findings, many recent studies that have considered socioenvironmental factors have underplayed the role of maternal IQ in the association between breast feeding and cognitive function.

Der and colleagues' new study demonstrates the importance of controlling for maternal IQ by showing that the association of breast feeding with cognitive performance in children drops from 4.7 to 0.5 points after adjusting for mother's cognitive competence and other socioenvironmental measures in a large cohort of 5475 children from the national longitudinal survey of youth.¹ Moreover, the study identifies maternal IQ as the main variable that accounts for the association between breast feeding and childhood IQ. Of the nine indicators included in their regression analysis, maternal IQ was the strongest predictor. The authors suggest that the association between breast feeding and childhood IQ results from the relation between cognitive competence in mother and child—attributable at least in part to heritability—and the fact that mothers with a higher IQ are more likely to breast feed.

The strength of the association between the outcome and a given predictor in multiple regression analysis depends, in part, on the reliability with which that predictor is measured. The short form of HOME was administered in the national longitudinal survey of youth, and Der and colleagues included only two of the subscales in their analysis. We used the complete HOME assessment in our research, and maternal vocabulary IQ and HOME contributed equally to the prediction of IQ score at 11 years of age.⁵ These data suggest that heritability and rearing environment play an equally important part in the association between breast feeding and childhood IQ, and that these factors should be considered in evaluating the impact of breast feeding on cognitive ability in children. In contrast to IQ and quality of child rearing, maternal depression, anxiety, and stressful events were not related to duration of exclusive breast feeding.^{5,6} These data support Der and colleagues' finding that maternal intellectual enrichment and genetic endowment, as measured by maternal IQ, are crucial potential confounders of the effect of breast feeding on cognitive competence in children.

The US Department of Health and Human Services Office on Women's Health concluded that

"the observation ... that ... cognitive function of [breast-fed] children is greater than in non-breastfed children ... has not been conclusively proven."⁷ The inconsistency in the literature is due, at least in part, to the use of global indirect indicators of the social environment. Der and colleagues' meta-analysis shows that, when the relevant confounding variables are included, the data do not support a direct nutritional benefit for childhood IQ in full term infants.

Other benefits of breast feeding—such as the effect of colostrum on the immune system, emotional benefits that may promote more secure infant-mother attachment, and the effects of omega 3 fatty acids on cognitive and visual development in preterm and low birthweight infants—are well established. But Der and colleagues' results may help doctors when giving advice on breast feeding to mothers with particular problems—for example, women who take drugs to prevent seizures or depression—which may affect the infant when transferred via breast milk—or women who want or need to go back to work. These data indicate that one consideration—an adverse long term effect on cognitive function—need not be of concern.

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Competing interests: None declared.

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doi 10.1136/bmj.39020.473322.80

Pulmonary artery catheters

As currently used, do not benefit patients

The description of the flow directed pulmonary artery catheter in 1970 and its subsequent commercial development allowed clinicians to measure cardiac output and derive central haemodynamic parameters at the bedside.¹ On the assumption that measuring and manipulating these variables would improve outcomes, this device became widely used in intensive care units. Very soon reports of serious complications including potentially fatal pulmonary artery rupture appeared,² and arguments for and

against its use have continued ever since. A recent addition to the debate is a comprehensive evaluation of both the clinical and cost effectiveness of such catheters in adult intensive care units in the United Kingdom.³ The research was commissioned by the UK's National Health Service Health Technology Assessment (HTA) programme; the authors were from the Intensive Care National Audit and Research Centre, practising intensive care clinicians, and academics. Given 35 years of research and debate,

BMJ 2006;333:930-1

clinicians might reasonably ask what is known about the usefulness of pulmonary artery catheters, what does this report add, is further research needed, and should they use these devices?

Research findings to date

The best evidence comes from well designed and conducted clinical trials in the general intensive care population,⁴ and more selected populations of high risk or critically ill patients.⁵⁻⁷ None of the trials show that using a pulmonary artery catheter benefits patients. A recently published trial in patients with acute lung injury confirmed these findings.⁸ A meta-analysis of 13 trials reported no overall effect of using these devices on mortality or length of hospital stay.⁹

The HTA report includes a systematic review that reaches the same conclusion, a more detailed description of the authors' previously published PACMAN trial,⁴ and an economic evaluation examining the cost effectiveness of withdrawing these catheters from UK intensive care units.³ Given the pre-existing evidence that the use of these devices does not benefit patients, the report's conclusion that withdrawing pulmonary artery catheters may reduce mortality at the cost of £2985 (€4446; \$5622) per quality adjusted life year deserves closer scrutiny.

The authors examined cost effectiveness from a decision science perspective,¹⁰ an approach that many clinicians will be unfamiliar with. In essence, whereas traditional hypothesis testing seeks to detect differences that are not likely to have arisen by chance, decision analysis seeks to determine what is most likely to happen if a particular course of action is taken. In this case, the most likely result of withdrawing pulmonary artery catheters from UK intensive care units is a net health gain at moderate cost. We also note that the conclusions are based upon assumptions regarding the duration and quality of life of survivors of critical illness, as the authors could find no appropriate health related quality of life data for survivors of intensive care units. The assumptions on which the analysis is based are open to question, and the results may not hold true for other healthcare systems.

Is the lack of benefit specific to the pulmonary artery catheter or does it extend to other devices that measure and monitor central haemodynamics? At present that question cannot be answered with certainty, but in the absence of benefit from the pulmonary artery catheter, the onus should be on the marketers of other haemodynamic monitors to demonstrate their clinical usefulness and cost effectiveness, not simply show that they are as good as a device that has no proved benefit.

Future research

Is any further research needed? While it is tempting to say no, we should perhaps start with the construct that measurement of central haemodynamics does not benefit critically ill patients. This may be because manipulation of haemodynamics beyond that which can be achieved through simple clinical examination and parameters such as heart rate, blood pressure, peripheral perfusion, and urine output does not alter outcome. It may equally be that manipulation of central haemodynamics can improve outcome but as yet

we just do not know how. Any future research should therefore evaluate specific treatment protocols in specific subgroups of patients. The HTA report highlights the lack of data on health related quality of life and life expectancy for patients surviving treatment in an intensive care unit; given that treatment in intensive care units is consuming an ever larger portion of healthcare budgets, systematic collection of these data should be a priority for the critical care community, healthcare funders, and policy makers.

What should clinicians do with all this information? Supporters of the pulmonary artery catheter have rightly pointed out that monitoring devices do not alter mortality, only treatment alters mortality.¹¹ However, at least five large randomised controlled trials tell us that this device does not benefit patients. The trials include those that allowed clinicians to direct therapy and trials in which treatment was protocolised.^{4-6, 8} No large trials challenge these results, and the results are consistent across patient groups and in different countries. Given that the use of pulmonary artery catheters increases the risk of important complications, continued use of these devices is difficult to defend. The onus is now on the proponents of the pulmonary artery catheter and related devices to limit their use to clinical trials and to show that protocols based on such devices do benefit patients.

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Competing interests: None declared.

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doi: 10.1136/bmj.39017.459907.BE