so that the measured effect of the independent variable exceeds the actual effect. *Id.*

247 *Id.* at 32. Difference equations regress the differences between brothers rather than the measured values. *Id.* For example, if y represents the first brother's earnings, y' represents the second brother's earnings, x represents the first brother's education, x' represents the second brother's education, $Y = y - y'$, and $X = x - x'$, then:

$$Y = B_xX + E_y.$$

Id. A researcher can determine how much of the association between education and earnings is due to shared family background by comparing B_x to B_x in a bivariate equation. *Id.*

248. *Id.* Although parents do not treat their sons exactly alike, parents probably treat

type.[249] Jencks also used multiple regression analysis to determine which intervening variables might influence the association between an independent and a dependent variable.[250]

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their sons similarly *Id.*

249. *Id.* Brothers share approximately half of the genes that vary among individuals. *Id.*

250. *Id.* at 32-33. In the courtroom, lawyers confront intervening variables in terms of causation. *See* J.D. LEE & BARRY A. LINDAHL, MODERN TORT LAW § 4.07 (rev. ed. 1988) (discussing intervening and superseding causes). For example, causation was an important issue when citizens living near the Nevada Test Site brought suit against the United States for injuries resulting from exposure to radioactive fallout. Allen v United States, 588 F Supp. 247, 257-58 (D. Utah 1984), *rev'd*, 816 F.2d 1417 (10th Cir. 1987), *and cert. denied*, 48 U.S. 1004 (1988). Because so many potential causes of cancer exist, the court required the plaintiffs to establish that nuclear fallout from the Nevada Test Site substantially contributed to their injuries. *Id.* at 428. Plaintiffs exposed to other cancer-causing agents, such as coffee or cigarettes, did not recover damages. *Id.* at 435.

By comparison, a study might find a strong positive relationship between birth to a wealthy family and a child's income as an adult. However, parents should not assume that a noble birth has magical qualities because many intervening variables, such as the child's education, upbringing, inheritance, and first job might explain the child's income better than the financial circumstances of the child's birth. *Cf.* JENCKS, *supra* note 193, at 32-33 (describing intervening variables). To test the relationship between financial status at birth and income as an adult, a researcher can control for the other variables by inserting them into the multiple regression equation and determining if the relationship between independent and dependent variables exists while holding the other variables constant. *Cf. id.* at 33 (describing testing for intervening variables). The researcher would construct the equation:

$$Y = B_0 + B_1Z_1 + B_2Z_1^2 + \ldots + B_nZ_n^2 + B_xX + E_y$$

where Y represents income as an adult, X represents the child's status at birth, and Z_1 through Z_n represents all the intervening variables (education, inheritance, and so on). *Id.* The equation will now measure the effects of status at birth among men who have the same education, inheritance, and so on (Z_1 through Z_n). *Id.* If B_x is the same in the above equation as in an equation without Z_1 through Z_n, the researcher can conclude that Z_1 through Z_n do not influence the relationship between income as an adult and status at birth. *Id.* If B_x is zero, however, the researcher might conclude that a noble birth does not possess magical qualities, other than that the parents pass wealth to the child through access to a superior education, connections resulting in a good first job, a large inheritance, and so on. *Id.*

Similarly, in *Allen*, 588 F Supp. at 247, the court can determine the causes of the plaintiffs' cancers by applying the above regression equation where Y represents the incidence of cancer, X represents exposure to radioactive fallout, Z_1 represents tobacco use, Z_2 represents coffee consumption, Z_3 represents background radiation, Z_4 represents workplace radiation, and so on through Z_n. If B_x remains the same in the multiple regression equation as in an equation without Z_1 through Z_n, the court can conclude that nuclear fallout probably caused the plaintiffs' cancers. *Id.* If B_x is zero the court can conclude that factors other than nuclear fallout probably caused the plaintiffs' cancers. *Id.* If adding Z_1 through Z_n to the equation significantly reduces B_x, the court can conclude that nuclear fallout partially caused the plaintiffs' cancers. *See generally* MORRIS ROSENBERG, THE LOGIC OF SURVEY ANALYSIS

After applying multiple regression analysis to the various data sets, Jencks concluded that the men's family background as a whole[251] explained 48% of the variance in occupational status[252] and 15-35% of the variance in income.[253] From these figures, Jencks implied that economically successful men owe almost half of their occupational advantage and 55-85% of their income advantage to family background.[254] Finally, Jencks found evidence that a child's future success was influenced not only by the child's family background at an arbitrary point in time, but rather by the family's average background characteristics during the time the child grew up.[255]

Although Jencks took pains to minimize errors in the analysis, conclusions drawn from regression analysis are always subject to the assumptions that no measurement error exists[256] and that the analysis includes all the causes of the dependent variable.[257] Those assumptions resemble

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54-66 (1968) (providing basic explanation of intervening variables).

251. JENCKS, *supra* note 193, at 81. Family background as a whole includes measures of family background and studies on brothers to determine the unmeasured effects of family background. *Id.* at 50-51.

252. *Id.* at 81. Jencks found that the correlation between family background and occupational status equals 0.409, and that the reliability of self-reports for occupation equals 0.86. *Id.* at 58. Thus, if Jencks assumed that he eliminated random error from the equations and that brothers do not influence each other, family background explains $0.409/0.86 = 48\%$ of the variance in occupational status. *Id.* The assumption that brothers do not influence each other increases the correlation between family background and the dependent variable because the surveys did not necessarily measure brothers' influences on one another adequately, and therefore Jencks may have included brothers' influence in the overall assessment of "family background." *Id.* at 70. Based on the limited data available, however, Jencks did not find any evidence to support the hypothesis that brothers influence each other. *Id.*

253. *Id.* at 81. The correlation between family background and income is 0.300. *Id.* at 58. Self-reports of income have reliabilities of between 0.86 and 0.93. *Id.* at 58. Assuming the truth of the least-reliable scenario, that random error does not exist, and that brothers do not influence each other, family background explains $0.300/0.86 = 35\%$ of the variance in income. *Id.* at 58.

254. *Id.* at 81.

255. *Id.* at 63. Jencks found that father's occupation when the child was older or younger than 15 predicted the child's life chances as well as father's occupation when the child was 15. *Id.* at 62-63.

256. BLALOCK, *supra* note 167, at 387; *see supra* notes 218-27 and accompanying text (noting data collection techniques and possible sources of error); *see also infra* note 257 (discussing measurement error in dependent variable as included in error term).

257 BLALOCK, *supra* note 167, at 387 In the regression equation:

$$Y_i = a + bX_i + e_i$$

where e_i is the error term, which equals the measurement error in Y (but not X) and any causes

assumptions inherent in the legal system.[258] A researcher also assumes normality[259] and homoscedasticity[260] in establishing confidence limits[261] and testing the significance[262] of the findings.[263]

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of Y the researcher fails to include in the equation. *Id.* Regression assumes that the causes of Y omitted from the equation have minor impacts on Y and do not correlate with X. *Id.* The researcher may justify the assumption that the error term is uncorrelated with the independent variable(s) if the causes of Y omitted from the equation are numerous, unrelated, and have minor impacts on Y. *Id.* Assuming the truth of these assumptions, the researcher may also reasonably assume that the expected value of the error term equals zero and that e_i has a normal distribution. *Id.* The social scientist usually has little evidence that e_i has a normal distribution. *Id.* The researcher can partially confirm the assumption that the error term equals zero by identifying variables with an impact on Y and adding them to the equation until additional variables have little effect on the equation. *Id.* at 388.

258. *See supra* notes 231-37 and 250 (noting similarities between survey methodology and courtroom practices).

259. BLALOCK, *supra* note 167, at 387 The normality assumption presumes a normal distribution of values for the dependent variable (X) about each value of the independent variable (Y). *Id.* at 388. A population with a normal distribution resembles a bell curve when graphed, so that the greatest number of values gather at the mean, with the number of values equally and consistently decreasing in frequency on either side of the mean as the distance from the mean increases. BARNES & CONLEY, *supra* note 125, § 4.13.

260. BLALOCK, *supra* note 167, at 387 In assuming homoscedasticity, regression analysis presumes equal variances (standard deviations) of the dependent variables (Y) for each independent variable (X). *Id.* at 389.

261. *Id.* at 387 Statisticians define confidence limits as the outer bounds of the estimated probability of error. *Id.* at 208.

262. *Id.* at 387 Tests of significance measure the likelihood that the researcher would have found a given relationship in the sample if no such relationship exists in the general population from which the researcher drew the sample. BARNES & CONLEY, *supra* note 125, § 8.5, at 435; BLALOCK, *supra* note 167, at 418.

263. BLALOCK, *supra* note 167, at 387 Financial considerations and time limitations usually restrict a researcher to collecting one value of Y for each value of X, even though many more values of Y exist in the general population. *Id.* at 389. The researcher then draws the regression equation to minimize the sum of the vertical distances of the data points from the regression line. *Id.* at 391. The researcher assumes that collecting data on the entire population will produce mean values for each variable that fall directly on the regression line, even though the collected data in the sample does not fall directly on the line. *Id.* at 384-85. The researcher also assumes that these assumed means have a normal distribution (normality assumption). *Id.* at 387 Furthermore, even though the data points collected in the sample are different distances from the line, the researcher assumes that the variance of Y's about X are equal (homoscedasticity). *Id.* at 389, 452.

C. Comparing Regression Estimates of Nurtural Damages With Court Estimates of Nurtural Damages

Despite the assumptions inherent in regression analysis, studies based on regression analysis provide an objective standard for measuring nurtural damages. By comparison, the United States District Court for the District of New Jersey in *Rodriquez v United States*[264] found that two children of a decedent with vocational training deserved nurtural damages equal to six children of a decedent with two master's degrees and an engineering degree.[265] The district court decided to award an equal amount to each family by balancing the greater life expectancy of one decedent against the greater number of children left by the other decedent.[266] If the district court had computed the damages with multiple regression analysis, the court would have understood that one year of a father's education, $1,000 in parents' average income, or ten points of father's occupational status on the Duncan scale results in an additional .04-.08 years of higher education for a child.[267] Moreover, one dollar of parents' annual income while the children grow up adds over thirteen cents to each child's earnings eight to ten years after each child graduates from high school.[268] Given that the second decedent had three times as many children as the first decedent, and that the second decedent had more education than the first decedent, the statistical evidence does not support equal awards to each decedent's family [269]

Unfortunately, the Third Circuit opinion does not provide sufficient information to calculate the expected value of each child's future earnings. By making certain assumptions based on the limited information provided by the Third Circuit, however, one can construct a hypothetical example of how the Third Circuit might have applied multiple regression analysis in *Rodriquez*. The first decedent, Mr. Rodriquez, was employed part-time as a machinist.[270] Mr. Rodriquez had no more than 12 years of education[271]

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264. Rodriquez v. United States, 823 F.2d 735 (3d Cir. 1987).

265. *Id.* at 750-51.

266. *Id.* at 749.

267 SEWELL & HAUSER, *supra* note 208, at 183.

268. *Id.*

269. *See supra* notes 264-67 and accompanying text (discussing nurtural damage awards based on statistical evidence).

270. *Rodriquez*, 823 F.2d at 747

271. *Id.* at 750.

and a Duncan occupational score of 33.[272] One may assume that Mr. Rodriquez had an income of about $17,000 a year.[273] The second decedent, Mr. Thomas, was employed as an engineer.[274] Mr. Thomas had 20 years of education[275] and a Duncan occupational score of 85.[276] One may assume that Mr. Thomas had an income of about $40,000 a year.[277]

Based on the above, the district court could have calculated the appropriate award for each child. Depending on the analysis used, each Rodriquez child could have expected to receive about 1.9 additional years of education had Mr. Rodriquez lived.[278] By contrast, each Thomas child could have expected to receive about 4.1 additional years of education had Mr. Thomas lived.[279] As each year of post high school education adds $200 to one's annual earnings,[280] Mr. Rodriquez's death may have deprived the Rodriquez children of $380 in annual earnings, and Mr. Thomas's death may have deprived the Thomas children of $820 in annual earnings. Moreover, each Rodriquez child could have expected to make an additional

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272. *See* ALBERT J. REISS, JR., OCCUPATIONS AND SOCIAL STATUS 268 app. B, tab. B-1 (1961) (noting that Duncan score for machinists is 33).

273. *See* BUREAU OF LABOR STATISTICS, U.S. DEP'T OF LABOR, BULLETIN NO. 2250, OCCUPATIONAL OUTLOOK HANDBOOK 438 (1986-87 ed. 1986) (noting that machine operators' median weekly earnings were $325 per week in 1984).

274. *Rodriquez*, 823 F.2d at 751.

275. *Id.*

276. *See* REISS, *supra* note 272, at 263 (noting that Duncan score for engineer is 85).

277 *See* BUREAU OF LABOR STATISTICS, *supra* note 273, at 62 (noting that salary for mid-level engineer without supervisory responsibility was $40,991 per year).

278. *See supra* text accompanying note 267 (stating that one year of father's education, $1,000 in parents' average income, or 10 points of father's occupational status on Duncan scale result in additional .04-.08 years of higher education for child). Mr. Rodriquez had 12 years of education, an income of $17,000 each year, and a Duncan score of 33. The court could determine that Mr. Rodriquez's children could expect about .72 years of higher education based on Mr. Rodriquez's 12 years of education; 1.02 years of higher education based on Mr. Rodriquez's $17,000 per year income; and .2 years of higher education based on Mr. Rodriquez's score of 33 on the Duncan scale.

279. *See supra* text accompanying note 267 (stating that one year of father's education, $1,000 in parents' average income, or 10 points of father's occupational status on Duncan scale result in additional .04-.08 years of higher education for child). Mr. Thomas had 20 years of education, an income of $40,000 each year, and a Duncan score of 85. The court could determine that Mr. Thomas's children could expect to receive 1.2 years of higher eduction based on Mr. Thomas's 20 years of education; 2.4 years of higher education based on Mr. Thomas's $40,000 per year income; and .5 years of higher education based on Mr. Thomas's Duncan score of 85.

280. SEWELL & HAUSER, *supra* note 208, at 84.

$2,210 per year in income had Mr. Rodriquez survived.[281] By contrast, each Thomas child could have expected to make an additional $5,200 per year in income had Mr. Thomas survived.[282] All told, Mr. Rodriquez's death deprived the Rodriquez children of $51,800 in income over a twenty year career, and Mr. Thomas's death deprived the Thomas children of $120,400 in income over a twenty year career. If the court had multiplied the per child awards by the number of children, the court would not have awarded each family $500,000. Instead the court would have awarded the Rodriquez family $103,600 and the Thomas family $722,400.[283]

In short, regression analysis can provide an expected value for a child's future income.[284] However, regression analysis provides an answer only as good as the data the researcher collects for the analysis.[285] Further, even when the researcher takes every precaution to collect flawless data, the regression equation provides an answer subject to certain assumptions inherent in regression analysis.[286] Despite these limitations, the judicious use of regression analysis can improve the predictive and analytical capabilities of courts and researchers.[287]

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281. *See supra* text accompanying note 268 (stating that one dollar of parental annual income while child grows up adds over 13 cents to child's annual earnings). Mr. Rodriquez's annual income of $17,000 was worth $2,210 in the Rodriquez children's annual earnings.

282. *See supra* text accompanying note 268 (stating that one dollar of parental annual income while child grows up adds over 13 cents to child's annual earnings). Mr. Thomas's annual income of $40,000 was worth $5,200 in the Thomas children's future earnings.

283. The author includes the above example only to illustrate the inequity of the *Rodriquez* court's award. The author wishes to emphasize that the above example in no way attempts to approximate the value of Mr. Rodriquez's and Mr. Thomas's parental nurture. As stated above, the *Rodriquez* opinion does not state facts upon which to base a comprehensive analysis. A lawyer confronted with a wrongful death case involving nurtural damages would want to collect information on the child and the parents that parallels the information collected by Jencks, discussed *supra* in notes 218-27

284. *See supra* notes 252-54 and accompanying text (calculating proportion of child's future income attributable to parental nurture).

285. *See supra* notes 218-27 and accompanying text (noting data collection techniques and possible sources of error); *see also supra* note 257 (discussing measurement error in dependent variable as included in error term).

286. *See supra* notes 256-63 and accompanying text (discussing assumptions inherent in regression analysis).

287 *See supra* note 166 and accompanying text (stating that courts' uses of regression analysis in estimating lost parental nurture's value would increase certainty in wrongful death cases).

VI. Conclusion

In most jurisdictions, courts accept lost parental nurture as an element of damages in wrongful death cases.[288] Although multiple regression analysis can estimate parental nurture's pecuniary value in terms of the child's lost future income, courts have not adopted this approach.[289] Instead of using regression analysis to estimate parental nurture's value, courts have preferred to repeat dicta from a 1864 case observing that courts cannot calculate the value of parental nurture.[290] The supposed inability of courts to calculate mathematically damages for lost parental nurture has led to arbitrary damage awards and judicial confusion regarding the precise nature of compensable damages in wrongful death cases.[291] Fortunately, most courts will consider statistical evidence presented by a qualified expert.[292] Plaintiffs and defendants in wrongful death cases can improve the certainty and the justice of the outcome by presenting statistical evidence on parental nurture's value.[293] More importantly, presenting courts with evidence on parental nurture's value will force courts to clarify the injury these enigmatic damages were designed to compensate and clear up over a century of judicial confusion regarding pecuniary damages.

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288. *See supra* note 4 and accompanying text (noting that most jurisdictions accept lost parental nurture as element of damages in wrongful death cases).

289. *Cf. infra* note 290 and accompanying text (noting that courts believe that researchers cannot calculate nurtural damages in wrongful death actions).

290. *See supra* note 7 and accompanying text (noting that courts often repeat *Tilley* court's observation that court cannot mathematically calculate damages for lost parental nurture).

291. *See supra* notes 69-119 and accompanying text (discussing courts' confusion regarding measurement of damages for lost parental nurture).

292. *See supra* notes 125-35 and accompanying text (discussing courts' general acceptance of statistical evidence).

293. *See supra* note 166 and accompanying text (stating that courts' uses of modern statistical techniques in assessing damages for lost parental nurture would increase certainty in wrongful death cases).

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LECTURES