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Abstract: Millennium Development Goal (MDG) 5, with its target of reducing maternal mortality by 75%, was not achieved. High numbers of maternal deaths and morbidities persist in spite of considerable progress in the coverage of maternity services. This mismatch between burden and coverage exposes a crucial gap in quality of care. In parallel, there are millions of pregnant women and adolescent girls who are outside the health system - left behind from the progress in coverage. This vulnerable population faces multiple challenges arising from their own individual circumstances of poverty, illiteracy, ethnicity, social and/or physical exclusion and dislocation, including in fragile, remote settings or conflict zones. Poor quality care and inaccessible care exist everywhere, affecting people in all countries, whether low, middle or high-income.

Maternal health is a determinant of the health of women, newborns, children and adolescents. Accelerating progress requires immediate and sustained action. What steps can we take in the next five years to catalyze action toward achieving the Sustainable Development Goal of less than 70 maternal deaths per 100,000 live births by 2030, with no single country exceeding 140? What steps can we take to ensure that high quality maternal health care is prioritized for every woman everywhere, supporting the vision of the Global Strategy for Women's, Children's and Adolescent Health? This paper addresses these questions.
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This paper calls on all stakeholders to work together in securing a healthy, prosperous future for every woman, everywhere. National and local governments must be supported by development partners, civil society and the private sector in leading efforts to improve maternal health. This means dedicating needed policies and resources, and sustaining implementation to address the many factors influencing

maternal healthcare provision and use. Drawing on the findings of this series, the following priority actions emerge for all partners:

Priority 1: Prioritise quality maternal health services that respond to the local specificities of need, and meet emerging challenges
Priority 2: Promote equity through universal coverage of maternal health services
Priority 3: Increase the resilience and strength of health systems
Priority 4: Accelerate progress through evidence, advocacy, and accountability.

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Quality maternity care for every woman, everywhere: A call to action

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Authors' contributions

MK conceptualized the paper and worked closely with CAM, SH, AL, AF, LH, NK, ACM, CC and OC on the first draft. CAM provided valuable editorial and technical inputs; LM helped with conceptualization of the priorities and editorial support; and OC and CC provided continuous support, both editorial and technical. All authors contributed draft sections of the paper, provided input to its overall direction and content, and reviewed each draft of the paper.

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Introduction (5658 words)

Globally, the maternal mortality ratio (MMR) nearly halved between 1990 and 2015. Progress, however, was patchy, with only nine countries with an MMR greater than 100 in 1990 achieving Millennium Development Goal 5a of 75% reduction.[1] Twenty-six countries made "no progress", and in 12 countries – including the United States –MMRs increased.[1] A woman's lifetime risk of dying as a result of pregnancy and childbirth is more than 100 times higher in sub-Saharan Africa than in high-income countries (HICs).[1]

This high burden of maternal mortality and morbidity[2] continues despite considerable progress in coverage of maternity services. Three-quarters of women now deliver with a skilled birth attendant (SBA) and two-thirds receive at least four antenatal care (ANC) visits. This mismatch between burden and coverage implies a crucial gap in quality of care. Millions of women receive services that are delayed, inadequate, unnecessary or harmful,[2-4] thus undermining the opportunity for health gains for mothers and babies.

In parallel to women accessing services but receiving poor quality care, millions of women who undertake their journey through pregnancy and childbirth outside the health system are *left behind* from the progress in coverage. These women without care represent a vulnerable population facing multiple challenges arising from their own individual circumstances of poverty, illiteracy, ethnicity, social and/or physical exclusion and dislocation, including in fragile, remote settings or conflict zones.

The dual streams of poor quality or no care exist everywhere – a universality that spans low-, middle- and high-income countries. Every woman everywhere has a right to access quality maternity services, a right stipulated under the Convention on the Elimination of All Forms of Discrimination against Women.[5] However, statistics show a marked and growing divergence within and between countries in women receiving this entitlement, mirrored by a doubling of the gap in levels of maternal mortality in the past 20 years. Graham and colleagues[6] document this divergence in health outcomes, and highlight the challenge of matching diverse needs for care across diverse settings for every woman.

In the next five years, how can we catalyze action toward achieving the Sustainable Development Goal (SDG) of a global MMR of less than 70 maternal deaths per 100,000 live births by 2030, with no single country having an MMR greater than 140? Quality maternal care is a determinant of the health of all women, newborns, children and adolescents. Supporting the UN Secretary-General's *Global Strategy for Women's, Children's and Adolescents' Health*, we call on all local, national, regional and global stakeholders to commit to meaningfully addressing the priorities presented in Box 1.

Each priority is predicated on addressing key lessons articulated in the Series' papers.

The priority actions, while focused primarily on maternal health, will directly benefit fetal, newborn and child health, given the inextricable link between mothers and their babies during pregnancy, childbirth, and the post-partum period.

Priority 1: Prioritise quality maternal health services that respond to the local specificities of need and meet emerging challenges

Priority Action 1.1: Ensure timely, equitable, respectful, evidence-based and safe maternal health care, delivered through context-appropriate implementation strategies

Souza's obstetric transition concept[7] applies a variant of the epidemiological transition to maternal health that helps determine locally appropriate intervention priorities. It comprises five phases from high fertility and maternal mortality to low fertility and mortality (Table 1). Across settings with MMRs corresponding to stages I-III (MMR>70), gaps in access remain, and direct causes of maternal death predominate although indirect causes are emerging. In middle- and high-income countries (MICs, HICs) with MMRs<70 (stages IV and V), nearly all women access services and indirect causes of death are substantial.

In all stages, "effective quality coverage" is the goal: the right care tailored to the local burden of illness received by the right people at the right time in a respectful manner.[3, 6] Where women reach maternity care services, timeliness, quality and over-intervention need to be addressed.[2, 4] For vulnerable populations in any stage, high effective coverage for relatively simple interventions (e.g. use of appropriate uterotonic drugs for prevention of postpartum hemorrhage,[8] antibiotics for sepsis, and preventive interventions for anemia[9]) could dramatically decrease maternal deaths.[10, 11,12] In later stages of the obstetric transition, routine labor augmentation[13] and excessive caesarean delivery[14-17] emerge as negative unintended consequences of wide access to facility delivery.[2, 4] An effective national strategy needs to include attention to iatrogenic outcomes arising from poor quality care and over-intervention.[2, 4]

There is sound evidence regarding the recommended content of care and guidelines for implementation throughout the pregnancy-post-partum continuum.[2-4, 18, 19] Adherence to high-quality clinical practice guidelines, when combined with simulation-based training, can help providers improve knowledge, clinical skills, and attitudes.[20] Underlying poor quality of care however, is the shortage of qualified health workers (quantified below), particularly in low-income countries (LICs). Growing the workforce in a short time is a major challenge, although there have been some successes.[3]

While global recommendations for the content of care may be valuable, it is less appropriate to rely on standardized global prescriptions for an implementation strategy

given the variation in context, resources and need.[3] Both health systems and maternity care models vary within and between countries, making it clear there is no simple "one-size-fits-all" solution. Providing maternity care in a given setting is, in part, a function of available resources and existing infrastructure, including the private sector, human resources, and factors such as geography, population density, facility density and capability, and distance between peripheral and referral centers.[3] Even so, we know that countries with the lowest clinical intervention rates, best outcomes and lowest costs have integrated midwifery-led care through different models including: team-based care in maternity wards, low-risk units alongside full-scope maternity hospitals and freestanding/home-based midwifery.[4]

Despite the diversity in provision of care, the starting point in working toward models of care that ensure that every woman, everywhere, delivers in a safe environment, is the same for all countries. We believe each country needs a clear national statement of what constitutes routine care for uncomplicated deliveries, of the mechanisms to respond on a timely basis for complicated deliveries, including referral linkages, and to critically compare this with their present situation using tools such as facility surveys, or routine information systems, such as DHIS2. (See Supplementary Figure 1 for priority actions to improve facility capabilities.)

Priority Action 1.2: Build linkages within and between maternal and other health care services to address the increasing diversity of the burden of poor maternal health

Although effective interventions for direct causes of maternal death are now well-known, achieving better outcomes globally requires approaches to address the increasing burden of indirect causes of maternal morbidity and mortality.[6] This involves integration with other facets of the health system.

In much of sub-Saharan Africa, infectious diseases, such as malaria and HIV, are taking their toll on maternal health.[11, 21, 22] In settings with a lower burden of these infectious diseases or fewer deaths due to traditional direct causes, mental health and non-communicable diseases (NCDs) are more prominent morbidities, including complications related to aging mothers and obesity.[4, 6, 23]

In these contexts, effectiveness of maternity services will increasingly depend on integration within and across health care services and linkages between levels of care. What this approach may look like will vary by context. In many low-income, high-burden settings, some of these services are unavailable, and funding and programming silos may fragment those that are: HIV/AIDS, tuberculosis and malaria obtain separate resources and may not be effectively linked with maternity services.[24]

A substantial patient-safety literature identifies movement between services as a critical point when care breaks down. For example, anti-retroviral therapy protocols for HIV+ women identified via ANC screening had to be adapted to require fewer visits to ensure high coverage of prevention of mother-to-child transmission in the limited time-window before delivery.[25] The availability of new interventions in general (e.g. screening tests, vaccines, high-tech medicine, and m-health or telemedicine) can provide solutions, but can also pose challenges for maintaining equity, particularly if costly.

Local empirical studies are needed to collect basic descriptive data and assess approaches for integrating maternal health care and services for NCDs, infectious diseases and mental health. Implications on staff workload, skill mix and service quality, not only of nurses and midwives but also of laboratory technicians, community health workers and supply chain managers, among others, also need assessing. Pre-service training curricula need to be strengthened to ensure clinicians' skills in the management of women with co-morbidities, and that CPGs for such are available and followed.[2] Essential drug lists will need to be expanded to include those for indirect morbidities.

Priority 2: Promote equity through universal coverage of maternal health services

Priority Action 2.1: Guarantee access to quality delivery care and other maternity services for the most vulnerable women

99 percent of maternal deaths take place in LMICs. Despite global gains in coverage of maternity services in the past 15 years, there has only been a 10 percent or less gain across the 75 countries that bear the world's burden of maternal, newborn and child deaths.[26]

Women everywhere – LICs, MICs, and HICs-- are vulnerable to exclusion from services for a variety of reasons. In Guatemala, for example, only 36% of indigenous women have institutional deliveries as compared to 73% of their Spanish-speaking *ladina* counterparts.[27] Social stigma against HIV positive women may also drive them away from use of maternity services.[28] Younger women in particular, risk exclusion. The prevalence of early marriage in 51 countries is more than 25 percent[29] and early marriage is a direct determinant of adolescent pregnancy: nine out of 10 adolescent births take place within early marriage.[30]

Women may decline to seek care for numerous reasons, including perceived poor quality care, cultural factors (e.g., lack of autonomy in decision-making, restrictions on movement outside the home, illiteracy) and financial constraints.[31-39] Some barriers may be specific to certain groups of vulnerable women, including adolescents, for example stigma, fear of judgmental treatment, discrimination, lack of confidentiality, and lack of husband's or parental consent.[40]

The challenges of mitigating financial barriers to access and increasing financial protection for pregnant and postpartum women, especially amongst the most vulnerable, deserve priority attention in the near term. Research continues to link poverty and affordability to lack of uptake,[41-43] as women and families must weigh the direct charges associated with the care they want alongside the indirect costs of transportation, medications, and time away from home and work, among others. Poor sub-populations in LMICs still face catastrophic expenditures due to emergency obstetric care. For example, in parts of Mali, more than 50% of households needing emergency obstetric care incurred catastrophic expenditures.[44] Continuing to establish risk-pooling mechanisms that reduce reliance on out-of-pocket spending curbs catastrophic health expenditures in the near- and long-term.

Many countries have explored innovative financing interventions over the last decade. A recent systematic review showed health insurance is positively correlated with the use of maternal health services, though available evidence of effects on quality and health outcomes remains inconclusive.[45] Various financing instruments can also be deployed to promote access to ANC and SBA: cash transfers, microcredit, vouchers, and user fee removal.[46-48] To support free healthcare policies, however, additional investment in pay and recruitment may be needed, including pay increases for more demanding workloads.[87,98,122]

As we move into the SDG era, there is growing demand for universal health coverage including financial risk protection.[49] Every UHC initiative should include a strong maternal health service core and ensure that quality care reaches every woman, everywhere without causing financial hardship. UHC can also benefit pregnant women by expanding access to care for NCDs, infections and other illnesses during pregnancy, childbirth, and postpartum as well as promoting better health before pregnancy.[61]

But financial access is only part of the answer; for other barriers there is less documentation of successful approaches. Solutions include culturally-adapted and humanized services targeted at women, communities and providers to increase demand.[50] Access to basic information is essential to promote agency and empower women to improve their own health and survival. On a limited scale, culturally appropriate messages shared through mass media, interpersonal counseling, and women's groups have improved use of facilities for birth, referral for complications, traditional birth attendant care practices during home births, and reduced maternal morbidities, stillbirths and perinatal mortality.[51-55] Messages are more effective when involving problem solving[56, 57] and participatory community engagement.[58,56, 59]

At least one meta-analysis shows that improving women's uptake of care through improved knowledge and self-care is insufficient: women involved in designing and implementing interventions however, did improve healthcare use.[60] Primary health care

systems in Venezuela and Brazil incorporate community members in their decision-making through local councils and committees.[61] Such initiatives are promising and could improve use of maternal care in both LMICs and HICs.[62]

Women in remote rural areas have further challenges in accessing good-quality services: they are significantly less likely than their urban counterparts to seek facility delivery.[63] Rural residence brings the obvious challenge of greater distance to hospitals. Solutions to improve access may include linking women to delivery services during antenatal care, providing maternity waiting homes to bring women closer to services before labour begins, and improved subsidized transport, including for emergencies.[3] Remoteness is also a proxy for other factors related to underutilization (e.g., poverty, lower educational attainment, ethnicity), solutions for which are discussed above.[63]

Priority 3: Increase the resilience and strength of health systems

Priority Action 3.1: Address persistent and emerging needs at scale and with quality care by optimizing the health workforce and improving facility capability

Given unserved populations and changing and diverging maternal health needs, it is urgent to increase the resilience and strength of national health systems to respond at scale with quality care and in a sustainable manner. Resilience demands the development of mechanisms to ensure essential health services are delivered regardless of the stress on the system, and must include the capacity to address the special needs of women, adolescents and newborns,[64,67] even as those needs change with outbreaks such as Ebola or Zika. At minimum, building resilient and strong health systems requires an emphasis on optimizing the health workforce and improving facility capability.

Human resources are a glaring challenge in health systems in all countries, especially LMICs. The numbers of skilled health professionals (i.e. midwives, nurses and physicians, and also anesthetists), their composition, deployment, retention and productivity are dynamic yet crucial variables in ensuring universal access to sexual, reproductive, maternal, newborn health.[65]

Analyses by WHO and the Global Health Workforce Alliance estimated a deficit of 7.2 million skilled health professionals in 2012, projected to rise above 10 million by 2030.[66] Eighty-three countries report a density of skilled health professionals below a suggested minimal threshold of 23 per 10,000 population.[67] Even in countries with provider-to-population ratios trending in the right direction, the geographical distribution of providers across urban and rural areas remains a challenge.[68] In Bangladesh, the national density of physicians is 4 per 10,000 population, however regional ratios range from 1 to 11.[67] In Brazil, the national average distribution of physicians is 19 per 10,000 population, while regions range from 7 to 41.[67]

Figure 1 focuses on providers of maternity care, and presents data from the 2014 State of the World's Midwifery Report using the number of pregnancies in African countries in 2012,[69] compared with the ratios of practicing midwives / auxiliary midwives / nurse-midwives and obstetrician/ gynaecologists to the number of pregnancies. It illustrates that countries with the largest numbers of births (e.g. Democratic Republic of Congo, Tanzania, Kenya and Ethiopia) have some of the lowest densities of midwives and obstetricians (<2 per 1000 pregnancies). Disparities in coverage would undoubtedly be seen for rural/urban locations, were such data available. Although countries are urbanizing, in 2050, two-fifths of births globally will still be rural.[61]

A WHO framework (Supplemental Figure 2) illustrates the supply, demand and contextual factors for human resources. It incorporates existing WHO guidelines and wider peer-reviewed evidence on related policy instruments (e.g. education, migration, retention, and HRH information systems). This approach has been adapted for the specific needs of maternity services in a UNFPA Handbook.[70]

An adequate health workforce is a starting point for improving facility capability, but such improvement also requires candid recognition that the designated level of a facility (e.g. health centre or hospital or BEmOC or CEmOC) may not correspond to its capability to provide routine or emergency obstetric care. Facility survey assessment tools (e.g., AMDD needs assessment[71]) can determine what facilities can provide by capturing appropriate infrastructure, staff, supplies, and equipment available.[72] For facilities only capable of routine delivery, there need to be appropriate means and protocols in place to ensure timely effective referral to higher-level facilities (e.g. transport, communications and procedures). To gain a full picture requires facility assessments be conducted in a census or representative sample of facilities, across both public and private sectors.

Priority action 3.2: Guarantee sustainable financing

The investment case for health financing, and in particular for investing in the health and education of women, has been clearly made by a Lancet Commission, WHO, and others.[73-76] Additional investments in high maternal and child mortality countries would yield high rates of return, producing up to 'nine times the economic and social benefit by 2035'.[76] Yet a very real resource gap remains.[77] Over the 2013-2035 time-frame, Stenberg et al project that US$ 72.1 billion additional investment is needed to achieve high coverage of an essential package of maternal and newborn health services.[76] How then can the global community translate potential long-term investment returns into concrete next steps that will improve maternal health over the next five years?

Capturing expanded domestic fiscal space for maternal health

Kruk et al. (2016)[61] highlight that the economic transition in LMICs can increase the domestic fiscal space for health. However, 10 years after the last Lancet series paper on financing for maternal health,[78] concern remains as to whether the maternal health financing gaps can be filled with domestic resources. Nandakumar et al[79] have shown that between 1995 and 2011, as countries transitioned from low to lower middle-income status and donor spending declined, governments did not step in to fill the gap. Indeed, the authors identified an increase in the share of out-of-pocket spending and other private sources of financing for health. Another analysis finds that while government spending on health in HICs rises commensurate with GDP growth, in LICs each percentage point increase in economic growth is associated with only half a percentage point growth in government spending on health.[80] A recent analysis echoed these concerns, projecting that between 2013 to 2040, only 3% of LICs and 37% of MICs are likely to reach the goal of 5% GDP of government health spending by 2040. [81]

Given this concern, greater coordination and investment in national advocacy is needed to support governments to build and sustain health investments. Advocates should leverage the consensus statement on domestic resource mobilization that emerged from the 2015 Conference on Financing for Development in Addis Ababa to campaign for improvements in country tax policy and tax administration. Some options to explore include sales taxes on alcohol and tobacco, tourist taxes, and redirecting fossil fuel subsidies to health.

Deploying coordinated, targeted donor assistance for vulnerable populations

Development aid for maternal health has increased annually since 2003,[82, 83 81]which is reassuring in the face of the decline in overall development assistance. But continued donor support for maternal health interventions is most critical where need cannot be met via domestic resources, such as in vulnerable populations where location and individual's characteristics stack against sub-groups of women.[6]

As Kruk and colleagues note (2016),[61] new initiatives are proliferating to maintain momentum for RMNCAH in the SDG era. For example, the Global Financing Facility (GFF) was launched in July 2015 to increase, coordinate, and better target donor and domestic funding for women's, children's and adolescents' health in support of the 2030 SDGs.[77] Still, some development players remain skeptical, citing concerns that the GFF will further fragment the global system and undermine the position of UN agencies to improve RMNCAH.[84] Moreover, it is not clear whether and how such mechanisms will reach the super-vulnerable within countries. The next five years will be critical for the GFF to demonstrate its capacity to raise national health resources and effectively improve RMNCAH.

Strategic purchasing and performance-based incentives

Equally important to the mobilization of adequate financial resources for maternal health care is the optimal allocation and efficient use of those resources. As domestic resources increasingly fund maternal health programming, the importance of supporting governments and private financiers to implement strategic purchasing will also grow. Strategic purchasing can be defined as proactively identifying *which* models of care and interventions to invest in (taking into account cost-effectiveness, burden of disease, and population preferences); determining *how* they should be purchased (including contractual mechanisms, pricing, and payment systems); *for whom* they should be purchased (which groups might benefit from subsidies, for instance); and selecting *which health care providers* to purchase services from – ideally those who can provide the highest quality of care most efficiently, whether public or private sector.[85, 86] Not only can this active purchasing approach ensure that scarce resources are allocated appropriately, but – if designed well – the mechanisms for paying providers can incentivize improvements in performance and quality of care.

Reviews of the effects of financial incentive programs, including performance-based or results-based financing (RBF) and vouchers, on improving the quality and quantity of maternal health service provision suggest these can be successful.[87, 88] However, RBF schemes that reward providers for better outcomes must be thoughtfully designed to avoid unintended consequences. In addition, accurate measurement for accountability in RBF programs is key to its impacts, and as yet such measurement remains challenging in many LMIC settings, particularly regarding equity. Nonetheless, in the next five years, particular attention should be paid to intelligently incorporating performance elements to provider payment systems to improve the efficiency and effectiveness of resource use for maternal health services.

Private-sector providers form a significant part of health systems in most countries, and are currently responsible for one of every five deliveries across 57 LMICs,[89] and the majority of care in some settings. Leveraging the power of the private health sector to deliver maternal health services efficiently and effectively is another critical component of strategic purchasing, through approaches such as contracting and social franchising. Contracts set clear expectations for providers and tie payments to achievement of predefined objectives.[90] As the utilization of private providers for maternal health services grows,[91] contracts between government payment agencies (such as national health insurance schemes) and private providers will be an important component of the toolkit for promoting quality and access.[92] Franchising has the potential to improve quality and maternal health outcomes in the private sector, but the evidence base is weak.[91, 93]

Priority Action 3.3: Strengthen leadership and governance to accelerate progress
Figure 2 schematically represents a Maternal Health Action Plan to accelerate progress toward improved maternal health, emphasizing that sustained efforts must be defined and initiated at local and national levels, and complemented and supported by efforts at the regional and global levels.

National and local stakeholders are best positioned to identify and address key elements of the national and local context to ensure effective maternal healthcare provision for all women, including adolescents. This includes assessing the local burden of disease; current models of care; the private sector's role; provider numbers, skills and working conditions; and the cultural, financial and geographical factors impacting illness, care-seeking, access, and women's perspectives and satisfaction. It also involves setting measurable, costed, time-anchored goals for: human resources; facility capabilities; content, quality and linkages of care provision; and health information systems and data. National and local stakeholders will be instrumental in ensuring that such goals are supported by corresponding national and local budgetary allocations and through collaboration between various levels and sections of government, civil society, private sector, and with other relevant ministries.

At global and regional level, stakeholders will need to advocate for increased attention to maternal health and ensure acknowledgement of women's rights and agency, including women's involvement in their own healthcare. Global stakeholders should encourage a fundamental paradigm shift toward more woman- and family-centred care, including more functional linkages between maternal healthcare services and other aspects of healthcare, such as combining family planning provision during postnatal care visits, or integrating with HIV services.[94] While such linkages are not easy to implement and sustain, and while funding silos are often difficult to bridge, this is precisely what is needed if we are to realize the maximum possible gains for maternal health globally.

Global stakeholders can also be helpful by supporting continued efforts to provide evidence-based clinical practice guidelines specific for LMIC and HIC settings, as well as case studies of program implementation. Finally, global partners can fund research on measurement of maternal outcomes, implementation facilitators for known interventions, and test integration and linkages with others services, all the while being aware that different contexts likely require different implementation strategies.

Priority 4: Accelerate progress through evidence, advocacy, and accountability

Priority Action 4.1: Develop better metrics and support implementation research to promote accountable, evidence-based maternal health care

Research is an essential component of the post-2015 maternal health agenda. Yet research funding is not commensurate with need: only 10% of research addresses problems in LMICs, where 90% of the health burden falls.[95]

Based on recent literature reviews,[96, 97] the five papers in this Series, and in discussion with the Series' authors, we identify two types of research needed to scale up and accelerate progress in maternal health. The first is research on measurement – specifically of the morbidity and mortality burden and causes, vulnerable groups, and indicators to measure progress of policies and promote accountability, health system capability, the content of intrapartum care, and women's satisfaction. Secondly, there is an urgent need for research on the implementation of care at all stages of the obstetric transition (Table 1).

Measurement: redefining maternal health metrics

Improving measurement and coding of maternal mortality and morbidity, including direct and indirect causes and risk factors, is essential to guide intervention research, set implementation priorities, and improve quality of care, particularly for women and babies most at risk. Better measurement will require standardizing definitions and methods of determining and recording direct, indirect, and contributing causes of death, as well as categories of illness and illness severity.[6] In addition, better civil vital registration systems that accurately and comprehensively document pregnancy outcomes – births, stillbirths, neonatal deaths, and maternal deaths[98] – are needed in many LMICs. The Maternal Death Surveillance and Response (MDSR), a global strategy that aims to improve identification of and response to maternal deaths, is a useful start: 92 countries have a national policy regarding maternal death notification, 76 have a national committee to review and respond, and 42 have a national committee that meets at least biannually.[99]

In addition, research that aims to better understand the changing patterns of socio-demographic, obstetric and medical risk factors is needed. What are the best mechanisms for real-time tracking of pregnancies and their outcomes, and how can such mechanisms capture those women who either do not obtain care or seek care outside the formal healthcare system? Addressing such issues will be pivotal in effectively and equitably improving maternal health and the quality of care in the coming years—leaving no one behind.

To measure the burden and the ability of health systems to provide quality maternal health care for all, Table 2 provides examples of indictors that cover a number of

domains. Some are already widely used (e.g. caesarean section rate by wealth quintile); others require development (e.g. percentage of women delivering without obstetric intervention), and standardization (e.g. percentage with a length-of-stay after a singleton vaginal delivery in a facility of 12 or 24 hours). This list is not exhaustive, and has yet to include indicators related to such important issues as delays in treatment, timely referrals, use of financial incentives, women's satisfaction and specific provider skills. Yet a sub-set of these indicators could be used depending on context. For example, in areas with very low coverage of facility delivery (Table 1, Stages I and II with MMR>420), managers could focus on barriers to service use (e.g. social, geographical and financial), while in areas with low maternal mortality (Table 1, Stages IV and V, MMR <70) and high coverage of ANC and SBA, morbidity-related metrics, content of care (under and over intervention) and women's satisfaction would be more important.

Implementation research: maternal health priorities

Implementation research that aims to understand what, why, and how interventions work (or can be improved) in a real world setting requires working with populations affected by the interventions, and with those involved in directing, managing and providing the services.[100] Supplemental Table 1 illustrates our assessment of high priority research areas, categorized by the priority areas identified in this paper.

Bridging the gap between priority identification and the implementation of research projects to address persisting or new maternal health needs requires sustained commitment on the part of national governments, donors, and researchers. National governments – especially in LMICs – need to allocate resources to support not only locally-driven research, but also to build capacity among in-country researchers, including epidemiologists, health system experts and social scientists. Only when in-country researchers have the training to compete for funding successfully and countries allocate resources to support such efforts will research truly reflect the needs of programs in LMICs. At the same time, donors must see the value in – and provide funding for – evidence generation and long-term, data-driven programming that targets vulnerable populations.

Priority Action 4.2: Translate evidence into action through effective advocacy and accountability for maternal health

Data and evidence can help advocacy partners generate political attention for maternal health at sub-national, national, regional and global levels. Investing in effective, joint platforms for action by all stakeholders – governments, donors, multilateral partners, civil society and the private sector – can help mobilize resources, strengthen laws and policies, and promote mutual accountability.

At global level, the *Global Strategy's* "Every Woman Every Child" advocacy platform supports the delivery of the SDGs, by encouraging partners to act together to leverage

financial, policy and service delivery commitments for maternal health and related issues identified by the *Global Strategy*. Partners are further guided by evidence presented in this Lancet series, the 2015 *Ending Preventable Maternal Mortality* (EPMM) plan and the *Every Newborn Action Plan* which highlight the need for effective maternal and newborn advocacy in support of the wider RMNCAH continuum of care.

Regional advocacy plays a vital role in reducing inequities and improving quality of care for women and children. In 2015, Egypt became the 45th member of the African Union since 2009 to become part of the Campaign for the Accelerated Reduction of Maternal Mortality in Africa. CARMMA is a regional initiative of the African Union to accelerate action on maternal, newborn and child health, as identified in the regional Maputo Plan of Action (MPoA) on sexual and reproductive health and rights. CARMMA brings together high-level political champions, including presidents and first ladies, with UN partners faith leaders, NGOs, health professionals and others to champion a joint plan of action tailored to local needs. CARMMA assists partners in using data and evidence for advocacy through its African Health Stats platform, an online data visualisation tool to track and disseminate progress on MPoA and related agreements.

Country scorecards and other data products can also help parliamentarians, media, and civil society track national performance on regional commitments such the 2001Abuja Declaration, committing countries to spending 15% of annual budgets on health by 2015.[101] The Global Health Observatory estimates that in 2013, these countries on average allocated 11.4% of government budgets to health. While less than the Abuja target, it is a significant improvement over 1995 when the average was 3.1%.[102] Whether this has translated into improved maternal health-specific funding in countries remains unclear.

In the transition to this new SDG era, robust national, regional and global advocacy and accountability efforts are needed to ensure women's and children's health retain prominence. In the MDG era, the *Global Strategy's* independent Expert Review Group (iERG) and the *Countdown to 2015* initiative provided periodic, scientifically credible feedback on what needed to be improved and where.[2,107] To support the SDGs, a successor group to the iERG, the Independent Accountability Panel (IAP), will provide evidence on needs and gaps that can be converted into actionable messages by advocacy actors such as the Partnership for Maternal, Newborn & Child Health, Women Deliver, White Ribbon Alliance and others.

Conclusion

This Series, following up on the 2006 Maternal Survival Series, describes, organizes and analyzes a large body of information that, if applied, could improve the health and pregnancy experience of millions of women and save thousands of lives around the world. Based on the hard fought experience working for improvements in maternal health

during the MDG era, it provides a crucial knowledge base to inform actions under the new SDGs over the next five years.

Maternal health strategies need to be responsive to the specific and often rapidly changing population needs as demographics, epidemiology and economies evolve and preferences shift and diversify. This will require unprecedented collaboration with a wide array of partners to improve equitable access to efficient, high-quality, and respectful maternal health care with functioning referral systems. It will require a fundamental paradigm shift toward woman- and family-centred care, with better linkages across RMNCAH and more, as NCDs and other maternal illnesses become apparent.

Crucial to achieving equity in maternal health will be the growing pressure on national and regional governments in even the poorest countries to provide UHC, i.e. high quality services available for every woman, everywhere, with financial protection. Maternal health improvements will influence, and be influenced by, achievements within the wider RMNCAH continuum of care, those working on NCDs, infectious diseases and mental health, and in relation to other SDG targets, from those aimed at ending poverty to those building resilient infrastructure. Finally, as these efforts yield independent, rigorous data, such results can guide national and local governments and global partners in working together to focus on what is needed to reach the SDG target for MMR <70 by 2030 and to attain equitable and accelerated improvement in maternal health.

Box 1: Priorities and priority actions for accelerated progress toward improved maternal health

Priority 1: Prioritise quality maternal health services that respond to the local specificities of need and meet emerging challenges

1.1: Ensure timely, equitable, respectful, evidence-based and safe maternal health care, delivered through context-appropriate implementation strategies
1.2: Build linkages within and between maternal and other health care services to address the increasing diversity of the burden of poor maternal health

Priority 2: Promote equity through universal coverage of maternal health services

2.1: Guarantee access to quality delivery care and other maternity services for the most vulnerable women

Priority 3: Increase the resilience and strength of health systems

3.1: Address persistent and emerging needs at scale and with quality care by optimizing the health workforce and improving facility capability
3.2: Guarantee sustainable financing
3.3: Strengthen leadership and governance to accelerate progress

Priority 4: Accelerate progress through evidence, advocacy, and accountability

4.1: Develop better metrics and support implementation research to promote accountable, evidence-based maternal health care
4.2: Translate evidence into action through effective advocacy and accountability for maternal health

Table 1: Stages in the Obstetric Transition and Corresponding Priority Actions

Stages I and II: MMR > 420	**Stage III:** MMR 70-420	**Stages IV and V:** MMR <70
Prioritize: • Develop infrastructure and human resources, both for frontline and for support • Provide simple preventive interventions, including family planning, bed nets and iron supplementation, and safe abortion • Provide routine maternal health care components (e.g., uterotonics post-delivery) to reduce major direct causes of mortality • Improve service quality with provider training, including respectful treatment of women, ready access to basic equipment and supplies, supportive supervision, and other key supports • Focus on equitable demand creation (UHC)	Assume actions for stages I and II are met, and prioritize: • Improve management of routine delivery and of complications, including a timely referral process • Improve service quality through appropriate integration, especially for infections, malnutrition and mental health, triage and referral • Employ quality of care improvement methods (including clinical practice guidelines), timely data collection and use for decision making and program improvements • Increase demand for services, with specific focus on the vulnerable, through respectful satisfactory care provision based on women's needs and perspectives, and effective use of financial initiatives (UHC),	Assume actions for stages I – III are met, and prioritize: • Improve integration/ linkages with health care for infections, malnutrition, NCDs and mental health • Address between and within-facility delays • Improve quality of care and decrease over-medicalization • Increase satisfaction with care and sense of wellbeing

Table 2: Example of indicators for measuring burden and the ability of health systems to provide quality maternal health care

Domain	Proposed Indicator	Widespread existing experience (Example of existing data source)	Issues
Impact	Pregnancy-related mortality ratio, preferably cause-specific	**Yes** (Vital Registration, US, Mexico[103, 104])	• Captures deaths; need timely, empirically based estimates • Using pregnancy-related definition avoids erratic approach to coincidental deaths
	Risk of severe maternal morbidity	**Yes** (Facility-based (UK)[105] or survey (multi[106]))	• Captures morbidity, broadens focus from mortality
	Percentage of women delivering without obstetric intervention (e.g. caesarean, induction)	**No** (DHS, Brazil & Denmark medical records[107, 108])	• Captures desire to avoiding over-intervention • Multiple versions of indicator exists; needs global consensus on definition
Coverage	Skilled attendant at birth by place of birth (level & sector; and type of provider-midwife, doctor, obstetrician)	**Yes** (Ghana DHS[109])	• Captures contact with person theoretically providing routine care, identification of complications and at least some BEmOC • Need to ascertain what various cadres are trained to do vis-à-vis routine and EmOC
	Uterotonics immediately after birth for prevention of postpartum haemorrhage (among facility births)	**No** (Facility based, Ecuador[110])	• Captures care at the individual level; measures content of routine care of an effective intervention, which has a benchmark of 100% • Very challenging to measure in the absence of good medical records (women's self-report via survey unreliable)
	Percentage with ANC with all essential elements of care	**Yes** (Ghana DHS, Ethiopia, India, Nigeria[109, 111])	• Captures care at the individual-level; moves beyond number/ timing of ANC contacts to assess receipt of effective care • Data to calculate indicator are widely available; essential elements need to be agreed and possibly expanded
	Caesarean section rate, by wealth quintile and/or urban/rural	**Yes** (DHS, multi[112])	• Captures a life-saving intervention for mothers & newborns but since not all women require caesarean, also reflects "too little, too late" & "too much, too soon", and highlights inequitable access
	Met need for family planning	**Yes** (DHS[113,	• Important preventative measure and recognises important of links with other

		[114])	reproductive health services
	Post-natal care visit within 24 hours of delivery (home births) or length of stay for 24 hours with check (facility births)	**Yes** (Countdown, multi[113])	• Captures contact in the immediate postpartum period; for facility delivery, assesses if length of stay sufficient for postnatal checks. For home-births without SBA, assesses coverage of postnatal home visit • Need to standardise the adequate period (12 or 24 hours postnatally); data could be used to calculate total length of stay after vaginal singleton delivery after facility birth
	Percentage of HIV positive pregnant and postpartum women receiving ART	**Yes** (Countdown, multi[113])	• Captures integration of maternal health services with general health services, in this case HIV • Most existing indicators focus on PMTCT, whereas ours emphasises women's own need for access to general health services that continue care beyond pregnancy • Operationalising this indicator, would need decision whether to measure any ARV, or movement long-term treatment for a certain length of time
Systems outputs	"Readiness" of facility with respect to: • Infrastructure (water, electricity, 24/7 opening) • Routine delivery (infection prevention, AMSTL, partograph) • Basic emergency care (antibiotics, uterotonics, $MgSO_4$, manual extraction of placenta, removal of retained products, assisted vaginal delivery) • Comprehensive care (C-section, blood transfusion) • Staffing	**Yes** (Service provision assessment data[3, 115, 116])	• Captures the facility capability to provide routine and emergency care, and is required for the two subsequent indicators • Operationalization requires standardisation across a variety of instruments, including consensus on whether a signal function was performed within a 3 month interval
	Availability of EmONC facilities within two hours	**No** (Ethiopia, Zambia[117, 118])	• Captures geographic access to functional emergency care & bolsters desirability of geo-located facility data, & assessment of facility capability • Experience is growing; best with facility censuses, including private-sector
	Availability of routine delivery facilities within two hours	**No** (Zambia[117])	• Captures routine provision & complements previous indicator at little marginal cost. Has advantage of emphasising access to decent care for all deliveries not just complicated ones
	(Full time equivalence of) Midwives (SBAs) per 100 births	**No** (Sri Lanka[119])	• Captures human resources available; provides a clear understanding of numbers with skills to do effective delivery in relation to numbers of births • Need to develop appropriate benchmarks & expected tasks of SBA

Figure 1: Human Resource Ratios per 1000 Pregnancies, 2012

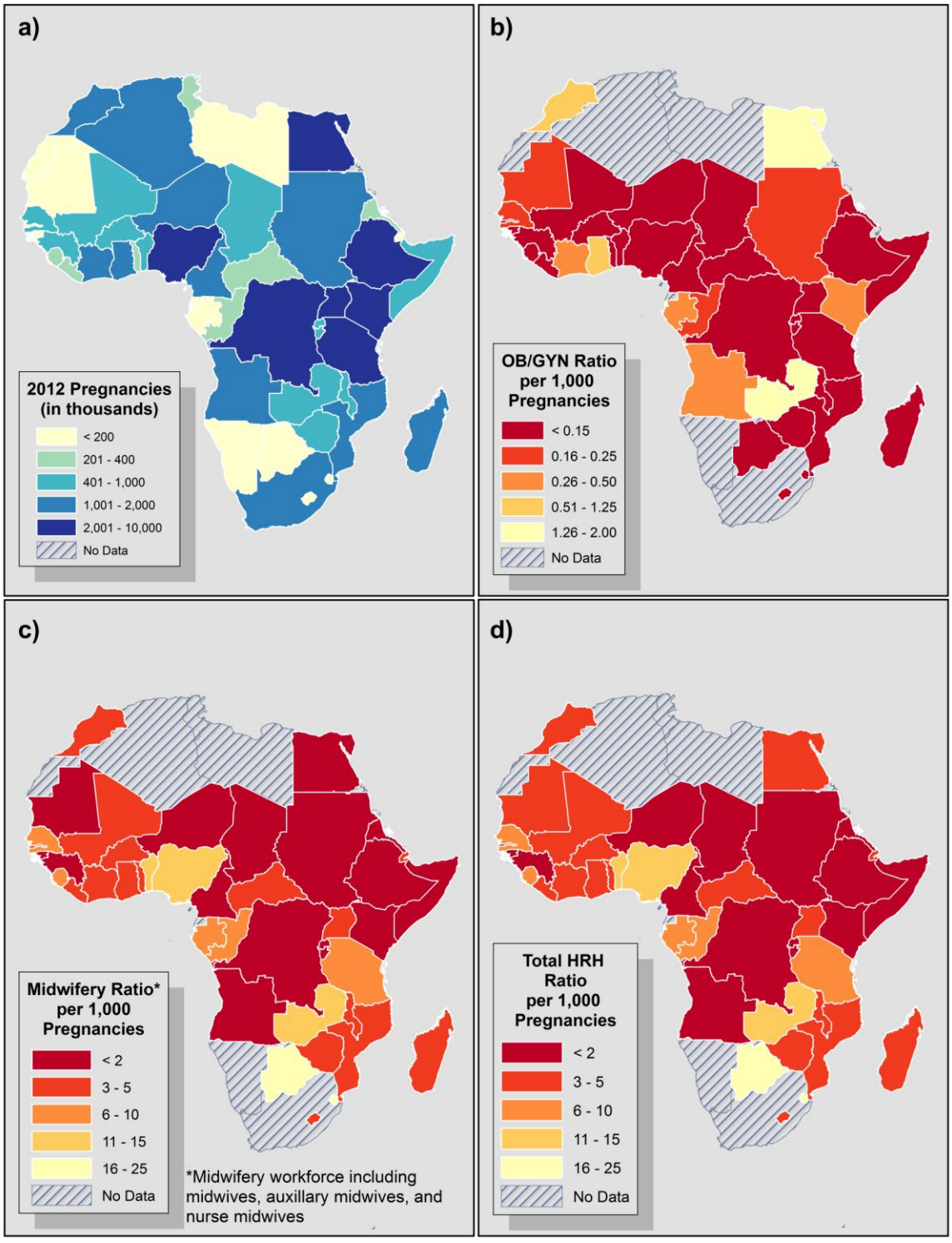
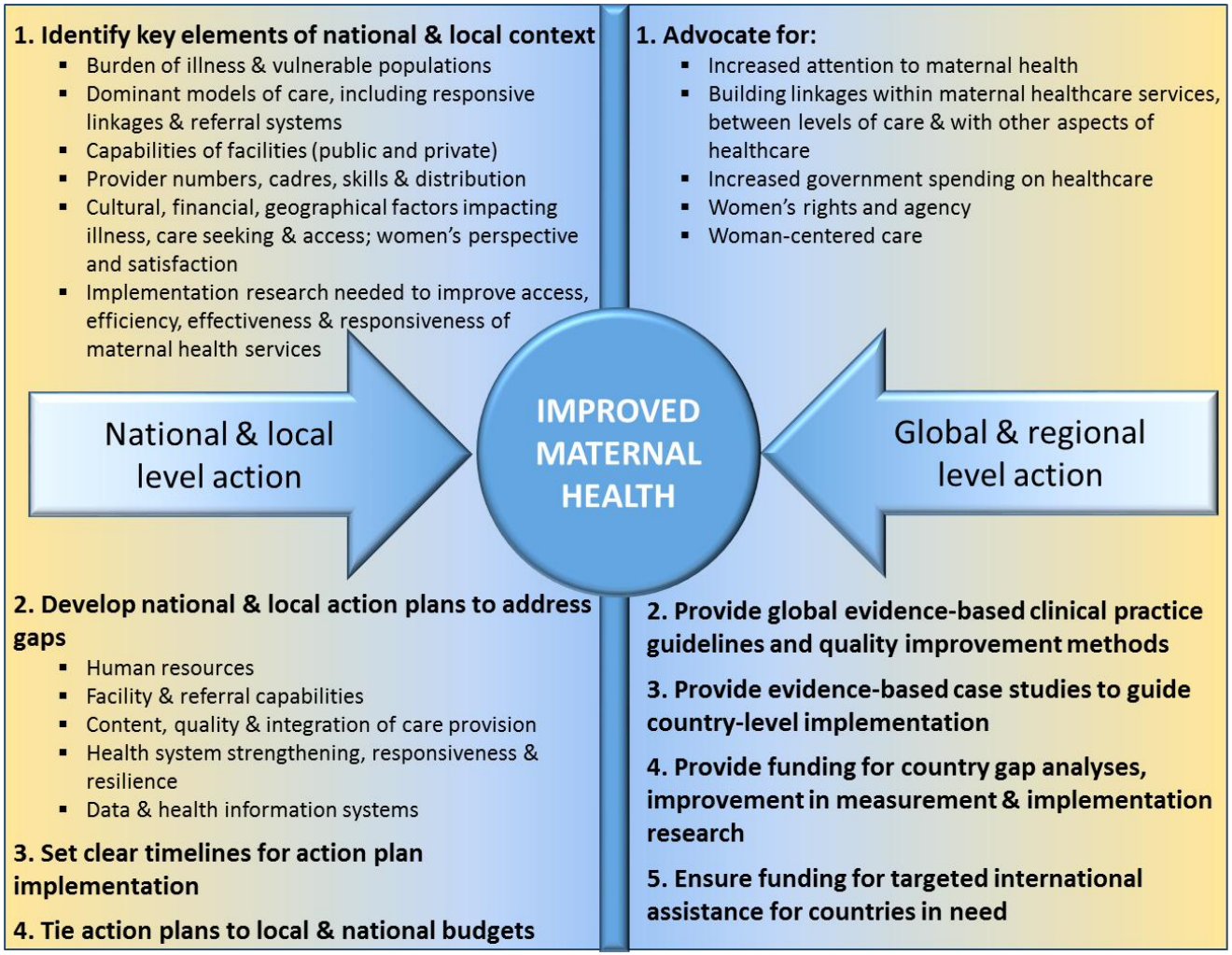


Figure 2: Maternal Action Plan: Accelerating Progress Toward Improved Maternal Health



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SUPPLEMENT:

Supplemental Table 1: Implementation Research Priorities by Priority Area

Priority 1.1: Ensure timely, equitable, respectful, evidence-based and safe maternal health care, delivered through context-appropriate implementation strategies
• With focus on countries with MMR>420, identify and test models of care, to address the direct causes of maternal death. • In countries with MMR between 70 and 420, determine the existing diversity of care needed, and test the facility capability, including referral, to deliver known effective means to prevent and treat the main causes of maternal mortality at scale and in diverse contexts. • In countries with MMR<70, use data to better understand effective models of service provision, avoid over-intervention and waste, reduce women and providers fear, and ensure women's satisfaction • Develop and test means to reduce the response times and delays at the level - of the family, and within and between facilities, including maternity waiting homes and emergency medical services • Implement and test participatory approaches for monitoring and improving quality, including adoption of clinical practice guidelines, and prioritize refinement of quality of care (QOC) indicators and development of user-friendly tools to facilitate data collection, analysis, and use to direct improvements on a timely basis • Develop and test means to limit the unnecessary or inappropriate medical interventions around childbirth, specifically non-medically indicated cesarean section or labor induction, unsafe labor augmentation, routine amniotomy and episiotomy, including by hospital-sited midwifery-led birthing units • Develop and evaluate approaches to prevent disrespect and abuse during maternity care and to increase women's satisfaction with care • Test clinical and technical innovations (e.g., Odon device, NASG, provider aids) to improve maternal health at lower levels of the health system
Priority 1.2: Build linkages within and between maternal and other health care services to address the increasing diversity of the burden of poor maternal health
• Determine the requirements for integrating or linking maternal health services with those addressing NCDs, indirect causes, malnutrition/obesity and mental health among pre-pregnant, pregnant and postpartum women, and among adolescent women • Establish the implications of such integrated services on providers' workload and service quality, as well as on laboratory technicians, community health workers and supply chain managers, among others • Ensure that the research & development agenda includes treatments that are relevant for pregnant and postpartum women; conduct post-marketing surveillance for adverse events • Test means to improve adherence to treatments • Identify and test means of improving women's, family's and providers' perceptions of the conditions and treatments (especially for NCDs and mental health) that impact women's pregnancy and their receptivity to treatment
Priority 2.1: Guarantee access to quality delivery care and other maternity services for the most vulnerable women
• Study the distribution and characteristics of vulnerable groups in specific countries and regions, and document and understand the barriers women face in accessing maternal health care and their perspectives on seeking care • Develop, implement and evaluate approaches and interventions to overcome the identified barriers (e.g., functional referral systems, culturally appropriate services, etc.) • Evaluate the impact of financial mechanisms (e.g., conditional or unconditional cash transfer programmes;) on access to and utilization of care by vulnerable groups; implementation of UHC on use of MH services, including for indirect causes of death/morbidity). • Test innovative models of care to redistribute and reorganize facilities and the health workforce to better meet population needs and increase satisfaction with care • Evaluate how interventions to empower women as health care users and health care providers, affect health system functioning and health outcomes. • Identify mechanisms to improve care-seeking behaviors of pregnant and postpartum women, through increased knowledge, awareness and satisfaction of/with maternal and fetal health and family planning, or through means that draw from behavioral economics, • Develop and evaluate interventions aimed at building capacity of women, families, communities and citizen groups to actively engage with each other, health providers, managers, and policy-makers, and hold health systems accountable • Explore psychological and behavioral factors that affect demand for maternal health services and evaluate the

implementation of behavioral economics strategies for improving use and provision of maternal health care (e.g. reminders, commitment devices, vouchers)

Priority 3.1: Address persistent and emerging needs at scale and with quality care by optimizing the health workforce and improving facility capability

- Test means of scaling up pre-service training to increase numbers of providers quickly, including such means as distance learning or use of mannequins
- Evaluate means of ensuring available skilled care and adequate facility capability for vulnerable populations, including how to site services, both in remote areas and urban slums, to optimize access

Priority 3.2: Guarantee sustainable financing

- Test how financial incentives can be deployed at scale to promote quality, satisfaction, and equity, and ensure better maternal health outcomes result
- Investigate how addressing the growing importance of the indirect causes of maternal death (including malaria, HIV and AIDS, NCDs, and mental health problems) will affect maternal health financing needs in LMICs
- Determine strategies to expand coverage and achieve UHC, including those that address other conditions that impact maternal health (e.g., s NCDs) and reduce the financial burden on families via expansion of insurance or other financial protection schemes

Priority 3.3: Strengthen leadership and governance to accelerate progress

- Identify how governments and private sector can best work together to improve access and quality
- Address better tools to identify vulnerable populations, and the services needed to respond to them
- Develop better planning tools and guidelines, including improved Health Management Information Systems

Priority 4.1: Develop better metrics and support implementation research to promote accountable, evidence-based maternal health care

Measurement

- Support efforts to improve data on numbers and causes of death, with standardized definitions, and their risk factors
- Measure persistent social and economic inequalities (data and indicators beyond economic inequality) to explain variation in quality of care and health outcomes and to track progress in reducing equity gaps.
- Develop mechanisms for improved measurement of the proximal and distal causes of maternal morbidities to set priorities for interventions and improve quality of care, specifically for high-risk groups
- Refine indicators of health service outputs and appropriate benchmarks and minimal thresholds

Implementation Research

- When in pregnancy and postpartum do morbidities occur, what needs to be screened for, and how/where can affected women be treated?
- Identify vulnerable individuals and population groups to provide relevant public health and clinical interventions.
- Develop mechanisms to support small scale locally generated site-specific research including vehicles for sharing and publishing knowledge gained
- For key health systems aspects where the evidence base is not clear fund independent high-quality large scale robust impact evaluation
- Improve data on M-health for implementation and expansion of programs for communities to report on quality of care and build accountability
- Develop platforms and systems which are updated regularly, and are transparent and accessible

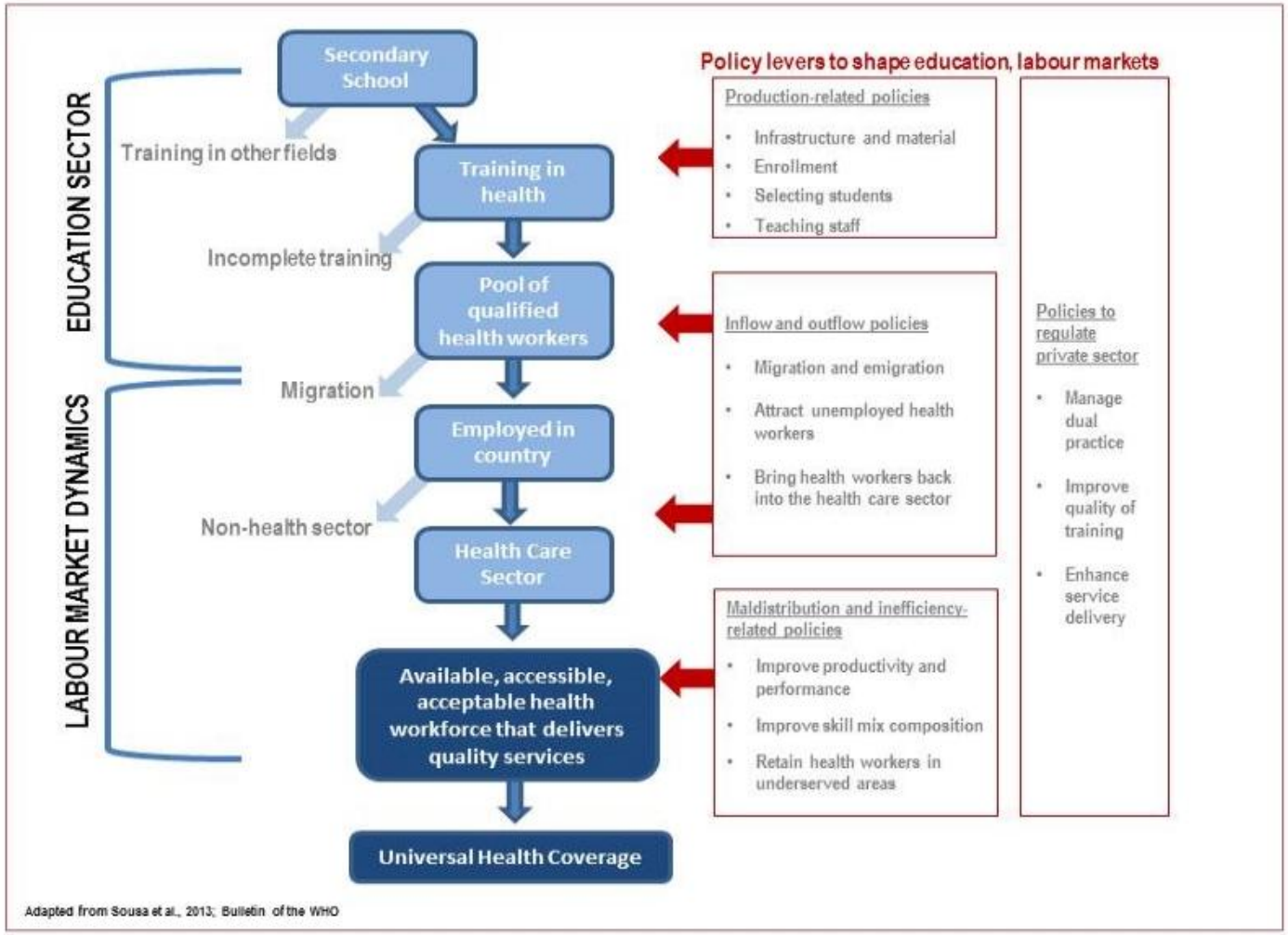
4.2: Translate evidence into action through effective advocacy and accountability for maternal health

- Generate technical knowledge to support policy advocacy to increase the availability, accessibility, acceptability and quality of essential services for maternal health, including contraception and safe abortion services
- Identify the most effective advocacy approaches to ensure that UHC is designed for women and women are included in the design, and that maternal health coverage and impact are included within monitoring frameworks
- Explore the needs and opportunities of LMIC to reach health convergence without outside assistance
- Generate evidence on the contribution of women to achieving the heath and other SDGs
- Test innovative tools for advocacy, for example maps and social media

Supplemental Figure 1: Country Action Steps To Improve Facility Capabilities

1. **Determine actual capability (i.e. facility infrastructure, staffing, equipment and drugs for routine and emergency obstetric and newborn care) of country facilities, regardless of current designation**
2. **Develop a clear national statement of what should constitute first-level care for uncomplicated deliveries, and what mechanisms need to be in place for complicated deliveries**
3. **Bring existing facilities to the desired level of care for routine deliveries (at least BEmOC):**
    a. **Developing long-term plans for human resource development, with targets**
    b. **Budgeting appropriately, including for increased workload, infrastructure and equipment improvements, and drugs and supplies**
4. **Explore options for inter-facility referral and maternity waiting homes for remote regions**

Supplemental Figure 2: WHO framework illustrating human resources for health pathways and associated policy levers



Supplementary Material

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