

## Editorial

**Improving women's health in low-income and middle-income countries. Part I: challenges and priorities**Giuliano Mariani<sup>a</sup>, Joanna Kasznia-Brown<sup>b</sup>, Diana Paez<sup>c</sup>, Miriam N. Mikhail<sup>d</sup>, Dina H. Salama<sup>e</sup>, Neerja Bhatla<sup>f</sup>, Paola A. Erba<sup>a</sup> and Ravi Kashyap<sup>c,✝</sup>

Nuclear Medicine Communications 2017, 38:1019–1023

<sup>a</sup>Regional Center of Nuclear Medicine, Department of Translational Research and Advanced Technologies in Medicine and Surgery, University of Pisa, Pisa, Italy, <sup>b</sup>Department of Radiology, Taunton and Somerset NHS Foundation Trust, Musgrove Park Hospital, Taunton, UK, <sup>c</sup>Nuclear Medicine and Diagnostic Imaging Section, Department of Nuclear Sciences and Applications, Division of Human Health, International Atomic Energy Agency, Vienna, Austria, <sup>d</sup>Departments of Essential Medicines and Health Products and Public Health Social and Environmental Determinants of Health, World Health Organization, Geneva, Switzerland, <sup>e</sup>National Center for Radiation Research and Technology, Egyptian

Atomic Energy Authority, Cairo, Egypt and <sup>f</sup>Department of Obstetrics and Gynaecology, All India Institute of Medical Sciences, New Delhi, India

Correspondence to Giuliano Mariani, MD, Regional Center of Nuclear Medicine, University of Pisa, Via Roma 67, I-56126 Pisa, Italy  
Tel: + 39 347 050 9632; fax: + 39 050 555 259;  
e-mail: giuliano.mariani@med.unipi.it

✝Deceased.

Received 10 August 2017 Accepted 21 August 2017

Despite considerable progress in the past decades, societies continue to fail to meet the healthcare needs of women at key moments of their lives, particularly in their adolescent years and older age. Global Strategy for Women's and Children's Health was launched by the UN's Secretary General in 2010, and then renewed in 2015 to focus worldwide attention and ensure international commitments and contributions toward improving the existing situation worldwide [1,2].

Especially in low-income and medium-income countries, the challenges exist in female health not only in terms of diseases or conditions specifically affecting the female sex but also general access to healthcare and proper diagnostic imaging. Several key issues justify the importance of imaging in disease management, the influence of sex on the practice of imaging, the importance of women in societies and the continuing efforts of global international organizations, such as the International Atomic Energy Agency and the WHO, geared toward capacity-building in low-income and middle-income countries.

**The current status**

Multiple international programmes and activities, such as the UN Millennium Development Goals (MDGs) [3], Global Strategy for Women's, Children's and Adolescents' Health [2] or WHO Global Action Plan [4], have been launched with the goal of impacting significantly toward improving women's health worldwide. Although the overall pattern is improving, female life expectancy at birth still markedly varies in different regions of the world, reaching 80 years and above in 46 high-income countries, but only averaging less than 58 years in the African region [5]. Furthermore, a disproportionately large number of

deaths occur in low-income countries for women in the younger age groups versus the high-income countries.

Shifts in population dynamics towards a more ageing population create new challenges and greater complexities in the global burden of ill health, including an increase in noncommunicable diseases [6]. Combined cardiovascular disease and stroke, often considered to be a 'male' problem, is the number one killer in women globally, with over 7.5 million deaths reported in 2010 for women older than 60 years of age and cardiovascular diseases accounting for 46% of older women's health issues [5].

The normal life cycle exposes women to multiple risk factors associated with diseases or to socioeconomic conditions leading to diseases later in life. Indeed, many health problems faced by women in their older age are the result of exposure to risk factors in adolescence and adulthood, such as smoking, sedentary lifestyles and unhealthy or insufficient diets.

**Maternal health**

Despite international efforts and implementation of MDGs 4 (reduction in child mortality) and 5 (improving the maternal health), maternal and antenatal death rates are still high, with more than 360 000 maternal and three million estimated annual neonatal deaths worldwide [7–9].

Nearly 800 women died every day in 2013 because of complications during pregnancy and childbirth, 99% of all maternal deaths occurring in developing countries. The global maternal mortality ratio has decreased by almost 50% worldwide between 1990 and 2013 [3,10], however, without reaching the target of MDG 5, that is, 75% reduction in maternal mortality by 2015.

The WHO Millennium Goals Progress Report showed that 36 of 40 countries with the highest maternal mortality rates are in Africa. In sub-Saharan Africa, the

This is an open-access article distributed under the terms of the Creative Commons Attribution-Non Commercial-No Derivatives License 4.0 (CCBY-NC-ND), where it is permissible to download and share the work provided it is properly cited. The work cannot be changed in any way or used commercially without permission from the journal.

maternal mortality risk is 1 : 30 compared with 1 : 5600 in the developed countries [3]. Lack of education and inadequate maternal care are major factors related to poor pregnancy outcomes and high maternal and antenatal mortality [11,12]. Although these causes are, in principle, fully preventable, and reversible, 45–50% of women in Africa do not even have basic antenatal care and 60 million of births occur without any skilled birth attendants [3,10].

Adolescent pregnancy is the leading cause of death in young women (15–19 years old) in low-income countries, contributing towards 15% of total maternal deaths worldwide, but 26% in Africa. Adolescent pregnancy is also linked to unsafe abortion, leads to low weight at birth and to poor health during infancy. Over 2.65 million stillbirths occur per year, many from preventable causes related to poor maternal health and care [12].

The main leading factors for maternal mortality include unsafe abortion, severe bleeding, infections, eclampsia/pre-eclampsia, complications from delivery and, above all, lack of access to healthcare facilities. The WHO Focused Antenatal Care model recommends at least four antenatal care visits for uncomplicated pregnancies, with the first visit starting before 16 weeks of gestation [13,14]. The first visit should take place in the early weeks of pregnancy to confirm the pregnancy and expected delivery time, classify woman for basic antenatal care or care in more specialized centres, and develop a birth and emergency plan. Further visits are centred on assessing the maternal well-being and foetal development.

During pregnancy, ultrasound (US) imaging plays a crucial role in detecting several conditions potentially to life-threatening complications, for example, ectopic pregnancy, multiple gestations, placenta previa, abnormal foetal growth and malposition; these conditions may thus be identified early and appropriately managed. Coupled with accurate gestational dating, US can assist in the management of pregnancies and allow the mother to reach appropriate obstetric care before delivery if a high-risk pregnancy is identified.

Congenital anomalies (2–4% of all births) cause 20–25% of all perinatal deaths and even higher percentages of perinatal morbidity. Routine US provides crucial information for decisions during pregnancy and appropriate treatment at birth, thus reducing perinatal mortality and morbidity.

Abnormal foetal growth is a leading cause of perinatal morbidity and mortality in both developed and developing countries. Growth parameters measured by US early in pregnancy serve as a baseline against which later scans may be compared for foetal growth and health, and facilitate the management of problems arising later in pregnancy. The Cochrane Library reviewed 11 randomized-controlled trials

including 37 505 women for outcome after routine early pregnancy US (before 24 weeks) versus selective US [15]. Routine US improved the early detection of multiple pregnancies and improved gestational dating, thus resulting in fewer inductions for postmaturity.

Whereas in most developed countries US is part of the standard obstetric and gynaecological care that every woman receives to diagnose high-risk conditions (thus allowing for timely treatment/intervention), in developing countries, the availability of US is very limited because of lack of the necessary training and restricted access to expensive equipment.

Introducing US technology to prenatal care should be the main priority of all governments and healthcare organizations worldwide. It is an easy-to-deliver, portable diagnostic examination, which can help to identify pregnancies at risk of adverse outcomes and plan adequate antenatal care and deliveries in hospital settings. It is recommended by the WHO as an optimal way to determine the well-being and development of the baby [13,14].

## Reproductive health

Providing universal access to reproductive healthcare has been recognized by the UN as a priority global health area, included in the MDGs. Women's access to reproductive healthcare is well established in the developed countries. However, in the developing countries, women's health services, particularly sexual and reproductive health services, are often not provided at a level of quality that meets human rights standards [16].

Infertility, or the inability to conceive after a prolonged period of unprotected intercourse, is a critical, but much neglected aspect of reproductive health. This condition affects couples worldwide and causes emotional and psychological distress in both men and women. Many factors – physiological, genetic, environmental and social factors – contribute towards infertility. According to the WHO [5,6,17], infertility resulting from sexually transmitted diseases or reproductive tract infections is particularly high in developing countries in Africa and Latin America. These causes are fully preventable and treatable.

Untreated sexually transmitted infections cause not only infertility and severe complications of pregnancies but also significant morbidity and mortality among young women. In 2013, 60% of new HIV infections in population younger than 25 years occurred in girls and young women [18]. About 70% of cases of cervical cancers worldwide are caused by the human papillomavirus (HPV) and untreated syphilis still causes over 200 000 deaths every year [19].

Clinical history, medical examination, laboratory tests and diagnostic imaging all play a significant role in improving the delivery of sexual and reproductive health.

US examinations enable the assessment of ovaries and the uterine cavity, help to exclude structural and congenital abnormalities and enable monitoring of changes in the ovaries and endometrium during the normal cycle. Hysterosalpingiography aids assessment of the fallopian tubes and the uterine cavity, their structure and patency, which plays an important role in the investigation of infertility and recurrent miscarriages.

### **Noncommunicable diseases**

Wide disparities exist in the three leading causes of death for women of varying age among countries with differing income levels. In the low-income and middle-income countries, infectious diseases are the prevalent cause for children and young adult women, but the prevalence of noncommunicable diseases as leading causes of death in the more advanced age groups is also increasing, related directly to the change in global dynamics and ageing of the human population [6]. On a global scale, ischaemic heart disease, stroke and chronic obstructive pulmonary disease account for 45% of deaths in women older than 60 years old versus 15% caused by cancer in the same age group.

### **Cardiopulmonary diseases**

Cardiovascular disease was traditionally considered to be a 'male' disease, but recent data show that women are affected in the same or even higher proportion than the male population, and noncommunicable disease causes significant mortality and morbidity in the overall population older than 60 years of age. In 2008, 7.5 million women older than 60 years of age died from cardiovascular disease versus 6.6 million men [6].

The situation is also changing in the younger population, with most visible effects in unprivileged countries. In 2012, the most premature deaths from noncommunicable diseases among women aged 30–70 years occurred in low-income and middle-income countries [20].

Other non-sex-specific medical conditions impact significantly on women's health, for example, infectious diseases, chronic obstructive pulmonary disease and mental problems among others. Although diabetes mellitus, a multifaceted disease, is not formally listed among those directly causing most of the deaths in the global statistics, its complications are especially important for infection and cardiovascular disease, therefore being at the base of a non-negligible fraction of the main causes of death listed above.

Diagnostic imaging in general plays some well-defined roles in certain phases of all these conditions, its impact on clinical management being especially important in the case of, for example, ischaemic heart disease. However, the type and modality of application of imaging techniques in women for these diseases do not differ markedly from those utilized generally in men.

### **Osteoporosis**

Poor nutrition in the younger age groups (child and adolescent girls) and during pregnancy leads to a decrease in bone mineral density (BMD) and osteoporosis in older age. Osteoporosis affects an estimated 200 million women worldwide, with approximately one in three women older than 50 years old experiencing an osteoporotic fracture [21]. Especially in low-income and middle-income countries, the consequences of osteoporosis (hip fracture and vertebral fractures) disrupt the woman's ability to maintain well-being from both medical and social points of view. Traditionally, women have provided most of the care in the families; therefore, the consequences and complications of osteoporosis will often increase poverty and decrease the socioeconomic status of the whole family.

Although the causes of osteoporosis vary from country to country and from region to region, India is a paradigmatic example for other sociopolitical scenarios as well. Over 61 million Indians (90% of whom are women) have osteoporosis; globally, Indians have the highest prevalence of osteopenia and, compared with Whites, osteoporotic fractures in the Indian population occur 10–12 years earlier.

In Europe, disability because of osteoporosis is higher than that caused by malignant disease and is comparable to or higher than a variety of noncommunicable diseases, such as rheumatoid arthritis, asthma or heart disease [22]. It constitutes an even more severe problem in low-income and middle-income countries because of the lack of education, poor nutrition and very limited access to treatment and prevention.

BMD is the single best factor for the diagnosis of osteoporosis and for the assessment of potential risk factors for developing osteoporosis, as well as to predict fracture risk and to monitor the efficacy of therapy. Noninvasive tests for measurement of BMD include dual-energy X-ray absorptiometry (DEXA), quantitative ultrasound (QUS) and quantitative computed tomography (CT) at different skeletal sites.

DEXA currently constitutes the 'gold standard' for measuring BMD, most commonly at 'central' or 'axial' skeletal sites (spine and hip); BMD can also be measured by DEXA at the forearm and in the total body.

Dedicated machines for peripheral quantitative CT at selected skeletal sites provide accurate data on total, cortical and cancellous BMD, thus investigating the architecture/microstructure of bone. In contrast to DEXA, peripheral quantitative CT measures a volumetric density, and is therefore not affected by bone size.

QUS is performed with equipment that can be transported at distant locations and operated by skilled, but not highly specialized personnel; this is an advantage for implementing screening programmes for women living in remote, rural areas. Although QUS has a high negative

predictive value for osteopenia/osteoporosis, reduced BMD values at QUS require confirmation with DEXA. Thus, QUS (a cheaper and more accessible technique) would be useful for mass screening to identify individuals with possible osteopenia/osteoporosis, to be further evaluated with DEXA.

### **Cancers**

Women's cancers result in high rates of mortality and morbidity, especially in low-income and middle-income countries. The most frequent cancers affect the breast and cervix for women living in low-income countries; the breast, the cervix and lungs (including the trachea and bronchus) in middle-income countries, and the breast and lungs in high-income countries. Major inequalities in access to early detection and screening lead to large variations in clinical outcomes and survival after treatment [23].

#### **Breast cancer**

Breast cancer, the leading cause of deaths from cancer in women (1.7 million new cases and 0.5 million deaths in 2012), is diagnosed in low-income and middle-income countries mostly at advanced stages, when palliative care is the only option [24,25]. Therefore, the 5-year survival differs markedly in different regions of the world, declining from more than 80% in North America and Sweden to ~60% in middle-income countries, and less than 40% in low-income countries [26].

The incidence of breast cancer increases with age, affecting one in every 2525 women at the age of 30 years, but one every 10 women at the age of 80 years. There is an alarming increase in incidence worldwide not only because of increased detection/reporting, but because of an actual increase in incidence (by about 30–40% from the 1970s to the 1990s), including more advanced stages. In the USA, breast cancer incidence (97/100 000 in white women) is over three-fold higher than that in Asian countries (27/100 000).

The imaging modalities available for screening purposes (i.e. for examining 'apparently' healthy individuals in certain risk groups to identify a disease in an early, asymptomatic stage) or for diagnostic purposes (i.e. patients with symptoms or individuals with some abnormality detected during screening) include X-ray mammography (digital mammography in most instances, in some cases complemented by computer-aided diagnosis), US, mammoscintigraphy, MRI, CT and galactography. The subsequent step towards correctly diagnosing a breast lesion is usually cytology or biopsy, generally aided by imaging as in US-guided fine-needle cytology, US-guided core biopsy, stereotactic core biopsy and needle placement for excisional biopsy. An efficient breast-screening unit cannot rely on a single imaging modality, but rather on the possibility of integrating during a single session the basic procedure (e.g. mammography) with other complementary procedures (e.g. US).

#### **Gynaecological cancers**

Approximately 85% of deaths because of cervical cancer occur in low-income and middle-income countries, where women have limited access to screening and treatment of premalignant lesions, which results in diagnosis at very late, advanced stages [25,26].

Cervical cancer is the second most common cancer in women, with ~530 000 new cases and more than 270 000 deaths every year [26]. The marked prevalence of cervical cancer (with the associated deaths) in low-income and middle-income countries can be explained by considering that in most instances, cervical cancer is linked to HPV infection, highly transmissible through sexual intercourse. Challenges to be faced to improve the current situation in low-income countries include very limited access to screening, inadequate education and a high rate of sexually transmitted diseases. In developed countries, the prevention procedures and vaccination against HPV infection play a crucial role in reducing the incidence of cervical cancer in the long term [27].

The impact of imaging on the clinical management of these malignancies varies according to the specific type of cancer and the stage at which cancer is diagnosed. When cervical and uterine cancers are detected at a relatively early stage, surgery is potentially curative and minor impact is expected from imaging. Ovarian cancer is usually detected in more advanced stages, when imaging has a major impact on risk stratification and choice of treatment.

The first-line approach to diagnosing gynaecological cancer is clinical examination, with colposcopy in selected cases, generally associated with cytological/histological and laboratory tests. Pelvic and abdominal lesions are often diagnosed by either transabdominal and/or transvaginal US. Local and general staging is usually based on CT and MRI.

### **Conclusion**

Medical imaging plays a crucial role in all aspects of women's healthcare – preventive, promotive, curative and palliative, with special reference to maternal well-being, reproductive health and noncommunicable diseases.

Providing universal access to affordable, appropriate and quality imaging services with an understanding of the challenges and variety of available resources should become a priority in providing female healthcare in all different Member States.

The International Atomic Energy Agency and other international professional organizations and societies should define guidelines and recommendations to standardize and harmonize the practice of clinical imaging in female healthcare; they should also provide advice on comprehensive education and training programmes, capacity-building, audit, quality control and continuous professional development.

## Acknowledgements

### Conflicts of interest

There are no conflicts of interest.

## References

- 1 United Nations. *Global strategy for women's and children's health*. New York, NY: United Nations; 2010.
- 2 United Nations. *Global strategy for women's, children's and adolescent's health*. New York, NY: United Nations; 2016.
- 3 United Nations. *The Millennium Developmental Goals Report 2015*. New York, NY: United Nations; 2015.
- 4 WHO. *Global action plan for the prevention and control of noncommunicable diseases*. Geneva, Switzerland: World Health Organization; 2013.
- 5 WHO. *Women and health: today's evidence – tomorrow agenda*. Geneva, Switzerland: World Health Organization; 2009.
- 6 WHO. *Global health estimates 2000–2012*. Geneva, Switzerland: World Health Organization; 2014.
- 7 Lozano R, Wang H, Foreman KJ, Rajaratnam JK, Naghavi M, Marcus JR, et al. Progress towards Millennium Development Goals 4 and 5 on maternal and child mortality: an updated systematic analysis. *Lancet* 2011; **378**:1139–1165.
- 8 Liu L, Johnson HL, Cousens S, Perin J, Scott S, Lawn JE, et al. Global, regional and national causes of child mortality: an updated systematic analysis for 2010 with time trends since 2000. *Lancet* 2012; **379**:2151–2161.
- 9 Say L, Chou D, Gemmill A, Tunçalp Ö, Moller AB, Daniels J, et al. Global causes of maternal death: a WHO systematic analysis. *Lancet Glob Health* 2014; **2e**:323–333.
- 10 WHO. *Trends in Maternal Mortality: 1990–2013, WHO, UNICEF, UNFPA and the World Bank estimates*. Geneva, Switzerland: World Health Organization; 2014.
- 11 Campbell OM, Graham WJ. Lancet Maternal Survival Series Steering Group. Strategies for reducing maternal mortality: getting on with what works. *Lancet* 2006; **368**:1284–1299.
- 12 Carroli G, Rooney C, Villar J. How effective is antenatal care in preventing maternal mortality and serious morbidity? an overview of the evidence. *Paediatr Perinatal Epidemiol* 2001; **15 (Suppl 1)**:1–42.
- 13 Provision of Effective Antenatal Care. *Standards for maternal and neonatal care*. Geneva, Switzerland: World Health Organization; 2006.
- 14 Lawn J, Kerber K. *Opportunities for Africa's newborns: practical data, policy and programmatic support for newborn care in Africa*. Geneva, Switzerland: PMNCH (Partnership for Maternal, Newborn and Child Health) and WHO (World Health Organisation); 2006.
- 15 Whitworth M, Bricker L, Neilson JP, Dowswell T. Ultrasound for fetal assessment in early pregnancy. *Cochrane Database Syst Rev* 2010. doi: 10.1002/14651858.pub2.
- 16 Germain A. *Meeting human rights norms for the quality of sexual and reproductive health information and services: discussion paper*. Noordwijk, The Netherlands: UNFPA International Conference on Human Rights; 2013.
- 17 WHO. *The essential interventions, commodities and guidelines for reproductive, maternal, newborn and child health*. Geneva, Switzerland: PMNCH (Partnership for Maternal, Newborn and Child Health) and WHO (World Health Organization); 2014.
- 18 United Nations. *Joint UN Programme on HIV/AIDS, Global Report 2012*. New York, NY: United Nations; 2012.
- 19 WHO. *Global Incidence and prevalence of selected curable sexually transmitted infections*. Geneva, Switzerland: World Health Organization; 2012.
- 20 AbouZahr C. *Trends and projections in mortality and morbidity*. Mexico City: Experts Meeting on Women's Health – Rights, Empowerment and Social Determinants; 2013.
- 21 Kanis JA. *WHO technical report*. Sheffield, UK: University of Sheffield; 2007. p. 66.
- 22 Johnell O, Kanis JA. An estimate of the worldwide prevalence and disability associated with osteoporotic fractures. *Osteoporos Int* 2006; **17**:1726–1733.
- 23 Temmerman M, Khosla R, Laski L, Mathews Z, Say L. Women and health working group for the global strategy for women's, children's and adolescents' health. Women's health priorities and interventions. *BMJ* 2015; **351**:h4147.
- 24 WHO. *Breast cancer: prevention and control*. Geneva, Switzerland: World Health Organization; 2011.
- 25 Forouzanfar MH, Foreman KJ, Delossantos AM, Lozano R, Lopez AD, Murray CJ, et al. Breast and cervical cancer in 187 countries between 1980 and 2010: a systematic analysis. *Lancet* 2011; **378**:1461–1484.
- 26 Coleman MP, Quaresma M, Berrino F, Lutz JM, De Angelis R, Capocaccia R, et al. Cancer survival in five continents: a worldwide population-based study (CONCORD). *Lancet Oncol* 2008; **9**:730–756.
- 27 WHO. *Human papillomavirus (HPV) and cervical cancer*. Geneva, Switzerland: World Health Organization; 2013.