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Technology at Birth

Innovations in medical care, as a rule, increase dependence on technology. Unease about technological intrusion into medicine is common, and frequently expressed as concern about increased costs or bioethical quandaries. But surprisingly little appraisal has been made of the impact of technologic innovation on the health of the public. Is there any measurable improvement in mortality or morbidity in the population as a result of renal dialysis, coronary care units, electronic fetal monitoring, or magnetic resonance imaging? Students of the quality of medical care often express doubt that such questions can ever be satisfactorily answered.¹

Skeptics should consider the case of newborn intensive care. In this issue of the Journal, Mayfield, *et al*,² replicate a very consistent finding: low birthweight infants born in hospitals with newborn intensive care facilities experience substantially lower mortality (a third lower or better) than do infants born in hospitals without such facilities. This has been shown to be the case in The Netherlands,³ in New York City,⁴ in four states,⁵ and now in the state of Washington, to list only studies which examine entire populations of newborns.

More importantly, the impact of this technology is large enough to have been the dominant (perhaps even the sole) driver of the recent strong decline in neonatal mortality in the United States.⁶ For the 15 years from 1967 until 1982, neonatal mortality declined about 4 percent per year, a rate of decline more rapid than any noted since neonatal mortality was first separately recorded in national data in 1915. This improvement is entirely in survival at a given birthweight⁷;

the principal determinants of neonatal mortality—low birthweight and preterm delivery—changed little or not at all in this interval.^{8,9}

The impact of health care services on health outcomes can be assessed from three perspectives:

- efficacy—can it work?
- effectiveness—does it work?
- efficiency—is it worth doing?¹⁰

Examined from the first two perspectives, newborn intensive care appears to be an excellent technology. It is efficacious; properly used it *can* improve newborn survival. It is effective; it *does* in fact produce measurably better survival in the population.

Gratifying as this may be, an answer to the third question we must ask about any technology—whether the investment of resources is worth the results—is more elusive. This elusiveness derives from two unknowns. The first is the long-term outcome of the population of infants now surviving who would have died without the application of the new technology. There is a suggestion, in countries better than ours at counting childhood handicap, that cerebral palsy, particularly spastic diplegia in premature infants, may be increasing in prevalence.^{11,12}

A second unknown is the cost, both financial and human, of the presence (and, it must follow, use) of this technology where it is not needed. Although low birthweight infants contribute heavily to infant mortality, they are relatively uncommon, about 7 percent of live births. The vast majority

of babies need no special technology to evade death; but electronic devices are used to monitor fetal heart rate patterns in almost all laboring women, and one in five infants is now delivered abdominally. Where it has been looked at, no mortality advantage is detectable in vital data for term, normal weight infants born in hospitals with newborn intensive care^{2,13}; this does not rule out advantages in very small sub-groups, or in morbidity. But it tells us that the marginal benefit of this technology to the bulk of infants must be small indeed.

This dilemma can be formulated as an issue in screening: how do we ensure *both* that infants in need get intensive care (sensitivity), and that infants not in need avoid it (specificity)? Mayfield, *et al*, find that tertiary care units deliver 22 percent of all Washington state babies, but 67 percent of births <1500g. This implies considerable screening and referral of high-risk mothers for place of delivery. But 54 percent of Washington infants of normal weight are born in hospitals equipped with some intensive care facilities. Is this necessary or wise?

Low technology delivery settings are becoming increasingly hard to find. Nesbitt, *et al*,¹⁴ in this same issue of the *Journal*, document that many rural areas in the State of Washington are now bereft of perinatal services. The flight of obstetric practitioners is partly due to fear of malpractice litigation, itself a product of the technological revolution in perinatal care. Screening for place of birth is thus unidirectional; our technological mindset seems to leave no room for contemplation of a safe, efficient way to deliver mothers screened for *low* risk.

A challenge to the practice of obstetrics and midwifery, as to any medical discipline which uses technology, is to discover efficient ways to use the technology with high specificity, not just high sensitivity. Too few formal evaluations have been performed of the safety of out-of-hospital,¹⁵ or midwife-based delivery services.¹⁶ It is possible, however, that with careful screening, and with appropriate intensive care back-up, a midwife-run low-risk delivery service can safely deliver a large proportion of women in labor. Technology, like the well-trained surgeon, must know when not to operate.

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