

# Obstetric Ultrasounds in Africa: Is it Necessary to Promote their Appropriate Use?

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## ABSTRACT

This paper reviews the situation of obstetric ultrasound scans in Africa (extent of use, sonographer training, indications and results, etc.). Special emphasis is given to the advisability of legally regulating their use, the need for improved training among today's sonographers and the potential dangers that the incorrect and indiscriminate use of ultrasounds can involve. The paper condemns the commodification of the technique and reviews the current status of scientific production.

**Keywords:** Obstetric ultrasonography, Africa, Developing countries, Cooperation, Commodification.

## INTRODUCTION

Africa is unquestionably the continent with the most problems in maternal and infant health. There are many reasons, all connected with its poor economic situation. One of the most important is the lack of health professionals, including doctors, midwives and nurses. In sub-Saharan Africa, there is only one doctor for every 50,000 inhabitants. This lack of properly trained health personnel hampers the correct and beneficial use of the scarce instrumental resources available, such as ultrasound scans. Together it means that maternal mortality is extremely high; 1,000 deaths for every 100,000 live births.<sup>1</sup>

In the 1990s, developing countries witnessed significant improvements in prenatal care with a noticeable rise in the use of ultrasounds in hospitals and health centers. The most outstanding progress was in Asia, due to favorable economic changes in some of the countries in the region, particularly large ones. Prenatal care, and hence the use of ultrasound equipment, also improved in Latin America, although many countries in this region already had relatively acceptable levels of prenatal controls. By contrast, prenatal care in sub-Saharan Africa barely improved over the course of the decade.<sup>2</sup>

In general, the WHO's recommendation of performing a minimum of four prenatal checks<sup>3</sup> is not met in Africa, and in rural areas of the continent most pregnant women are not seen even once by competent personnel.<sup>4</sup> This means that only a small percentage of expectant mothers have the opportunity to have their pregnancy controlled through the use of an ultrasound.

Despite the fact that ultrasonography was introduced into Africa quite early (at the University of Cape Town in 1970), it is presently the continent where the lowest number of obstetric ultrasound scans are performed. And, although the commercialization of medical care has led to the excessive use of scans in some urban areas, this is in detriment to other procedures (taking blood pressure, for example).<sup>5</sup>

## OBSTACLES TO THE WIDESPREAD USE OF ULTRASOUNDS IN AFRICA

About 80% of Africa's provincial hospitals lack a conventional electricity supply, making it very hard to use ultrasound equipment. Some centers resort to batteries, although solar panels are progressively being introduced on hospital roofs. The first were installed in Mali.<sup>6</sup>

In some African societies, there is cultural resistance to ultrasound, particularly in the obstetrics area, where it runs up against traditional myths and taboos.<sup>7</sup> Some ethnic groups consider it bad luck to reveal the content of the uterus in pregnancy and to be able to see the fetus.

The possibility of an early diagnosis of fetal sex also has significant problems in countries where for diverse reasons people hope to have a male child.

## EXTENT OF USE OF PRENATAL ULTRASOUND SCANS

As with the economic situation, the situation of maternal and infant health in Africa differs markedly from one country to another. Furthermore, the use of ultrasound scans does not depend entirely on economic problems, but geographic, cultural, and anthropological ones as well.

Unfortunately, there are no reliable statistics in Africa, only estimates. It is worth remembering that 71% of births<sup>8</sup> go unrecorded in sub-Saharan Africa (Figs 1 and 2). This makes it very difficult to have completely reliable figures on the take-up rates of different techniques. However, information from local sonographers and Matres Mundi's voluntary doctors living and working in Africa leads us to believe the figures included in Table 1, and those in Figure 3 are credible. They do not provide figures for each country but group the information by geographic areas.<sup>9</sup>

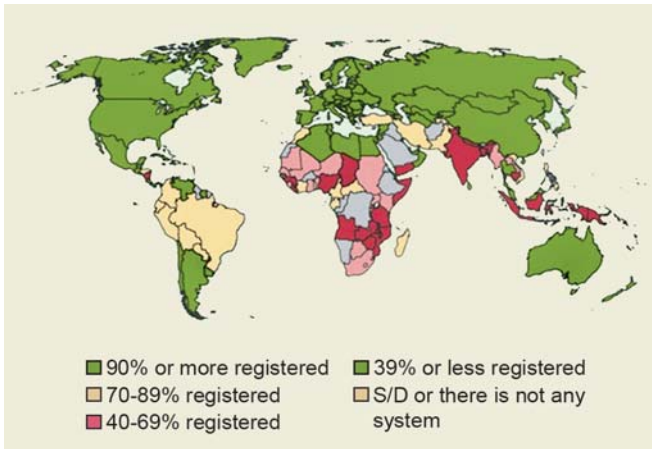


Fig. 1: Percentage of births registered (2001). Source: Unicef 2001

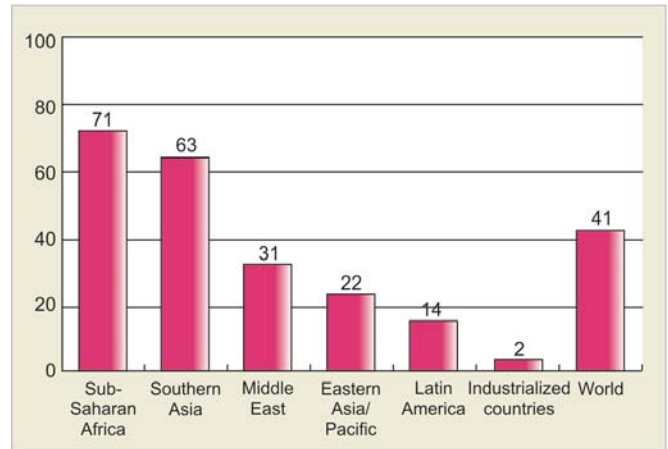


Fig. 2: Annual percentage of births without register by WHO regions (2000). Source: Unicef 2001

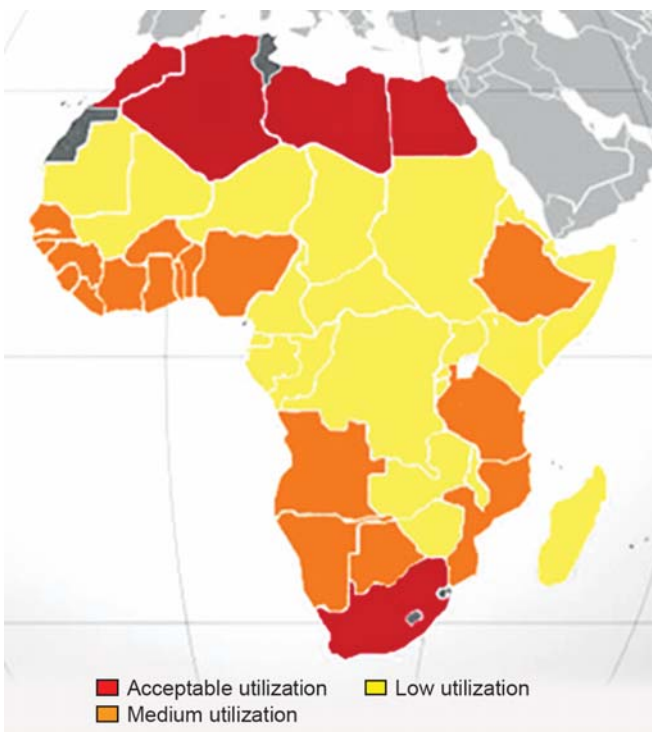


Fig. 3: Prenatal obstetric ultrasonography in Africa

As can be seen, countries in North Africa (Morocco, Algeria, Tunisia, Egypt, etc.) have significant prenatal coverage that includes an ultrasound scan, particularly in urban areas, where 88% of the pregnant population has been given at least one.

The figure falls to 53% when only pregnant women who have been given at least the three ultrasounds which are the protocol in the West, is considered. However, the figures are particularly low in rural areas, where 80% of expectant mothers are not given any ultrasound at all.

The situation is much worse in sub-Saharan Africa. In countries such as Mali, Mauritania, Nigeria, Chad, Cameroon, the Central African Republic, the Democratic Republic of the Congo, Gabon, Uganda, Somalia and Zimbabwe, most pregnant women do not even know what an ultrasound is. Only in urban areas around one-third have been given a prenatal ultrasound scan. In rural areas, the vast majority (94%) are unaware of the possibility.

Finally, in Southern Africa, particularly in the Republic of South Africa and its area of influence (Botswana, Mozambique, Angola, etc.), the situation improves somewhat. In urban areas, around 68% of expectant mothers have had at least one ultrasound. But in rural areas, 82% of pregnant women have not had a prenatal ultrasound.

### SONOGRAPHER TRAINING

The theoretical and practical training provided to the health professionals who perform prenatal scans in Africa is generally low-quality.<sup>10</sup> As we know, ultrasound is an operator-dependent technique where the results depend crucially on the sonographer's knowledge and experience. As we can see on Table 2, most of today's practitioners are not sufficiently

Table 1: Prenatal ultrasonography in Africa

Geographical area	Urban Area		Rural Area	
	One examination	≥ 3 examinations	One examination	≥ 3 examinations
North Africa	88%	53%	20%	5%
Sub-Saharan Africa	32%	14%	6%	1%
Southern Africa	68%	38%	18%	6%

Source: Matres Mundi International (Africa)

**Table 2:** Training of sonologists in Africa

Short course (theoretical)	40.4%
No training	38.3%
Practical course	14.9%
Self-service	6.4%
In service training	2.1%

Source: Foulkes S et al<sup>10</sup>

well-trained, either because they have not learnt the minimum about the technique (38.3%), have only received theoretical training (40.4%), or the training provided was disorganized (6.4%). Very few received a practical course (14.9%) or learnt the technique in a hospital environment (2.1%). It is therefore understandable that the obtained results are not good.

At present, the majority of sonographers who perform prenatal scans come from the obstetrics area (doctors mainly, but also midwives) or from radiology (who also work with other imaging techniques) and general practitioners.

It is therefore necessary to establish a training system that guarantees that prenatal ultrasound scans can really be a way to reduce high maternal and perinatal mortality rates and do not interfere in traditional control procedures.

That is why some NGOs advise against sending ultrasound machines to African countries, unless one or more number of doctors are trained in the use of the technique at the same time. Unfortunately, quite a lot of the equipment in African hospitals is not used, or even worse, is used incorrectly.

## INDICATIONS AND RESULTS OF ULTRASOUND IN AFRICA

As in the other countries, the regulated and systematic use of ultrasound in Africa could help bring down the high levels of maternal mortality. The women who today die from severe hemorrhaging due to placenta previa or premature detachment of the placenta might have survived if they had been given a proper ultrasound scan earlier. Similarly, perinatal mortality might be reduced if, with a prenatal ultrasound scan, the consequences of fetal growth changes and development could be reduced. Unfortunately, no country in Africa has any kind of regulations regarding the use of ultrasounds in obstetrics, and only some national scientific organizations make any recommendations.

A significant number of African women do not remember the date of their last menstrual period (LMP). The reasons are frequent menstrual irregularities (45-68%) among these women and illiteracy (over 60%). This means that true gestational age is often not known.<sup>11</sup>

Gestational age is crucial to good prenatal control. Without this reference it is difficult or impossible to diagnose an IUGR or premature birth. That is why ultrasound scans should focus largely on the reliable determination of gestational age through

regular biometric procedures. Biparietal diameter (BPD) is the most commonly used ultrasound measurement for fetal age assessment. Assessment in the second trimester can also be based on head circumference (HC) and femur length (FL). These methods are less influenced by maternal and fetal factors, such as parity, maternal age and fetal gender.<sup>11-17</sup>

Fetal growth generally studied by traditional methods, such as symphysis-fundal height (SFH), is more sensitive and specific with ultrasound-dating.<sup>19</sup>

A significant percentage of prenatal ultrasound scans are performed at the request of the pregnant woman and not from a request by the physician. In some places, with high purchasing power, patients want a scan every month, which is often carried out in different centers and results in a loss of continuity of control. The reasons that lead women to seek a scan are shown on Table 3. As we can see, nearly a quarter of the cases can be attributed to the woman wanting to know the sex of the fetus (Table 4).

Only 5.5%<sup>20</sup> of the women who had an ultrasound did not want to know the baby's gender.

Pregnant women's level of satisfaction when given an ultrasound is very high.<sup>21</sup> The only complaints are in relation to long waiting times, the short time the check-up lasts and the few explanations they receive.

Prenatal ultrasound diagnosis of congenital defects is one of the black points of African ultrasonography (Table 5). The number of congenital defects diagnosed prenatally is very low and nearly always late in the pregnancy. Malformation detection rates do not exceed 20%.<sup>22-24</sup> The reason lies both in the use of inappropriate equipment and poor sonographer training. This is a field that requires suitable experience, acquired in a center with sufficient resources, and these circumstances are very uncommon in Africa.

Also, the birth of a fetus with serious morphological alterations has less importance than in developed countries. For instance, in some African communities, a neonate who dies in the first months of life is not considered a full person because only neonates who survive past the age of 40 days achieve "personhood". If a neonate dies before 40 days, it is as if it never existed.<sup>7</sup>

The position the doctor takes when diagnosing a fetal malformation differs in line with religion, ethnic group and

**Table 3:** Requesting's reasons for prenatal ultrasound

Reasons	%
Fetal viability	64.7
Fetal gender	22.6
Number of fetus	5.3
Position of placenta	2.6
Fetal age	2.1
Fetal position	0.5
Others	2.1

Source: Enakpene CA et al<sup>18</sup>

**Table 4:** Relationship between reasons for scan considering gender vs other reasons and some variables

Variable	Gender (% within the category)	p-value
<i>Age (years)</i>		
< 30	13.6	0.001*
30-34	21.6	
35+	45.7	
<i>Religion</i>		
Christianity	27.1	0.004*
Islam	6.7	
<i>Occupation</i>		
Artisans	8.1	0.002*
Civil servants	32.6	
Professionals	31.4	
Others	31.4	
<i>Education</i>		
Secondary or less	15.3	0.072*
Tertiary	26.6	
<i>Ethnic group</i>		
Yoruba	22.9	0.552*
Others	17.4	
<i>Gravidity</i>		
1	10.8	0.007*
2	14.5	
3	35.3	
4+	35.4	
<i>Sex of previous babies</i>		
All males	26.4	0.191*
All females	34.1	
Mixed	27.0	
Nulliparous	9.1	
<i>Gestational age (trimesters)</i>		
First	0.0	0.108*
Second	15.4	
Third	21.6	

\*Statistically significant at  $p < 0.05$

Source: Enakpene CA et al<sup>18</sup>

sociocultural context. However, many hospital services today offer a termination in such cases. In one hospital in South Africa,<sup>25</sup> this possibility was offered to 116 patients whose fetus had some type of congenital defect. Of them, 73 (65%) requested a termination. Although the group included women of different races and beliefs, the least predisposed to termination were black women.

## THE ROLE OF MIDWIVES

In rural and socioeconomically deprived urban areas alike, the usefulness of establishing a midwife obstetrics unit with a community-based obstetric ultrasound service has been demonstrated. Although in general perinatal results do not improve substantially, there is a reduction in the number of preterm births (12.0% vs 16.7%) and referrals for fetal surveillance (15.9% vs 29.6%).<sup>26</sup>

In various rural districts of Tanzania and different countries in the sub-Saharan region, it has been shown that educated midwives can take charge of Level II obstetric ultrasound studies in rural hospital centers.<sup>27</sup>

The use of portable ultrasounds can also be beneficial in areas some distance from major hospitals. The experience in Ghana is positive, where both midwives and primary care physicians perform ultrasound scans in isolated villages.<sup>28</sup> Similar experiences are reported from Kenya, Sudan, Ethiopia, and Tanzania.<sup>29</sup>

A pilot study carried out in Zambia demonstrates that midwives in rural areas can be trained to perform basic ultrasounds and that this impacts clinical decision-making.<sup>30</sup>

## REGULARLY USED EQUIPMENT

There is a great variety of ultrasound equipment used in Africa. It largely comes from donations by European or North American foundations, as well as contributions from NGOs, generally offered along with a course of some duration. Some equipment, particularly portable machinery, has been introduced by the manufacturers themselves in an attempt to open the market up to their promotion and sale. Only a relatively low percentage of equipment is acquired by the health ministries in the different

**Table 5:** Percentage of prenatal diagnostic techniques

Geographical area	North Africa	Sub-Saharan Africa	Southern Africa
Ultrasonographic PD	< 50%	<10%	< 25%
Biochemical PD	< 5%	—	< 5%
Invasive PD	< 2%	—	< 2%
Financial arrangement	Private	—	Private

**Table 6:** Type of ultrasound transducer

Head type	%
Curvilinear	46
Sector	30
Curvilinear and vaginal	10
Sector and linear	2
Curvilinear and sector	2
Curvilinear, sector and Doppler	2

Source: Foulkese S et al<sup>10</sup>

countries. In recent years, private physicians with sufficient economic capacity have acquired a considerable number of 2D and 3D machines.

The result of this chaotic arrival of ultrasound equipment is that some hospitals have various scanners (not being used), while the majority of provincial hospitals have none. Also, the technical features of the available equipment are often not that which should be used in prenatal checks.

Table 6 shows the types of ultrasound transducers most commonly used. Although the figures are from South Africa, they could probably be extrapolated to the rest of the continent.<sup>10</sup>

## NORMAL GROWTH CURVES AND DIFFERENT ETHNIC GROUPS

Given the large variety of ethnic groups in Africa, various authors have suggested that the use of normal growth curves to calculate gestational age or fetal weight should not be employed across the continent as a whole and that specific curves should be used for each different ethnic or populational group.<sup>31-33</sup> Other researchers believe, however, such differences are negligible<sup>11,34,35</sup> and that reference curves can be used across the continent.

However, evidence shows that the morphometry of some ethnic groups is clearly different from others. The femur of a pigmy woman is obviously much shorter than that of a Maasai woman. For this reason, in many cases it is necessary to adjust the reference curves to the reality of the studied population.

In areas with few resources, endemic malaria and maternal nutritional factors, including low pre-pregnancy weight and pregnancy weight gain, probably lead to lower fetal weight, and the use of nomograms as employed in developed countries is inappropriate.<sup>36</sup>

## COMMERCIALIZATION OF OBSTETRIC ULTRASOUND EQUIPMENT

Africa as well as Asia,<sup>37</sup> is experiencing increased commercialization of ultrasound devices. The lack of specific regulations in most African countries,<sup>18</sup> the fact that the technique is an important source of revenue for private and public service providers and the fact that any private obstetrician can in principle buy and operate ultrasound equipment without previous training, mean that market forces and not health requirements dominate. Seduced by advertisements from commercial firms and private doctors, women will, when their financial situation allows (10% of the population), seek a scan without a previous medical request. This is a worrying trend that is seeing many women replacing regular prenatal controls with ultrasounds.

The cost of a prenatal ultrasound scan in Africa varies a great deal, but generally ranges from \$3 to \$10 for 2D scans and \$10 to \$20 for 3D and 4D ones. These sums are prohibitive for women with scarce resources, but not for medium- and higher-income segments of the population.

In some centers, a doctor can perform up to 80 2D scans a day, or 40 to 50 3D ones. So it is not surprising that women say that “the doctors just run the scan and read off the result. They do not say or explain anything else”.<sup>37</sup>

However, the most common situation in non-hospital centers is for each clinic to run 60 to 100 ultrasound scans per month, and for 3 to 5% of patients to be referred to a hospital.

The result is that, in some areas (urban and rural alike), more ultrasounds are performed than are necessary and other aspects of prenatal care are neglected. In Botswana, it was found that health personnel were tending to fill in medical records and perform physical check-ups in a more lackluster fashion than prior to the arrival of ultrasound.<sup>38</sup>

One widespread conclusion is that the routine use of ultrasounds in early pregnancy cannot be justified in developing countries.<sup>39</sup>

At present, there are moves afoot to promote the “compact ultrasound”, a low-cost portable device (priced at under \$US5,000) that can be particularly useful in rural areas and non-hospital centers.<sup>7</sup>

## THE DANGERS OF ULTRASOUNDS IN AFRICA

Unfortunately, in many parts of Africa, whether for cultural or financial reasons, the appearance of ultrasound has caused a number of problems.

The lack of proper practitioner training and sonographers who misinterpret scans lead to an unjustified rise in obstetric and gynecological surgery procedures. This is particularly so when the sonographer is also the surgeon. Such behavior not only carries a higher risk for the woman with high morbidity and mortality rates, but is also an easily preventable waste of money and resources.

Theoretical and practical courses to improve sonographer training are absolutely essential, but sophisticated techniques cannot be offered if sonographers lack critical judgment and falsely perceive equipment as simple to operate or try to use it with catastrophic results. This is particularly obvious in the case of prenatal diagnosis techniques, such as amniocentesis, cordocentesis, CVS, etc.

The absence of any type of control regarding equipment, practitioners, or diagnostic techniques not only leads to errors of interpretation, but also a lack of scruples in scanning calendars (too many of them) and the treatment of supposed problems.

Corruption is also an important factor. Some NGOs that donated ultrasound machines to hospitals or centers which did not have them were later surprised to find that the equipment had been unashamedly transferred to private practices where they were “exploited” by one or various colleagues.

## AFRICAN SCIENTIFIC PRODUCTION REGARDING OBSTETRIC ULTRASOUNDS

There was practically no scientific work emerging from Africa 10 to 15 years ago. However, despite the fact that Africa continues to be the continent with the lowest production of scientific works, the situation has now changed.

In the past five years, no fewer than 500 works from hospital groups and services from across Africa have been published in various national and international journals.

A large part of this effort has been channeled through specialist African journals, such as the *South African Medical Journal*, the *African Journal of Medicine and Medical Sciences*, the *Annals of African Medicine*, the *South African Journal of Child Health*, the *Nigerian Journal of Medicine*, the *Tunisian Journal of Medicine*, *Tropical Doctor*, etc. and have gone practically unnoticed by the international community.

However, a considerable number of works have reached renowned international journals including *Ultrasound*, the *Journal of Ultrasound Medicine*, *Ultrasound in Medicine and Biology*, the *British Journal of Obstetric Gynaecology*, *Radiol Technology*, *Prenatal Diagnosis*, *SA Family Practice*, and *Tropical Medicine and International Health*, etc. In many cases, the works are signed by African authors who have done the fieldwork, but also by their European or American ‘tutors’ who may have designed the work and aided in its preparation. This has undoubtedly helped them be accepted by the various journals’ committees. The quality of some of the works is really very good.

The themes of these works are disparate but many are publications on embryonic and fetal biometry, establishing

normal growth curves adapted to the African population in question.<sup>10,40,41,42</sup> Other themes include cervical length,<sup>43,44</sup> fetal sex diagnosis<sup>20,45,46</sup> and fetal weight estimation.<sup>42</sup>

Particularly of note are works that attempt to establish the characteristics of routine obstetric ultrasound in Africa, and the cost and effect on perinatal outcome.<sup>47,48</sup> These are randomized and controlled works.

Doppler studies are also slowly beginning to appear, many targeted at the study of middle cerebral artery in eclamptic patients.<sup>49,50</sup>

The countries with the most abundant and standardized scientific production are the Democratic Republic of the Congo, South Africa, Tanzania and Nigeria.

## OBSTETRIC ULTRASOUND SOCIETIES AND SCHOOLS

A number of different ultrasound societies and associations have been created in Africa in recent years, particularly in regard to obstetrics and gynecology. Apart from some considerably active national societies (the South African Society of Ultrasound in Obstetrics and Gynecology, the Egyptian Society of Ultrasound, the Libyan Society of Ultrasound, etc.) a number of different continental and regional societies have been formalized, including the African Society of Radiology (ASR), the Mediterranean and African Society of Ultrasounds, the West African Medical Ultrasound Society, etc.

The African Association of Perinatal Medicine (AAPM) was founded in Barcelona in September 2010 and its first congress is scheduled to be held in Addis Ababa (Ethiopia). The congress is expected to have a vigorous section on fetal ultrasonography.

With respect to obstetrics and gynecology schools of ultrasonography, we should mention the significant work being done by the Ian Donald School of Medical Ultrasound, which runs different-level courses across the whole of the continent. The school, run by two world-renowned ultrasound specialists (Professors Asim Kurjak and Frank Chervenak), has now established branches or delegations in Egypt, Sudan and Tunisia, and is expected to open in other countries in coming years. Each of these branches holds one or various theoretical and practical ultrasound courses a year.<sup>51</sup>

There are other African ultrasound schools as well, including the Kilimanjaro School of Radiology (Tanzania) and the Kigali Health Institute (Rwanda), which organize international training workshops on ultrasonography. The World Federation for Ultrasound in Medicine and Biology (WFUMB) also anticipates creating a training center in Africa in the near future.

Furthermore, various international societies of perinatal medicine (the World Association of Perinatal Medicine, the International Academy of Perinatal Medicine, the International Society of the Fetus as a Patient and, again, the Ian Donald School) together with Matres Mundi have made a great deal of headway in a project to create a mother and child teaching

hospital in Addis Ababa, with a reference school of perinatal medicine that would be the African headquarters of all of these organizations and which would serve as a permanent school of ultrasonography and fetal medicine for the whole of the continent.

## CONCLUSIONS AND RECOMMENDATIONS

1. In Africa, where economic limitations are extreme, prenatal ultrasounds should always be performed under indications, prioritizing suitable use. In this regard, recommendations from the WHO,<sup>52</sup> the American College of Radiologists,<sup>53</sup> the Cochrane Database of Systematic Reviews,<sup>54</sup> and Canada's Guidelines Advisory Committee<sup>55</sup> can be useful. Various research works on the ground agree that routine ultrasound scans do not currently improve perinatal results in Africa.<sup>47,56</sup>
2. Health professionals who perform obstetric ultrasounds should be provided with better theoretical and practical training. Nobody should use an ultrasound machine without the right training. It is therefore urgent to implement permanent ultrasound schools on the ground.
3. Local health authorities must regulate obstetric ultrasound practice (number of scans per pregnancy, scans in line with medical instructions, technique protocols). In the meantime, the continent's scientific societies should issue clear and strict guidelines in this area. Additionally, the accreditation of ultrasound practitioners may be a prerequisite.
4. A health system should be implemented that allows ultrasounds to be extended to rural areas, and at the same time their excessive use in certain urban communities should be curtailed.
5. It is advisable to provide the population and women of reproductive age in particular with objective information about the possibilities and limitations of obstetric ultrasounds, emphasizing the recommended number of scans.
6. Ultrasound scientific societies should take on a bigger role, guiding authorities on the particular features of the prenatal ultrasound scan and keeping an eye on the behavior of their members.

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