

Reproductive health research and innovation in Sri Lanka: Challenges and the road ahead

Chathura Ratnayake

Abstract

Sri Lanka has achieved maternal and child health outcomes well above its income level, yet several reproductive health indicators have stalled or worsened. The prevalence of anaemia in pregnancy, for example, rose from 31.9% in 2009 to 35.4% in 2016. Since a national priority-setting exercise in 2007, research output on reproductive health has grown, but much of the local evidence has not been translated into practice.

This article draws on two decades of work by a multidisciplinary team at the University of Peradeniya and Teaching Hospital Peradeniya. It summarises studies on maternal infections (varicella zoster, *Toxoplasma gondii*, human papillomavirus and group B streptococcus), metabolic disease in women, diabetes in pregnancy, the quality of intrapartum care, reproductive toxicology, and two medical devices developed with engineers: an automated urine volume monitor (patented) and an accelerometer-based fetal movement monitor (patent pending).

The recurring barriers were the absence of national coordination and dedicated funding, fragmented research and data systems, slow policy translation, little work on environmental exposures, and limited time and supervision capacity. We propose a national reproductive health research registry and data repository, a National Reproductive Health Research and Innovation Council, a digital antenatal record, a training pipeline for clinician-scientists, investment in translational infrastructure, and incentives for interdisciplinary and international collaboration.

Keywords: reproductive health, research translation, maternal infection, gestational diabetes, intrapartum care, reproductive toxicology, medical devices, Sri Lanka

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Department of Obstetrics and Gynaecology, Faculty of Medicine, University of Peradeniya, Sri Lanka.

Corresponding Author: Prof. Chathura Ratnayake, e-mail: chathura.ratnayake@med.pdn.ac.lk

 <https://orcid.org/0000-0002-1797-0754>

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Introduction

Dr Siva Chinnathamby devoted her career to improving the reproductive health of Sri Lankan women, most visibly by introducing family planning methods to the country. The subject of this oration, research and innovation in reproductive health, follows directly from that work.

The Programme of Action of the International Conference on Population and Development (ICPD), Cairo 1994, and the Fourth World Conference on Women, Beijing 1995, defined reproductive health as “a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity, in all matters relating to the reproductive system and to its functions and processes”¹. Reproductive health care is the set of methods, techniques and services that prevent and solve reproductive health problems. Its main components are maternal health, family planning, sexual health, fertility and subfertility, adolescent health and post-reproductive health.

Reproductive health is central to Sustainable Development Goal 3 (good health and well-being) and Goal 5 (gender equality)². Across the life course, reproductive disorders account for a large share of

the global disease burden. This article outlines where Sri Lanka stands, what local research has contributed, and what would help that research change practice faster.

Reproductive health in Sri Lanka: progress and persistent gaps

Sustained public investment in maternal and reproductive health has allowed Sri Lanka to meet several health-related development milestones, of which the fall in maternal mortality is the best known. The maternal mortality ratio fell from 2,327.4 in 1911, with a peak of 2,679.6 in the 1930s, to 23.5 in 1995 (Figure 1)³. Other indicators have not followed. World Bank estimates show that the prevalence of anaemia among pregnant women fell slightly from 32.7% in 2005 to 31.9% in 2009, then rose every year to 35.4% in 2016⁴ (Figure 2).

The health system has been highly successful at delivering care in volume, at “clearing the crowd” in busy clinics and labour wards. Whether it has improved the quality of that care across the reproductive health spectrum is less certain. Apart from maternal mortality, few reproductive health outcomes have improved over the last 18 years.

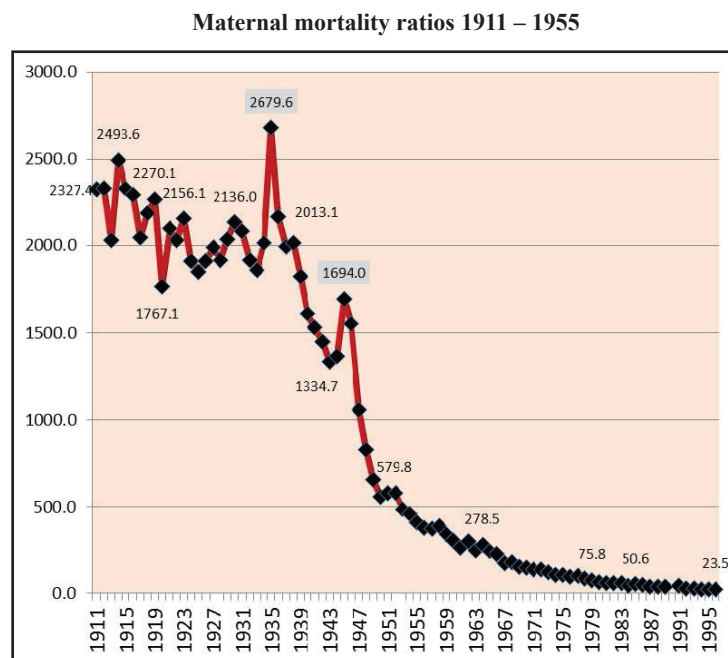


Figure 1. Maternal mortality ratios in Sri Lanka, 1911–1995 (per 100,000 live births). Reproduced from *Weekly Epidemiological Report*, Vol. 42, No. 46, 7-13 November 2015; data from the Family Health Bureau, Ministry of Health, Sri Lanka.

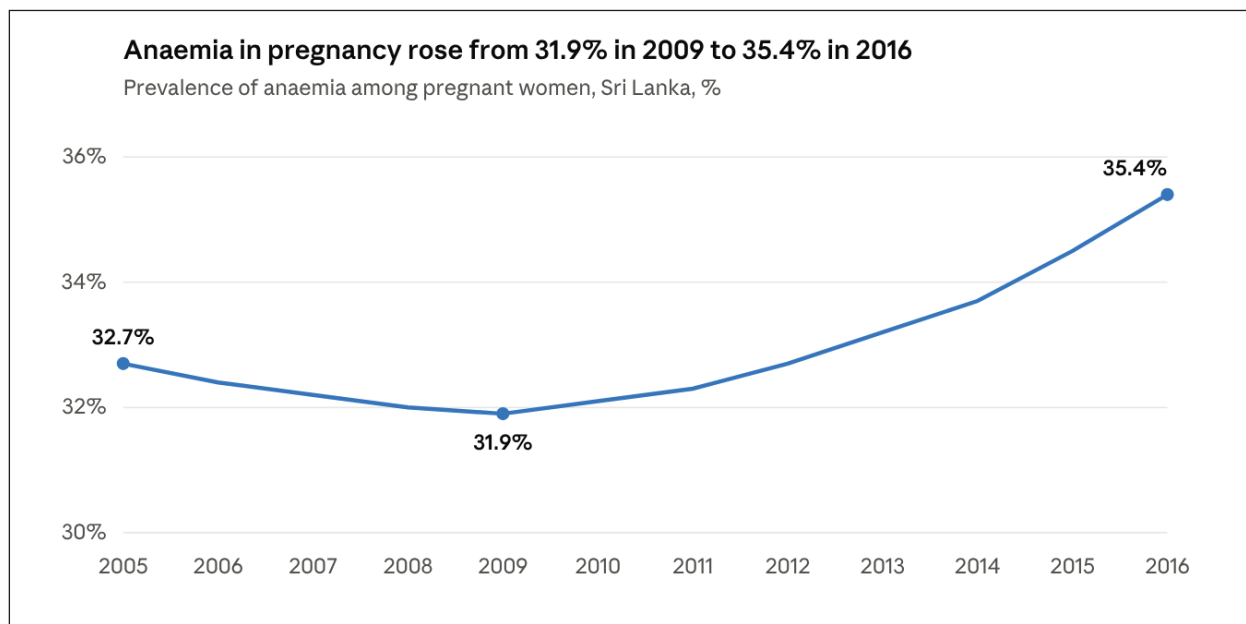


Figure 2. Prevalence of anaemia among pregnant women in Sri Lanka, 2005–2016 (%). Source: World Bank, via CEIC Data⁴.

The research landscape since 2007

In 2007 the National Coordinating Centre for Reproductive Health Research held a workshop to set research priorities for the following five years⁵. Its report collated all reproductive health publications from the previous 15 years, and a panel of scholars used it to identify gaps. In 2009, when I joined the Centre on the nomination of Professor Indrajee Amarasinghe, then Dean of the Faculty of Medicine, Professors Hemantha Senanayake and Malik Goonewardene urged new members to work on those priority areas. The 2007 report showed a modest number of publications for 15 years.

Output has since grown considerably in indexed journals, local journals and the proceedings of clinical societies. A search of reproductive health publications from 2007 to 2025 found 796 of Sri Lankan origin among 733,738 in PubMed, and 1,334 among 1,244,592 in Scopus [search strategy: (“reproductive health” OR “maternal health” OR pregnancy OR obstetric*OR gynaecolog* OR gynecolog* OR fertility OR infertility

OR “family planning” OR contraception OR perinatal OR neonatal OR “preterm birth” OR “sexually transmitted infections” OR STI OR “sexual health” OR “reproductive cancer*” OR “adolescent health”)].

More publications have not produced matching changes in care. Several strands of local evidence are still only partly implemented:

- the work on anaemia in pregnancy led by Professor Malik Goonewardene
- misoprostol for induction of labour
- respectful maternity care, pioneered by Professor Hemantha Senanayake
- adolescent health clinics
- sexual health education in schools
- digital maternal health records

Emerging challenges

New problems are adding to the unfinished agenda. In the middle decades of this century, Sri Lankan reproductive health services will have to deal with:

- emerging and re-emerging infectious diseases in pregnancy
- the health needs of adolescents
- a growing population of older, post-reproductive women
- the rise of non-communicable diseases, particularly obesity and diabetes

- wide gaps in outcomes between rich and poor, and between urban and rural areas
- the spread of health data in digital form, with its opportunities and risks

Meeting these needs requires new methods and new ways of thinking about reproductive health. The obstacles are considerable. The economic collapse of 2022 has deepened Sri Lanka's disadvantage relative to wealthier countries, and new tools such as artificial intelligence-based health care are hard for low-resource health systems to adopt.

The rest of this article describes how our research team at the University of Peradeniya and Teaching Hospital Peradeniya has tried to address some of these questions.

Contributions from Peradeniya

Infections in pregnancy

Varicella zoster virus. Varicella was not a notifiable disease in Sri Lanka until 2005. In 181 women attending the antenatal clinic at Teaching Hospital Peradeniya, 77.9% had anti-VZV IgG⁶. Seropositivity was lowest among women from estate communities, and the authors recommended age-specific, population-based serosurveys. The study received the Presidential Award for Research Publication in 2017.

***Toxoplasma gondii*.** Among 536 pregnant women, 29.9% had *T. gondii* IgG and 0.37% IgM⁷. Preparing or selling raw meat and household gardening were associated with seropositivity, which raises questions about contamination of locally produced meat. Because 70.1% of women were seronegative and so susceptible to primary infection in pregnancy, targeted health education is warranted. The work received a National Research Council (NRC) Merit Award in 2017.

Human papillomavirus. HPV causes cervical cancer, a preventable sexually transmitted cancer that is still screened for mainly by cytology. With a competitive grant from the National Science Foundation, the team developed a low-cost PCR-RFLP method to detect HPV and genotype HPV 16 and 18⁸. In 433 clinically normal women, HPV prevalence was 5.8%. Self-collected cervical samples agreed with clinician-collected samples in 93% of cases, the first such evidence in Sri Lanka. Proprietary assays detect only a few high-risk genotypes, whereas a PCR workflow

can be adapted to all locally prevalent types. Funding stopped before the project could run a planned national survey of HPV genotypes or train medical laboratory technologists for a national roll-out. A linked survey found that women attending the clinic knew little about cervical cancer screening. The work produced an MPhil, and the trainee has since completed a PhD.

Group B streptococcus (GBS). A pilot study of 78 mother–newborn pairs found a GBS colonisation rate of 13% and a vertical transmission rate of 40%⁹. All isolates were sensitive to penicillin, but 60% were resistant to erythromycin and 50% to clindamycin. A subsequent MPhil project established a direct duplex colony PCR (DDC-PCR) for rapid, low-cost GBS screening at delivery, the first such method in Sri Lanka, and screened isolates for genes associated with reduced β -lactam susceptibility, for which no Sri Lankan data had been reported¹⁰.

Metabolic disease in women

Obesity is increasingly common among Sri Lankan women of reproductive age. In women undergoing abdominal surgery, adipose tissue macrophage infiltration (crown-like structures) was present in 71% of those with a body mass index of 25 kg/m² or more, against 17% of those below 25¹¹. Serum and adipose tissue resistin were associated with dysglycaemia in South Asian women, suggesting resistin as a link between central adiposity and insulin resistance¹²; this study received an NRC Merit Award in 2019. In a related cohort, waist circumference, adipocyte hypertrophy, fasting glucose and resistin were associated with non-alcoholic fatty liver disease¹³.

Diabetes in pregnancy

Diabetes is the most common endocrine disorder in pregnancy and accounts for much of the obstetric workload. We compared three over-the-counter glucometers with laboratory venous plasma glucose in 103 samples from pregnant women with diabetes¹⁴. Only one device met the ISO accuracy standard for glucose values above 100 mg/dL, and none met it below 100 mg/dL. These devices should be evaluated for accuracy before they are licensed for sale.

In a prospective cohort of 138 women, management guided by 1-hour postprandial glucose produced better long-term control than management guided by 2-hour values (mean HbA1c 5.73% vs 6.04%, $p = 0.02$), with less fetal macrosomia¹⁵. A cross-sectional study

Table 1. Frequency of WHO-recommended intrapartum practices observed at Teaching Hospital Peradeniya (n = 196)¹⁷

Practice	Observed
Providing privacy	33.2%
Offering oral fluids	39.3%
Opioids for pain relief	48.5%
Encouraging correct pushing technique	77.6%
Early breastfeeding	83.2%
Regular assessment of vaginal bleeding	91.3%
Skin-to-skin contact	93.4%
Prophylactic uterotonics	100.0%

using the SF-36 found that women with diabetes in pregnancy (n = 294) had lower physical health-related quality of life than controls (n = 306)¹⁶.

Clinical innovation: the first EXIT procedure in Sri Lanka

In 2018, a team from obstetrics, paediatric surgery, otorhinolaryngology and anaesthesiology at Teaching Hospital Peradeniya performed the first successful ex utero intrapartum treatment (EXIT) procedure in Sri Lanka, for a fetus with a large neck tumour. Mother and baby were kept stable on placental support until the airway was secured by a difficult intubation and the baby is fully recovered after the surgery.

Quality of antenatal and intrapartum care

The qualitative side of reproductive health care is poorly studied in Sri Lanka. A focus on volume has contributed to poor experiences of care, dissatisfied patients and litigation. With the Faculty of Allied Health Sciences and the Department of Sociology, Faculty of Arts, we completed two studies that led to MPhil degrees.

In the first, a non-participant observer recorded intrapartum care for 196 women in the labour room and compared it with World Health Organisation recommendations¹⁷. Care that is cheap and simple

was often missing (Table 1). Labour companionship, upright positions in labour, the woman's choice of birth position, and manual or relaxation techniques for pain relief were not observed at all.

In the second, in-depth interviews with 19 primiparous women showed that most valued antenatal exercise and held positive attitudes, though some held misconceptions¹⁸. Women wanted guidance and support from health care providers before they would exercise.

Other clinical studies tested routine practices:

- Transvaginal cervical length did not predict successful induction of labour in 392 nulliparous women beyond 40 weeks with an unfavourable cervix¹⁹.
- In a randomised trial of 394 women with incomplete or missed miscarriage, single-dose doxycycline before evacuation did not significantly reduce post-procedure pelvic infection (4.0% vs 6.2%, $p = 0.37$)²⁰.
- A maternity care audit found that 64% of mothers were satisfied with antenatal and postnatal services overall, with wide variation between aspects of care²¹.
- Among subfertile couples, 18% of men and 10% of women had depressive features, showing that men carry a substantial share of the distress²².

- During the 2017 dengue epidemic, 9 of 29 pregnant women with dengue developed dengue haemorrhagic fever and 2 died, which supports a dedicated national guideline for dengue in pregnancy²³.
- In 77 stillbirths in Kandy district, 23.4% of fetuses had anomalies, and the period of gestation at stillbirth differed by fetal sex²⁴.

Reproductive toxicology

Pesticides, plastics and other pollutants can impair reproductive function. Mancozeb, a fungicide widely used in Sri Lanka but banned in some European countries, has been studied extensively by Professor Suranga Kodithuwakku's group, with our department as collaborator. Mancozeb impaired oocyte maturation and granulosa cell function in vitro²⁵, impaired embryo implantation in vitro and in vivo²⁶, and affected sperm and ovarian function. That it is still in use illustrates the delay between research findings and policy again.

With the South Asian Clinical Toxicology Research Collaboration (SACTRAC), led by Professor Indika Gawarammana, we studied organophosphate exposure in 248 pregnant women²⁷. Forty per cent lived on or within 10 m of a farm, 74% of those farms used pesticides, 47% of women drank well water, yet only 14% believed pesticides could harm them or their fetus.

Interdisciplinary innovation

The University of Peradeniya is well placed for collaborative research. Most of the projects above involved researchers from the Faculties of Agriculture, Arts, Engineering and Allied Health Sciences, which let the team look at clinical problems from outside medicine. The University's Multidisciplinary Centre and the University Research Council, then headed by Professor Janaka Ekanayake, provided seed funding, and the then Vice-Chancellor, Professor M. D. Lamawansa, supported the establishment of a research forum. Two devices have come out of the collaboration with the Faculty of Engineering.

Automated urine volume measurement (patent awarded). Urine output is a basic clinical measurement that is still recorded by hand. During the 2017–18 dengue epidemic, the gynaecology ward at Teaching Hospital Peradeniya was given over to dengue patients from the medical wards. Fluid

balance is central to dengue management, yet output was often measured at midnight by an elderly relative with failing eyesight in a dimly lit corridor. With Dr Ruwan Ranaweera and Dr Janaka Wijayakulasooriya, we developed a thermistor-based device that counts drops and transmits urine volume to clinicians over an Internet-of-Things network²⁸. The resulting patent has been transferred to the University of Peradeniya.

Non-invasive fetal movement monitoring (patent pending). Kick charts are widely used to monitor fetal well-being, but women find them hard to keep accurate, and they can add to anxiety. With Professors Roshan Godaliyadda and Parakrama Ekanayake, we built a low-cost wearable system that records fetal movements with accelerometers and can be used at home²⁹. Validated against ultrasound, its best algorithm detected movements with a true positive rate of 86% and a false positive rate of 7%. A patent application has been filed (LK/P/20786), and several engineering students from the project have gone on to doctoral study.

Work continues on early detection of preterm labour contractions using electrohysterography.

Barriers and the road ahead

Barriers identified

The same obstacles recurred across these projects:

1. No national body coordinates reproductive health research, and there is no source of direct funding for it.
2. The research ecosystem is fragmented, and funding is short and unreliable; the HPV project ended halfway for this reason.
3. Findings are translated into policy slowly, and the Ministry of Health has no fast route for adopting them.
4. Clinical data sit in silos, with little interoperability between systems.
5. Environmental and toxicological influences on reproductive health receive little research attention.
6. Research supervision varies in quality, and staff shortages leave clinicians little time for research.

Recommendations

With the freedom of opinion an oration allows, I propose the following actions:

1. **A national reproductive health research registry and data repository**, an integrated digital registry linking maternal, fetal and reproductive health data.
2. **A National Reproductive Health Research and Innovation Council** to coordinate funding and ethics review and to move findings from research to the bedside.
3. **A digital antenatal record** for monitoring and record keeping, so that clinical data can be retrieved for research and audit.
4. **Clinician-scientists**, by supporting obstetricians to complete a PhD in addition to the MD.
5. **A national training pipeline** for reproductive health researchers and research supervisors.
6. **Translational research infrastructure**, including biobanks, device prototyping laboratories and data analytics units.
7. **Incentives for interdisciplinary projects** that connect medicine with engineering and the social sciences.
8. **International partnerships**, such as regional reproductive health innovation hubs or a South Asian consortium.
9. **Artificial intelligence and digital health literacy** built into postgraduate medical curricula.

Conclusion

Sri Lanka produces more reproductive health research than it did in 2007, and local teams have shown they can develop low-cost diagnostics, test routine practices and build devices suited to the health system. Whether this work improves the care women receive now depends on coordination, sustained funding, shared data and a direct route from evidence to policy. Research and innovation in reproductive health are not about technology alone; they depend on empathy, equity and evidence working together to give every woman and every child a fair start in life. That is the best tribute we can pay to Dr Siva Chinnatamby.

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Conflicts of interest: The author is a named inventor on the urine volume measurement patent and the fetal movement monitoring patent application described in this article.

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