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Publics, technologies and interventions in reproduction and early life in South Africa

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Despite successful clinical interventions and maternal and child health monitoring for over a century, low and middle-income countries, including South Africa, continue to experience the quadruple burden of disease of high maternal mortality rates and poor infant and child health, non-communicable diseases, infectious diseases, and violence and injury. In this article, we focus on how different kinds of technologies in South Africa are implemented in the ‘first 1000 days’ from conception to early childhood. Some of these interventions, as we discuss, are lifesaving; others are conceptualised as preventing early and longer-term health problems, including cardiometabolic conditions into adulthood and in future generations. Here, we consider the use of routine and specialist technologies in reproduction and early life: scanning and monitoring in pregnancy, caesarean section, extracorporeal membrane oxygenation (ECMO) for very low birth weight infants, and the Road to Health Booklet. Through this focus, we illustrate how ‘publics’ are constituted such that foetal and infant health outcomes are privileged over women’s health, reproductive rights, and public health safety.

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Introduction

Maternal and child health outcomes are sensitive indicators of the provision of health care to women in pregnancy and delivery, including the quality of health services and the capacity of health professionals to provide timely interventions. They also point to the capacity of the state to provide broader structural and infrastructural interventions, insofar as compromised maternal and child health correlate with and are an outcome of poverty, poor infrastructure, and inequality. Conversely, improvements in these respects are reflected in better health outcomes. The decline in infant (i.e. children under one year old) and early childhood deaths from diarrhoeal disease, for instance, is the result of improved water and sanitation as much as timely medical interventions or maternal action to prevent dehydration; the decline in maternal deaths from septicaemia reflects improved quality of care in labour and delivery.

However, two parallel trends illustrate the extent to which states have side-stepped the social and economic determinants of unequal health outcomes, and have opted instead for more focused interventions. One is the continued attraction for clinicians, hospitals and governments of technological interventions to the majority population to reduce the risk of complications, poor outcomes, or untimely death among a minority. As we discuss below, birth interventions are a particular example of this. The other is the emphasis on individual action to ensure positive health outcomes, so deflecting government or professional responsibility by promoting neoliberal ideology. The monitoring of indicators of physical wellbeing as a proxy of behaviour and an indication of future well-being, and the use of expensive interventions to alter short-term medical outcomes with uncertain effects, reflect both the changing nature of medicine, and the changing roles of medical professionals, the state and various publics, including health professionals and reproductive women. We explore these trends through a set of examples of technologies that focus on maternal and infant care, with particular attention to South Africa.

We work with an extended understanding of technology, its employment in preventing and managing disease, and its impacts on wellbeing, social identity and everyday life. In our understanding, technologies are not limited to objects and products, but include also constructs, paradigms and systems, institutions and regulations, protocols and cognitive instrumentation. These technologies have largely been developed in the global north, but they are commonly tested and implemented in the global south. Protocols and screening tools, using height/weight standards for age by sex of child, track child growth and development across nations and regions, drawing attention to the attraction of universal valid tools. In this article, while we often write of technology to refer to hardware—physical items linked to preventive health action, diagnosis, surveillance and treatment—we also include procedures and processes in which such products might feature. Hence we include medical diagnostics that extend into increasingly globalised clinical environments and beyond, and carry from diagnosis of disease to understandings of how, through behaviour and its surveillance, chronic pathologies might be diverted.

Understanding how and why different technologies are used requires attention to the ideological and ideational structures that value specific objects and items; these structures shape how such technologies are introduced in different cultural, institutional and personal settings. We draw on South African policies and practices to illustrate how understandings of risk and its aversion in gestation, infancy and early childhood lead to the use of various technologies in preventive and salvation medicine and in public health. The five technologies we have chosen include paradigms

(as exemplified in policy and research in the first thousand days of life); instruments (ECMO and ultrasounds); practices (medicalised birth, especially relating to caesarean section); and techniques that incorporate all of these (the Road to Health Booklet). All implicate one another or other technologies, and each constitutes its public slightly differently. Some are commonplace in households, hospitals, private and community health clinics, and so are unremarkable, mundane, and taken for granted. Other technologies are exceptional, yet likewise reflect a broader commitment to the use of medical and medicalised interventions to achieve short-term individual health outcomes, long-term public health objectives, and so healthy publics.

Background

Everywhere, life expectancy has increased as a consequence of improved medical diagnostics, effective treatments and preventive medicine, and improved water, sanitation and other public health interventions. However, medical and public health successes of the past century and more, and their contributions to associated increased longevity, are now complicated by changes in economic and physical activity, globalisation, and changes in food systems, which have contributed to the increased incidence of chronic non-communicable conditions including cardiometabolic (diabetes and cardiovascular) diseases. In consequence, in line with preventive medical practice, a growing number of people depend on drugs as they age, with increasing costs to households and the state.

In South Africa, epidemiological changes are complicated by the enduring legacies of apartheid's race-based policies of exclusion; a post-apartheid economy characterised by massive unemployment and under-employment, limited growth and failures of redistribution, and gross inequality; and a quadruple burden of disease of high maternal mortality rates and poor infant and child health, non-communicable diseases, infectious diseases, and violence and injury (Nabukalu et al., 2013; Gouda et al., 2019). Structural inequalities, instantiated by apartheid and incompletely remedied by the post-apartheid state, are such that the racialised skewed economy of health remains almost intact. More than a quarter of South Africans are considered obese by current WHO measures; diabetes, thought to affect some 7% of the population (3.5 million people), is mostly undiagnosed; and cardiometabolic disease is the primary cause of death (Chang et al., 2019; Ellapen et al., 2020). Added to this is continued HIV transmission, giving rise to a hyperendemic situation: over 20% of the population is estimated to live with HIV. While vast numbers are on lifelong anti-retroviral medication, there is growing concern about a rise in infections among young people. Widespread tuberculosis and malaria complicate the picture. These factors provide the impetus to develop early interventions to maximise health outcomes from birth, including to prevent parent to child transmission of HIV, and to prevent the development of chronic non-communicable conditions over the life-course and intergenerationally (Choukem et al., 2020).

The South African health care system is divided into two sectors. A highly refined private sector offers high-end interventions for those who can afford to pay. The state sector consists of a three-tier system, with an emphasis on primary health care. Birth is highly medicalised. More than 80% of recorded births are attended by medical professionals. For women who rely on state care, reproductive and birthing services are offered through Midwife and Obstetric Units (MOUs), the first level of care. Here care services are provided by nursing staff (including medical midwives) for 'low-risk', 'uncomplicated' pregnancies. Midwives and traditional birthing attendants may not practice unless they

are also biomedically certified (Rogerson, 2019). Women are encouraged to report ‘early’, from 12 weeks gestation, for antenatal care at MOUs where five to eight visits, by appointment, enable assessment and intervention to reduce risks relating to diabetes, high blood pressure, STIs and HIV (Ferreira, 2017; Pillay and Baron, 2018). As noted above, around 20% of all adults 15–49 are HIV+, including an estimated 30% of pregnant women (Woldesenbet et al., 2019). Likely for this reason, women with HIV infection are not considered at high risk and they are not referred to higher level facilities; instead prevention of mother-to-child transmission (PMTCT) through the provision of ART is provided without charge to all women who test HIV+. Women with pre-existing disorders, such as diabetes or high blood pressure, or pregnancy-related conditions such as pre-eclampsia, are referred from the primary sector to secondary and tertiary units in public sector hospitals; women who are habitual drug-users may also be referred. High risk births take place in the tertiary sector, where hospitals provide specialised neonatal care including ICUs. Close on 200 hospitals are recognised by UNICEF as ‘baby friendly hospitals’ that offer breastfeeding assistance in support of the goal of increasing breastfeeding rates and duration consistent with current policy supporting exclusive breastfeeding to 6 months.

Clairvoyance in the clinic

Although dropping largely due to the PMTCT programme, South Africa’s infant and maternal mortality rates remain well above the levels set by the Sustainable Development Goals to which the country aspires (Dorrington et al., 2019). In addition, neonatal deaths account for approximately a third of all deaths in children under 5; of the remaining two-thirds, most deaths are the result of respiratory infection, HIV and diarrhoea (Bamford et al., 2018). Accordingly, maternal and infant health remain important focuses of health service delivery in the country.

In order to anticipate problems that might occur in pregnancy and result in maternal or foetal death, or affect pregnancy outcome or the longer term health of the child, ultrasound is now a common-place, routine component of pregnancy care. It has become increasingly simple to execute at point of care and to interpret results. Portable ultrasound scanners and handheld devices, apps, wifi and mobile phone networks (Amoah et al., 2016; Sobhani et al., 2016; for new developments, see <https://www.clarius.me/aium-debut-pr/>) extend the technology into primary care settings and bring the laboratory to the most remote clinics, and even, for the elite who can afford hand-held devices, into homes. Ultrasound’s power is its empiricism: to see and thereby monitor foetal growth and development and diagnose foetal and maternal anomalies, so flagging the need for prompt action or further investigation. Variance in any number of factors—gestational age and sex of the foetus (and numbers, in the case of multiple births); foetal heartbeat (regularity, number, duration of beats), body movement and estimated weight; maternal health (specifically, ovarian health); placenta location and functioning, and volume of amniotic fluid—might flag the need for and result in medical/surgical intervention. In late pregnancy, the technology monitors cervical dilation and foetal position to ensure an optimum (i.e. live) birth, so guiding the need for medical induction of labour and caesarean section delivery.

As noted, ultrasound is used to identify and monitor the effect of maternal conditions on the foetus, where there is a risk of gestational diabetes and pre-eclampsia, so allowing for timely interventions to prevent more serious conditions and foetal loss. But the ultrasonic monitoring of intrauterine development also generates data that might predict longer-term health outcomes. While monitoring pregnant women therefore addresses the short-

term risks of cardiometabolic disease so to ensure maternal and foetal survival, regular ultrasound provides evidence to anticipate the risk of cardiometabolic disease in offspring in childhood and adulthood and, through epigenetic factors, across generations. Ultrasound supplements the monitoring that occurs with the most ordinary technologies and procedures—bathroom scales, urine analysis, a blood pressure cuff and tape measure. These are all technologies that monitor a woman’s weight and cardiac health, including as a proxy of her adherence to behavioural advice both preconception and in pregnancy (Manderson, 2016).

Clinical concerns with cardiometabolic disease, as indicated above, converge with epidemiological studies conducted in South Africa and elsewhere that highlight how maternal risk factors contribute to the ‘obesity epidemic’ (Munthali et al., 2017). Perinatal outcomes and life-long risks of cardiometabolic disease are associated with the in utero environment, with maternal factors influencing foetal, infant and child growth and development (Cameron et al., 2003; Adair et al., 2013; Richardson, 2015; Khan et al., 2016; Munthali et al., 2016). The premise is as follows. A woman who is significantly overweight preconception and who gains excess weight in pregnancy—according to the shifting notions of ‘correct’ weight gain—is most likely to have an infant who is high weight for age; if the woman develops gestational diabetes, she is also at greater risk than other women of giving birth to a low birth weight infant (Barker, 1992; Barker et al., 2002). Infants are at risk of compromised cognitive and physical development in both cases. Low and high birth weight infants risk rapid weight gain in infancy and childhood; they are at greater risk of obesity, diabetes, and cardiovascular disease (and their complications) in maturity. Their health, in turn, predicts the health of their descendants. Maternal health and behaviours prepartum and postpartum, and in some respects paternal health (although this is under-researched; see Richardson, 2015; Davison et al., 2019), can therefore impact on birth outcomes, future health status, and intergenerational and multigenerational health. In summary, the children and grandchildren of overweight women are at high risk of developing diabetes and heart disease. At its simplest this is considered to be preventable through women’s weight control.

Publications from cohort studies, including the Birth-to-Twenty Cohort Study in South Africa, set out the epidemiological connections between maternal obesity, ‘lifestyle’ and multigenerational cardiometabolic disease (Barker et al., 2018; Wrottesley et al., 2019), leading its advocates to reiterate the need for research on the developmental origins of health and disease (DOHaD) and life course studies to enhance health outcomes across generations (Norris et al., 2017; Said-Mohamed et al., 2018; Aagaard-Hansen et al., 2019). However, not all researchers agree on the pathways to poor (or better) health for infants and through childhood and adulthood, with some researchers challenging the importance of maternal preconception and gestational weight on infant weight (McPhie et al., 2017). Other studies in low income settings suggest that low maternal weight prior to conception and in pregnancy is the greater risk (Johnson et al., 2017), and that maternal weight gain is less important than preconception maternal weight (cf. Robitaille, 2015; Bodnar et al., 2016; Hellmuth et al., 2017; Lengyel et al., 2017). Other studies suggest that ‘the window of opportunity’ for interventions to ameliorate population health are more evenly distributed across the life course than the current emphasis on perinatal health suggests (Pentecost et al., 2018). Despite conflicting findings, the epigenetics of cardiometabolic disease across generations have led to renewed interest in pregnant and maternal bodies.

Within South Africa’s Birth-to-Twenty Cohort Study, The Soweto 1000 Days Study has recruited women early in pregnancy and follows them up six times prior to delivery with

questionnaires on levels of physical activity and dietary patterns, the collection of blood for biometric data on stress and blood glucose, and foetal ultrasounds. The biological fathers of the unborn babies are invited to participate in a Father of the Baby sub-study. Given the preponderance of epigenetic and other research on women not men globally, and the general absence of genitors in the social lives of women and children in South Africa (Richter and Morrell, 2008; Hall and Sambu, 2018), inclusion of men in the study is important.

Following delivery, infants and mothers are followed up for two more years to assess infant growth and development and women's own health. Sub-samples of these participants are also involved in other studies, for instance, on acquiring HIV (Mlotshwa, 2019). For women, the benefits of participating in the research include regular pictures of their in-utero infants and supportive antenatal care (a rare commodity for many women). However, the study pays less attention to the social and environmental factors that directly influence weight, nutritional status and distress, and may also contribute to the development of diabetes and heart disease. These factors—for instance, unemployment, poverty, precarious housing, poor infrastructure (particularly access to potable water and safe sanitation), exposure to environmental pollutants, social suffering, intimate partner violence—are endemic. At the same time, it is critical to understand how resources are distributed within households over time. Carina Truys' (2017) ethnographic research in seasonally food insecure regions of the Western Cape has shown that, while pregnant, women often have access to adequate nutrition and care, but after birth, household resources are refocused, usually on men and infants, leaving post-partum women undernourished and undermining their breastfeeding attempts. This is compounded by incoherence in state policy; as noted above, the state is committed to exclusive breastfeeding for 6 months (the Tshwane Declaration of 2011), but provides unemployment insurance for only four of those months (Nieuwoudt and Manderson, 2018; Nieuwoudt et al., 2018).¹ This suggests that much more attention needs to be paid to the social and economic conditions that shape well-being. Further enquiry into broader socioeconomic factors, with an extended study of household and regional relations, might provide insight into how reproduction is shaped.

Rather than addressing socioeconomic factors in adverse healthcare outcomes, however, both high and low technology interventions focus on the bodies of women, their behaviour, their practices as mothers and their (future) infants (Richardson, 2015; Manderson, 2016; Pentecost et al., 2018; Pentecost and Ross, 2019). Advocates of such interventions argue that this technology will provide more options preventively and therapeutically (Moussa et al., 2016) to address maternal obesity so to enhance health, wellbeing, productivity, and equity in current and future generations (Hanson et al., 2017). Others focus on individual interventions and promote a mix of comprehensive 'appropriate' preconception care, 'lifestyle' interventions and changes (Moss and Harris, 2015; Yan, 2015; Abell et al., 2016; Hill et al., 2017). Through the delivery of antenatal care, public health interventions are displaced by clinical care and its technologies despite evidence of the social, structural, environmental, institutional and global factors that shape people's health at individual and population level. In South Africa, both processes and outcomes are racialised as a result of colonialism and apartheid's cruel and durable legacies.

Caesarian deliveries

While important when medically necessary, a global surge in c-sections (caesarian delivery) without medical justification is

generating concern from the World Health Organization (WHO, 2015), which argues that while maternal and neonatal mortality decrease as c-sections rise to 10 percent of births, increases in rates thereafter do not result in improved maternal or newborn health. While poor women may lack access to such life-saving surgery, increasingly, c-section is treated as a 'normal' way to give birth and is frequently presented as a birth option to economic elites. Women may elect to have such high-risk surgery because they believe it is safer for the baby, or because they fear pain, or because they lack the kinds of support that would make vaginal birth possible.

C-section rates in South Africa are among the highest in the world, accounting for 80 percent of births in the private sector. Public sector rates are lower (estimated to be at 26 percent, albeit with regional hotspots), but they are well above 10–15 percent recommended by the WHO. The reasons vary. In the private sector, c-sections are the result of elective surgery, defensive medical practice by doctors who fear being sued, and narrow interpretations of the clinical measurements offered by technologies such as ultrasound/foetal dopplers. Often such interpretations give rise to 'crisis' interventions such as emergency caesarians, in which women who had prepared for vaginal birth are presented with medical interpretations of risk (such as stalled labour, infant distress, breech or transverse positioning, placenta praevia), and are encouraged to secure infant safety through surgery. This is frequently recorded as 'elective' surgery, despite the pressures on women by medical practitioners and the technological information on which they rely, including ultrasound (Koster and Ross, 2017). As few medical practitioners in the private sector support vaginal birth after caesarians (VBACs) for fear of surgical complications, longer term complications, and, most importantly, being sued, repeat caesarians are the norm among economic elites, in South Africa, largely white and Indian women. In the public sector, a high c-section rate has been attributed to the increasing medicalisation of birth; in the 1980s–1990s concern with mother-to-child transmission of HIV particularly led to higher rates of surgical intervention. This has diminished with effective ART and PCTMT interventions, but the maternal body is still considered to pose risks.

There are direct and future health costs to c-section birth in every context. Women who have had c-sections are less likely to initiate breastfeeding or continue to breastfeed (Prior et al., 2012; Hobbs et al., 2016).² All things being equal, they are more likely to suffer postpartum complications including depression, infection and pain. Women may be more likely to have difficulties falling pregnant again and carrying to term (Keag et al., 2018). Sandall and colleagues (2018) have noted that pregnancies subsequent to a c-section show increased risks of hysterectomy, abnormal placentation, uterine rupture, stillbirth, and preterm birth. They also note greater need for blood transfusion, and a greater rate of hysterectomy. In a systematic review, Sohby and colleagues (2019) show that maternal and perinatal death after c-sections in low and middle income countries are disproportionately high. In the South African context, postpartum mental health complications are compounded by difficult socioeconomic contexts, intimate partner violence, high but undiagnosed and untreated mental disorders, and limited support networks, including for mental health (Van Heyningen et al., 2016; Field et al., 2018). Turner and Honikman (2016) note that poor maternal mental health in turn produces greater likelihood of, among other things, preterm delivery, caesarian section, low birthweight babies and lower rates and shorter duration of breastfeeding. Structural inequalities mean that such outcomes are racialised.

Unprimed by exposure to the maternal microbiome during the birth, infants' immune systems are compromised by c-section

birth (Sandall et al., 2018). They are more likely to contract childhood-onset chronic diseases, including Type 1 and increasingly Type 2 diabetes, obesity and respiratory-related disorders such as asthma, pneumonia, tuberculosis and allergic reactions (Kuhle et al., 2015; Keag et al., 2018). The manner of birth thus has direct implications for individual health and places an additional burden on the health system in the present and in the future, with the same problems that provide the rationale for preconception and antenatal interventions, as discussed in the previous section. Again, this needs to be seen in the broader and more significant context of inequalities; style of birth is not as significant a factor in shaping public health as is the distribution of resources.

Neonatal cyborgs

We have illustrated how chronic disease is imagined to be headed off through clinical interventions with women in order to impact on public health in the long term. We now turn to efforts to ensure the survival at birth of highly vulnerable infants; in addressing this, we raise issues about the ethics of intervention—its prioritisation to advantage some individuals, but with questionable advantages and various risks and costs at a population level. Here, unlike in the cases discussed above, interventions understand ‘the public’ as ‘the individual’ infant and its parents.

Depending on diagnosis, prognosis and technical availability, medical practitioners may use a range of extra-corporeal and intra-corporeal technologies to redress, mitigate and manage different conditions on a temporary basis. Body parts have long been replaceable through transplantation surgery and mechanically. Here we consider the most sophisticated and sensitive example of an artificial ‘lung’. Historically, iron lungs were used for treating polio paralysis (Emerson and Loynes, 1978; Emerson, 1985; Ott, 2016), and are no longer used, not only because polio has been near eliminated, but also because other technologies provide assistance with breathing when required. The Iron Lung’s replacement, the extracorporeal membrane oxygenation (ECMO), still functions as an external lung, either for a temporary condition or as a temporary intensive care measure prior to a lung transplant. Extracorporeal life support (ECLS) provides pulmonary, cardiac or cardiopulmonary support in neonates, paediatric and adult patients when conventional life-saving methods of care are not feasible or likely successful.

High care hospitals in South Africa as elsewhere use ECMO as a last resort for adults with potentially fatal respiratory disease—avian flu, influenza A, swine flu, COVID-19 and other viruses³ (Zielinska et al., 2016)—and for other diseases including leukaemia and severe malaria. In neonatal intensive care units, it is used to allow the heart and lungs to rest⁴ for several reasons: meconium aspiration syndrome, persistent pulmonary hypertension of the newborn (PPHN), severe respiratory distress syndrome, or pneumonia or other life-threatening infection. It is also used when breathing is compromised because of gestational age and weight (that is, the infant is <34 weeks, or weighs <2 kg—infants referred to, sometimes, as ‘micro-preemies’), as may occur in association with various maternal health problems discussed above.

ECMO can be lifesaving. It is—like similar technologies—expensive, and it comes with risks. Very low birth weight infants are already severely compromised, hence their need for this intervention; but the intervention also places them at risk of haemorrhage, including in the brain, problematic blood clotting, the need for transfusions, and nosocomial (hospital acquired) infections. Infection is especially high via the microbial colonisation of catheters, the ECMO cannula, or the oxygenator. Fungal and bacterial infections may translocate from the gut, leading to

pneumonia, blood stream infections, urinary tract infections and ECMO-related immune impairment (Coffin et al., 1997; Burket et al., 1999; O’Neill et al., 2001; Haneke et al., 2016; Biffi et al., 2017; Sukhal et al., 2017). The infections introduced through these processes and technologies are increasingly resistant to first and second-line drugs, leading to the growing need in South African hospitals for surgeons to use drugs which South African interlocutors refer to as the ‘big guns’. ECMO’s micro-ecologies and interactions, like other invasive procedures, disrupt the ecosystems of patients, hospitals, and environments. Complications with ECMO are substantial because of antimicrobial resistance (Kutlesa et al., 2017). Although the most common admissions to hospital are risk factors for bacterial, viral and fungal infections, staying in an intensive care unit accelerates the risk.⁵ The total cost of antimicrobial resistance (in terms of morbidity and mortality) is difficult to calculate locally or globally, but in South Africa, with high burdens of HIV, TB and diarrhoeal disease, the implications of antimicrobial resistance are especially serious.

ECMO is just one example of high-end hospital technology used for acute care. But ECMO as an intervention is high risk, it creates unrealistic expectations, is of questionable benefit for wider publics, and raises important questions around the ethics of clinical outcomes and resource allocation for surgeons and public health practitioners. Like many such procedures, life extending surgical practices compete with other needs where budgets are constrained. Perinatal intervention to prevent cardiometabolic disease is less expensive to deliver than interventions later in life, and is hypothesised to have intergenerational public health benefits. But it is also an intervention which, because it is patient-centred, ignores the macro- and meso-ecological causes of health and medical problems, and it does nothing to address the inequalities that produce them.

Clinical and pastoral care: the road to health booklet

Our most common example, because of the longstanding use of this technology, is the Road to Health Card or Child Health Card, introduced globally to empower parents. The cards use biometric data to track child growth and by proxy nutrition; record physical, cognitive and social development; and track caregiver compliance with immunisation schedules and clinic visits.⁶ Diverse ‘clinic cards’ (patient-held health records) have been in use to monitor infant well-being in South Africa since 1973 (Crisp and Donald, 1987, p. 331), although variations of this across British colonies, and worldwide, date from the early 20th century (Davies, 1978; Fildes et al., 1992). In South Africa they have undergone many modifications, most recently to provide information and track HIV exposure and care and to make them more ‘patient-friendly’. From the two-page fold-out clinic card of just over a decade ago, aimed at providing information for healthcare workers, the current (2019) national Road to Health Booklet is now 46 pages long, offering caregivers ‘advice on how to raise a happy, healthy child’ and directing health care workers on referral pathways when infants are found to be at risk of underdevelopment. The booklet, once the domain of medical experts, is now a technology for caregivers and healthcare workers to take responsibility for infants and small children. There is no record of maternal or social well-being.

Earlier versions of the card, like child health cards in other countries, focused mainly on height/weight-for-age by sex, antenatal and birth information. South Africa’s new booklet is aligned to Sustainable Development Goals. It covers five main areas—nutrition, love, protection, health care, and extra care, providing information about ‘best practice’ in each, where appropriate, with tick lists or charts. The charts, to be completed

by healthcare workers, include a record of clinic visits, mid-upper arm circumference measurements (to assess malnourishment, ranging from severely malnourished to obese), and sex-specific weight-for-height tables to infer acute malnutrition or wasting. The WHO Child Growth Standards (WHO, 2006) inform the weight-for-age and height-for-age charts that track growth from birth to 5 years of age. These are used to identify poor growth—short-term growth problems identified by weight for age; longer term problems such as faltering or stunting as identified by height-for-age. Drawing from research in six countries, the sample that informs the charts comprises healthy children living under conditions which are likely to favour the achievement of their full genetic growth potential whose mothers engage in fundamental health-promoting practices, namely breastfeeding and not smoking (WHO, 2006, p. xvii). In other words, the measures on which children are assessed are based on optimal living conditions in each study area and so skew measures toward findings of malnourishment. Further, identifying children at risk is one thing; changing the situation another. Poor countries, and poor people in wealthy countries, may have little capacity to ameliorate the situation.

Key developmental milestones for hearing, vision, cognition and motor skills are identified from birth to 6 years, again based on assumed universal milestones. Immunisation, deworming, the administration of vitamin A and dental records are also kept. The booklet includes five pages for general clinical notes and records of referral, including when development goals fall short, along with a record of long-term health conditions. There is a record of antenatal, birth and newborn histories, including APGAR scores,⁷ maternal HIV status, breastfeeding, intrapartum history and risk factors such as low birth weight, neurological or congenital disorders. Social risk factors include whether the mother or primary caregiver is a teenager or grandparent, exposure to abuse, violence, drugs or alcohol, whether the mother feels she is coping, and whether there is prolonged maternal sadness. In other words, the booklet is a history, a comprehensive assessment, and a 'how to' guide, combining both medical and pastoral roles (Ngcowa, 2019), focused on infant well-being. Despite notes on mother's mood, for example, there is little in the booklet which allows action to support maternal well-being. As a result, while the antenatal period is maternally focused, the post-natal period focuses on the infant and absents the mother, except when her status or behaviour is deemed a risk factor to infant survival or well-being.

As careful and detailed as the information in the booklet is, it is of little use unless it is properly completed and unless healthcare staff and caregivers are able to act on the data. Naidoo et al. (2018) found that rates of accurate completion were suboptimal, noting in particular incomplete or insufficient information relating to HIV exposure and prophylaxis, and weight for length measurements (the key indicator of severe malnutrition/stunting). This finding is replicated in other studies, which show that cards are often lost (Le Roux et al., 2017) or not used by caregivers using private health care facilities (Harrison et al., 1998), that immunisation records are inadequately kept (Le Roux et al., 2017), and that even doctors do not record information adequately, giving rise to lost opportunities for continuity of care (Harrison et al., 1998; Smith and Reji, 2015; Wiles and Swingler, 2018).

Ngcowa (2019) notes that because they contain information about maternal HIV exposure, which is often highly stigmatised, caregivers often hide the booklets from other residents of the household, including those who might be taking day-to-day care of the infants. Caregivers may be aware of the significance of the information in booklets, but the booklets are written in languages (usually English or Afrikaans) that are unfamiliar to many caregivers. Some of the advice, such as best feeding practices

(including exclusive breastfeeding for at least 6 months followed by the introduction of solid food with high iron content) is not possible given people's material circumstances and conditions of employment, for middle class as well as poor women (Ngcowa, 2019; Nieuwoudt et al., 2019). Le Roux et al. (2017) found that despite carefully completed booklets, caregivers had to return to clinics repeatedly because of vaccine and medication stock-outs. Consistency in supply chains and integrity of the cold chain where appropriate is a significant problem in relation to HIV-care and vaccine integrity in South Africa, and is a persistent problem in lower income countries worldwide.

Our point here is four-fold. First, the booklet offers an opportunity to record data and to disseminate information pertinent to child well-being. However, despite improvements, it requires considerable skill to complete and interpret, and its affordances are often lost. Second, factors beyond the record play a critical role; caregivers, a highly pressurised and inefficient health care system, shortages of skilled staff with limited time and heavy workloads, disruptions to the medical supply chain, and so on, all impact negatively on well-being. Thirdly, the booklet's increasing refinements have turned it from an object for the professional monitoring of infant well-being into an object of pastoral care, assessing caregivers in judgemental terms and offering injunctions and directives to caregivers on best practices frequently based on Euro-American models of family, care and well-being but assumed to be both universal and best practice. The fourth point is that there is a remarkable shift from a focus on the mother before birth to an almost-exclusive focus on the infant after birth. At least part of the objective of the booklet is to produce a public educated about infant well-being. We see this as the manifestation of a responsabilising discourse, productive, at least in principle, of knowing subjects actively engaged in the production of better health for this and future generations. The risk is that women's well-being is elided in the exclusive focus on infants.

Conclusion

We have traced five technologies—ultrasound, weight management as advocated for the prevention of metabolic conditions, caesarian section, ECMO and Road to Health booklets. These technologies range from high risk, dependent on biomedical execution—c-section, ECMO—to very low risk, reliant on patient adherence to medical advice (weight loss in pregnancy, Road to Health); the other technology, ultrasound, illustrates the increasing democratisation of a technology although with skilled interpretation still needed. Some of the technologies are directed at specific bodies at specific times. For example, ECMOs are life saving for individuals but have no public health value; maternal pre-natal monitoring is assumed to have beneficial effects for both the individual baby and for future generations.

One feature appears to remain standard: the assumption of the female body as an incubator of population health, both in the immediate present and, according to current understandings of epigenetics, for two generations (at least) into the future. A second notable feature is the increase in individualising and responsabilising discourses relating to well-being. These features provide a rationale to justify the surveillance of particular bodies. In South Africa, the focus is usually black women, with often moralising inferences and judgmental interventions in their lives in the interests of individuals and populations yet to come. A third is the growing reliance on measures designed in the global North, tested in the South and assumed to be universal. This is particularly the case for technologies such as ultrasound, but it is also true even when attempts are made to standardise using a wider sample base, such as in the WHO Growth Standards.

Both ideas about maternal weight and child development draw on such standards.

The outcomes of interventions are diverse and not all of them necessarily work in favour of either individual or population health over the long term. Here are some examples. Medically unjustifiable caesarian sections are implicated in reduced rates of breastfeeding, thus working directly against South Africa's commitment in the Tshwane Declaration on exclusive breastfeeding for 6 months, itself a technology intended to improve infant health and reduce mortality rates, especially among at-risk populations.

The shift in focus from women in the antenatal period to infants, postpartum, means that women's health needs after birth, especially but not only in relation to poor mental health, are under-recognised, and infant well-being is accomplished often at the expense of other sectors of the population or aspects of well-being. For example, recent research frames maternal perinatal depression as a threat to foetal development and infant well-being (Marsay et al., 2018), especially where attachment theory is the prevailing approach in infant psychology (Tomlinson et al., 2005). The intense focus on early life interventions may run the risk of undoing women's reproductive rights. The emphasis on the first thousand days of life as measured from conception can easily be read in pro-natalist ways, potentially limiting women's access to birth control and termination of pregnancy. The assumption that wombs are incubators has meant that men's roles in physiological and social reproduction are under-examined. Infants may be recognised as being under-nourished, but the needs of those who care for them are not assessed and interventions are generally unavailable. Further, for the most part, available interventions and policies do not take into account broader social forms such as families and households (Mkhwanazi and Manderson, 2020). While people are exposed to living conditions that are directly responsible for ill-health, they are also held to be individually responsible for their own well-being. This became particularly apparent during the COVID-19 lockdown which commenced in South Africa on 26 March 2020. There is a tension, indeed, a contradiction, between what the state does or is able to do in terms of ameliorating illness-producing living conditions and providing care. In South Africa, these arise from and reproduce highly racialised conditions.

Each of the technologies we have examined here constitutes its public slightly differently, producing tensions in the understanding of 'the public' to which 'public health' and 'healthy publics' refer. The focus on interventions in the first thousand days envisages 'the public' as simultaneously the mother-infant dyad, the infant in adulthood, and the population two-plus generations into the future. Ultrasound makes possible interventions such as c-sections to secure infant well-being, even where this will involve increased risks for mothers both during and after birth, and for women's future reproductive well-being. C-sections, especially when elective, reframe what is normal and pathological, and produce outcomes that differentiate populations by respiratory and immune function. When offered as 'choices', they also constitute pregnant women as neoliberal subjects. The public of ECMOs is more narrowly constituted—infants whose survival is compromised in utero and so at birth. Meanwhile, the Road to Health Booklet, a population-based intervention, imagines its public as invested carers, constellating the state and individual carers around a single child. 'The public,' then, is not a singular entity. Publics are brought into being by specific sets of knowledge practices and the technologies they enjoin. A concern with well-being may materialise different publics in different contexts over time, with different consequences and potentials for well-being.

Complex questions arise about the universalist approaches that underpin technologies and the interventions they mandate. Standardised measures and norms can work in favour of specific populations. When states recognise the significance of the first thousand days of life, for example, the resultant policies, if well-framed, may enable women to make claims on the health care system for proper support of peri-natal life, for ante-natal care, reproductive rights and so on. These measures can offer potent means to reshape current forms of power, authority and knowledge. As we have shown above, however, it is by no means inevitable that this will be the case. The critical issue is how and whether it is possible to do so without excluding categories of people or re-medicalising social worlds, and if not, what the effects of such medicalisation might be.

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Notes

- 1 Few women can sustain breastfeeding for this period; even women in regular employment, including those working to implement the Declaration, are not entitled to maternity leave for this full period.
- 2 Renewed global emphasis on the importance of breastfeeding, along with encouraging post-birth interventions, such as immediate skin-to-skin contact, assistance with latching and better pain management, may reduce difficulties in initiating breastfeeding.
- 3 The role of ECMO in managing severe COVID-19 remains unclear at time of writing (April 2020).
- 4 <https://childrensnational.org/choose-childrens-conditions-and-treatments/critical-care/extracorporeal-membrane-oxygenation-ecmo-program>.
- 5 In South Africa, up to 60 or 70 percent of bacteria in some hospitals are resistant to most available (and the least expensive) antibiotics. See <http://www.health24.com/Medical/Flu/News/the-most-important-thing-south-africans-should-know-about-superbugs-20160531>.
- 6 Globally, there is a move to patient-held child health cards, such as that endorsed by UNICEF (<https://www.unicef.org/egypt/press-releases/launch-new-child-health-cards>).
- 7 A five point score registered at birth and based on skin tone, heart rate, responsiveness, muscle tone and breathing response. The amalgamated score (out of 10) indicates whether additional medical interventions are required.

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Competing interests

The authors declare no competing interests.

Additional information

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