that of our study, but the prevalence of symptomatic HIV infection or AIDS in these cohorts varied greatly.

We recently published findings from our study cohort examining the association of HIV infection and adverse pregnancy outcomes (5). This analysis was limited to women who were randomly assigned to receive no multivitamins because of the significant effect of multivitamin supplements on the risk of adverse pregnancy outcomes previously reported in this cohort (2). We concurrently enrolled and followed 502 HIV-uninfected pregnant women in addition to our trial cohort of 1078 HIV-infected women, and we found no significant differences between these 2 groups in poor pregnancy outcomes, including the risk of fetal loss, LBW, and preterm delivery (5). However, we found significantly higher relative risks (RRs) of LBW (RR: 2.29; 95% CI: 1.34, 3.92) and preterm delivery (RR: 1.93; 95% CI: 1.35, 2.77) among symptomatic HIV-infected women than among HIV-uninfected women (5). The rates of LBW were 14.7%, 13.0%, and 26.4% in HIV-uninfected, asymptomatic HIV-infected, and symptomatic HIV-infected women, respectively. Symptomatic HIV-infected women (World Health Organization stage II or higher) made up 16.6% of this cohort. Bradick et al (3) reported a 17% LBW rate among women in Kenya with HIV-related diseases compared with a 6% LBW rate among women who were asymptomatic or had generalized lymphadenopathy alone (odds ratio: 3.4; \( P = 0.08 \)). LBW was rare (3%) among uninfected women in the study. Ryder et al (6) reported LBW rates of 9.8%, 16.9%, and 32.9% among Rwandan women who were HIV uninfected, HIV infected without AIDS, and HIV infected with AIDS, respectively.

In the Brocklehurst and French (7) meta-analysis of HIV infection and perinatal outcomes, a modest relation was observed between HIV infection and LBW, but there was considerable heterogeneity among study results. The reported association was stronger in studies from developing countries than in those from developed countries. Compared with HIV-infected women in developed countries, infected women in developing countries are more likely to be at advanced clinical and immunologic stages of HIV-related disease, possibly because of the high prevalence of undernutrition, opportunistic infections, and poor access to treatment. These conditions increase the risk of poor pregnancy outcomes regardless of HIV status, and they may be important contributors to the high rates observed among HIV-infected women, particularly those with symptoms of HIV-related disease. Our findings support those of the meta-analysis and suggest that the increased risk of LBW and preterm delivery associated with HIV infection may be due in large part to the more advanced disease in some HIV-infected women.

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Validation of air-displacement plethysmography to measure body fat

Dear Sir:

Fields et al (1) compare results obtained with the “new” method of air-displacement plethysmography (BOD POD; Life Measurement Inc, Concord, CA) with those obtained by hydrodensitometry and other reference methods to determine the fat content of human subjects. They conclude that air-displacement plethysmography is a reliable, valid, and safe technique but advocate further research to explain the differences between the estimates obtained by these methods. In a recent paper, Demerath et al (2) reached a similar conclusion.

A major problem when methods for measuring human body composition are validated by comparison with other methods is that the other methods also have quite large errors and there is no gold standard with which to compare results other than whole-body chemical analysis, which is unacceptable for living subjects. However, there are accurate (but tedious) methods for measuring change in body fat in volunteers confined to a closed metabolic ward and who consume a low-energy diet. If energy intake and output are carefully measured over several weeks and a value for the energy density of fat and fat-free mass are assumed, the proportion of fat and fat-free mass in the weight lost can be calculated. Similarly, this calculation can be made if nitrogen balance is measured and a value for the nitrogen content of fat-free mass is assumed.

Long ago we reported a study on 19 obese women studied in a closed metabolic ward for a total of 408 person-days (3). The women’s mean (\( \pm \) SD) initial weight was 97.55 \( \pm \) 19.81 kg and in
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REFERENCES

Reply to JS Garrow

Dear Sir:

We thank Garrow for highlighting an inherent and almost unavoidable characteristic of body-composition validation studies: that the reference methods against which we compare the test methods have their own associated errors. The most common techniques against which air-displacement plethysmography (BOD POD; Life Measurement Inc, Concord, CA) has thus far been validated are hydrostatic weighing and dual-energy X-ray absorptiometry, each of which, as we point out in our review (1), has multiple inherent errors. When evaluating these studies, therefore, we must keep in mind that any differences in body-composition measurements between the reference method and the BOD POD should be attributed not only to the BOD POD but also to the reference method. Whenever possible, measurements made by any new body-composition method should be evaluated against techniques with the highest achievable accuracy and precision. These include any number of multicompartment models that take into account individual variations in body compartments (2–4). However more precise and accurate these may be, they still have some associated error (4–7). In addition, they may not be completely independent of the method under evaluation; such is the case when the BOD POD, which ultimately is a densitometric method, is evaluated against a 4-compartment model that also requires a measurement of densitometry. Examples of methods that could serve as independent reference methods are in vivo neutron activation analysis (8) and total-body carbon analysis (9). Neither of these methods is widely available, however; thus, the BOD POD will continue to be evaluated against commonly used techniques such as hydrostatic weighing and dual-energy X-ray absorptiometry. Because of this, when judging whether the BOD POD (or any other method) is reliable and accurate, we believe it is important to keep in mind the big picture. It may be reasonable to expect and also accept that differences in measurements between methods exist. When the totality of studies shows that these differences between methods are small and randomly distributed among studies, the method under evaluation can be deemed acceptable and reasonably valid.

Garrow also states in his letter that a smaller air volume around the subject will lead to a more precise measurement of body composition. In theory this should be true; however, as stated in our review (1), evidence thus far suggests that, in practice, the size of the air volume makes only a small difference in the BOD POD. Recently, Wells and Fuller (7) reported that the absolute precision for percentage body fat (%BF) measurement was 0.88%BF for adults and 0.91%BF for children aged 5–14 y. The difference in precision between adults and children increased only slightly when expressed relative to the mean %BF in each group (4.2%BF for adults and 5.8%BF for children). Additionally, there was no relation between the difference in 2 consecutive body density measurements and body volume (r = −0.20, P = 0.14). One major advantage of the BOD POD over hydrostatic weighing is that individuals do not need to get wet. Whereas Garrow’s plethysmograph (10), in which subjects are immersed to the neck in water, is likely a precise research tool, we feel that for everyday clinical use the gain in precision achieved by having a smaller air volume is offset by the inconvenience of the subject’s having to get wet.

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