efforts. But the extent of the human resource crisis in Africa in general and particularly in the countries with a high HIV/AIDS prevalence, forces us to act decisively. We believe that we need to reconsider approaches that used to be politically incorrect. If not, the current staff deficits will continue to undermine the absorption capacity of all the new international initiatives.

PRSPs should be grasped with both hands if the root of the crisis is to be tackled across sectors. A national human resources for health plan should be part of any PRSP as a condition for approval. Moreover, the recruitment ceilings imposed under the structural adjustment programmes represent a relic from the past and need to be removed. International actors should no longer shun the funding of recurrent expenditure with the excuse that this amounts to unsustainable interventions. For example, international development agencies need to reconsider contributing to funding salaries and wages in the new recruitment drives. Also bilateral agencies need to critically review their policies. Sending out expatriate medical personnel as a short-term measure or hiring medical professionals from the brain drain diaspora are options.

In short, the context and the challenges besetting health systems in developing countries have changed dramatically and paradigm shifts are called for to come up with effective strategies.

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Risk of cancer from diagnostic X-rays

Sir—In their otherwise balanced Commentary on cancer risks from diagnostic X-rays, Peter Herzog and Christina Rieger (Jan 31, p 340)[1] make the assertion that “there are no reliable data proving that radiation doses as used in diagnostic X-rays do induce cancer”. This statement is a central issue because, if true, the risks of diagnostic X-rays would be at most hypothetical, dependent on the substantial uncertainties associated with low-dose radiation-risk extrapolation[2]—and not something for the practising physician to be overly concerned about. For adults, however, their statement is probably not correct, and for children it is almost certainly incorrect.

To take the common adult CT examinations as an example, depending on the machine settings, typical equivalent doses in examined organs are in the range of 20–30 mSv for a single examination;[3] the average number of CT scans for a given medical problem for which CT is used is about two,[3] giving an average total dose of 40–60 mSv. Is there direct evidence of increased cancer risk in this dose range?

The individuals in the lowest dose group of atomic-bomb survivors that showed a significant rise in cancer incidence, received doses in the range of 5–100 mSv (mean 29 mSv).[2] The corresponding lowest dose group that showed significantly increased cancer mortality was very similar (5–125 mSv, mean 34 mSv).[2,4] Thus, there are reliable data showing increased cancer risk at the doses (40–60 mSv) used in adult diagnostic CT.

The situation is still clearer for paediatric CT for which, depending on the age and settings used, the doses for the same examinations are up to four times higher than in adults.[3] Additionally, depending on their age, children are three to five times more sensitive than adults to radiation-induced cancer.[4] Therefore, there can be little doubt that diagnostic CT examinations in children result in an increased cancer risk. Although the individual risk is small, use of paediatric CT is increasing; therefore the public-health risk is not negligible.[1,3]

Are the atomic-bomb exposures relevant to radiological examinations? The major differences are (1) radiological exposures are less uniform, so fewer organs are effectively at risk; and (2) radiological examinations use lower-energy X-rays, which, since they are more densely ionising, are more carcinogenic than the high-energy γ rays to which atomic-bomb survivors were exposed. Therefore, atomic-bomb exposures are relevant to radiological examinations, but there is also direct evidence from in-utero radiological examinations, where the increased sensitivity of the developing embryo and fetus allows significantly increased cancer risks to be seen at doses as low as 6 mSv.[2]

We applaud the recommendations of Herzog and Rieger[1] that physicians should carefully consider the risks and benefits before ordering radiological examinations. However, particularly for CT examinations, which increasingly dominate the radiologically related population dose, we would add that the radiation risks have a much firmer scientific basis than Herzog and Rieger imply.

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Authors' reply

Sir—David Brenner and Eric Hall make the assumption that our statement[1] regarding the probable impreciseness of the estimate of cancer risk from diagnostic radiological exposure, from Berrington de Gonzalez and Darby's work,[2] is incorrect.

Brenner and Hall disregard the different quality of radiation derived from X-ray tubes and detonation of nuclear devices. The atomic-bomb survivors were not only directly exposed to γ rays emitted from radionuclides—which would be comparable to X-ray radiation—but also to neutron radiation from the bomb detonations and, most importantly, to radionuclides, from contaminated food, water, and air (dust), emitting γ, β, and high-energy α radiation. Some of these radionuclides have a long half-life and are embedded into bone metabolism and stored there for almost the whole life of the individual. This additional exposure is not apparent in patients undergoing radiological examinations, but it contributes to the morbidity and mortality of the atomic-bomb survivors. Different radiation qualities are only poorly accounted for by use of weighting factors. The difference between incorporated radionuclides and short-time external radiation sources is not accounted for at all. Additionally, the γ rays the atomic-bomb survivors were exposed to were of a different