



Review Article

Strengthening maternal nutrition counselling during routine health services: a gap analysis to guide country programmes

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Abstract

Objective: The WHO recommends counselling on healthy eating, weight gain, and physical activity during antenatal care (ANC) and postnatal care (PNC), yet advice and information are often not tailored to women's nutritional needs and contexts. The purpose of the gap analysis was to identify key elements related to the provision of maternal nutrition counselling during routine health contacts and provide programme considerations to strengthen quality service delivery.

Design: A search of PubMed, Cochrane Library, CINAHL Plus and Scopus databases was conducted to retrieve studies from January 2010 to December 2021. Using inclusion criteria, quantitative, qualitative and mixed methods studies were included in the final gap analysis.

Setting: Low-, middle- and high-income country contexts.

Participants: Following application of gap analysis criteria, thirty-seven articles from sixteen countries were included in the analysis.

Results: Gaps in delivery of maternal nutrition counselling include provider capacity building, frequency, content and delivery platforms. Globally, counselling on appropriate weight gain during pregnancy is often not delivered with the desired content nor quality, while targeted counselling to overweight and obese women was provided in several high-income country contexts. Delivery of maternal nutrition counselling through multiple delivery platforms demonstrated improvements in maternal diet and/or weight gain during pregnancy.

Conclusions: Strengthening the integration of maternal nutrition counselling into pre- and in-service curricula, routine health provider training, supportive supervision and provider mentoring is needed. Future efforts may consider generating global and regional weight gain guidelines and incorporating maternal nutrition counselling indicators as part of quality-of-care ANC/PNC standards and routine health systems.

Keywords

Maternal nutrition
Nutrition counselling
Weight gain during pregnancy
Antenatal care
Postnatal care

The 2021 Lancet series underscores the importance of adequate maternal dietary intake alongside scale up of complementary interventions, such as multiple micronutrient and Ca supplementation, through national health systems^(1–3). Supporting pregnancy and postnatal care (PNC) is seminal – as data indicate countries' progress towards attaining World Health Assembly targets for maternal anaemia and low birth weight is slow^(1–4).

Poor-quality diets, inadequate access and quality of essential nutrition health services and suboptimal diet-related behaviours and practices continue to hold back

progress globally^(5–7). Worldwide shifts from traditional diets towards greater consumption of unhealthy 'junk' foods, alongside sociocultural, economic and political factors, have contributed to a steady rise in the number of overweight (BMI > 25 kg/m²) and obese (BMI > 30 kg/m²) women from 69 to 390 million during 1975–2016⁽⁸⁾. The recent COVID-19 pandemic and the Ukraine–Russia war has further disrupted food systems and threatens to exacerbate poor-quality diets due to rising food prices, limited availability and access to nutritious foods, and an increasing reliance on cheap staples (i.e. cereals, roots and tubers) and ultra-processed foods in

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low- and middle-income countries (LMIC) (9–12). The 2022 State of Food Insecurity and Nutrition in the World (SOFI) report reveals that moderate or severe food insecurity disproportionately affects women more so than men, globally and across every region of the world⁽¹²⁾. Underweight and anaemia are likely to worsen – which affects 170 and 520 million women, respectively⁽¹³⁾.

While maternal nutrition is considered integral to the 1000-d window of opportunity, programming efforts have largely neglected maternal nutrition and focused on prevention and treatment of child undernutrition^(6,7,14). Maternal nutrition counselling during antenatal care (ANC) and PNC is a core WHO recommendation for all women, regardless of nutritional status⁽¹⁵⁾. Yet, often counselling is not tailored to women's nutritional needs and situations with the quality, intensity and frequency required to achieve meaningful improvements in nutrition outcomes through current programming efforts (i.e. healthy dietary intake and maternal nutritional status)^(7,16,17). Further, counselling on appropriate gestational weight gain is not adequately and consistently integrated as part of routine ANC in LMIC⁽⁷⁾. Recent meta-analyses reveal that excessive pregnancy weight gain is associated with higher risk of obesity, caesarean section and large-for-gestational age infants, while inadequate weight gain increases risk of delivering a small-for-gestational age infant⁽¹⁸⁾.

The objectives of this paper are to: (1) examine gaps in key elements of quality maternal nutrition counselling, including provider capacity building, frequency, content, and use of delivery platforms in low-, middle- and high-income countries and (2) offer programme considerations to strengthen delivery of maternal nutrition counselling.

Design and methods

A gap analysis was conducted on actual *v.* recommended elements of maternal nutrition counselling during pregnancy and lactation carried out globally. The analysis was comprised of a review of peer-reviewed and grey literature, followed by programmatic considerations. Elements related to quality maternal nutrition counselling are as follows: provider capacity building (i.e. interventions such as courses/tools for improving provider knowledge and/or counselling skills), frequency, content (i.e. counselling on maternal diet, weight gain during pregnancy and/or physical activity during ANC and/or PNC) and delivery platforms, based on evidence from several seminal papers, WHO recommendations and standards of care for ANC and PNC^(15,19–21). These elements are described in a conceptual framework (see Fig. 1) which delineates key components of quality maternal nutrition counselling provided at routine facility and community ANC and PNC services.

The search strategy was developed and included the following key words in various combinations of the Medical Subject Headings (MeSH) terms: 'maternal nutrition',

'eating', 'maternal diet', 'maternal dietary intake', 'counselling' and 'health care'. Articles on counselling for micronutrient (i.e. iron folic acid supplementation) are excluded from this gap analysis, as this analysis focuses on specific, neglected areas of maternal nutrition counselling, inclusive of counselling on maternal diet, weight gain during pregnancy and physical activity⁽⁷⁾. PubMed, Cochrane Library, CINAHL Plus and Scopus databases were searched using the above key words, and libguides, opengrey.eu, greyli-t.org, greynet.org were perused for non-published, grey literature of programme reports published from January 2010 to December 2021. Quantitative, qualitative and mixed methods studies were included in the final gap analysis, based on the quality of evidence presented in the studies.

The initial search resulted in 506 peer-reviewed articles. Titles and abstracts were reviewed and screened to determine initial inclusion. Exclusion criteria included studies/trials with non-human subjects (i.e. animals); articles reporting only study/clinical trial protocols, systematic reviews, data and literature reviews, and articles that reported maternal counselling focused solely on infant and/or young child nutrition, articles that focused on behaviours and/or medical interventions associated with addressing or treating smoking cessation, gestational diabetes, HIV/PMTCT, and articles that examined specific individualised dietary interventions tailored to obese women/excessive weight gain, rather than public health approaches. After this initial exclusion of these articles, thirty-seven articles were confirmed for final inclusion in this gap analysis (see Table 1).

The final thirty-seven articles were chosen based on the following criteria and elements defined in the conceptual framework: (a) identified specific elements related to the provision and/or quality of maternal diet counselling during pregnancy and postpartum (i.e. time and frequency); (b) provided data on key elements that affected counselling given on maternal diet during pregnancy and post-partum/lactation, including provider capacity, content, frequency and/or delivery platforms; and (c) provided information on counselling on appropriate weight gain during pregnancy and/or physical activity/maternal rest, within the context of counselling on maternal nutrition (if a and b criteria were met).

Findings

This gap analysis examined key elements of quality maternal nutrition counselling, which is comprised of building provider capacity to counsel, frequency, content (i.e. weight gain and physical activity during pregnancy, healthy eating during antenatal and postnatal periods) and delivery platforms (see Table 1).

Capacity building for health providers on maternal nutrition counselling

Two studies examined capacity building interventions (course/tools) on improvement of provider knowledge

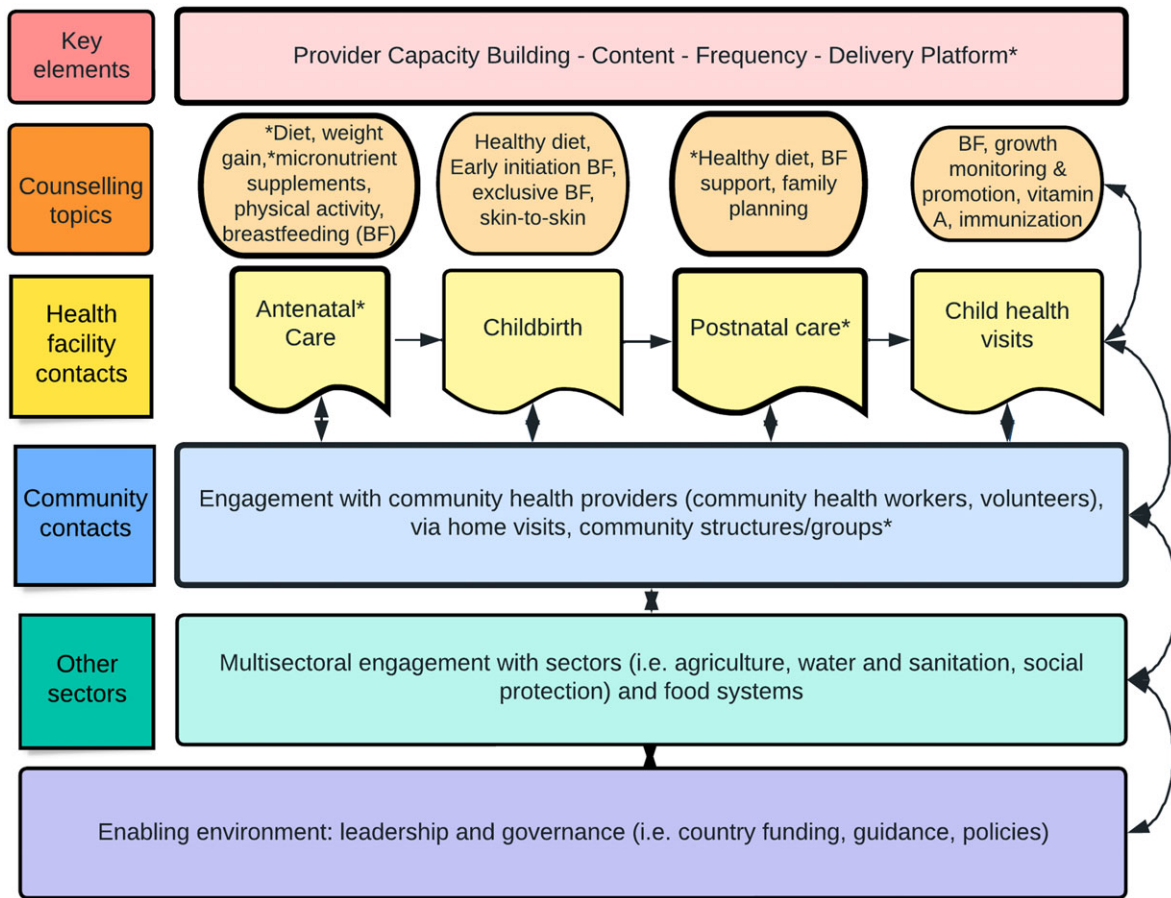


Fig. 1 Conceptual framework on elements related to quality maternal nutrition counselling delivered through facility and community routine health contacts. Bold-bordered boxes with * denote elements explored in this gap analysis

and counselling provision during ANC^(22,23). In Brazil, a 16-h training course and three workshops on healthy eating and physical activity during pregnancy resulted in improved provider knowledge scores, as well a greater proportion of women who reported receipt of guidance on 'leisure-time walking' (50.7% *v.* 19.1%) and 'healthy eating' at ANC (58.6% *v.* 33.3%)⁽²³⁾. In Benin, pictorial job aids (i.e. capacity building tools) which were used to counsel health providers showed higher receipt of messages on 'eating more and varied' during pregnancy (+4.8 ppt) and breast-feeding messages (+32.0 percentage points (ppt) – early initiation, +41.3 ppt – exclusive breast-feeding) in intervention *v.* control arm⁽²²⁾.

Frequency of counselling on maternal nutrition

Two studies reported that frequent attendance at ANC, either early in pregnancy or the number of visits, may not result in greater receipt of maternal nutrition counselling on the topics of dietary intake, breast-feeding, weight gain during pregnancy or physical activity^(24,25). In Malawi, while ANC attendance was high, women received, on average, one instance of nutrition counselling and rarely received breast-feeding counselling on early and/or

exclusive breast-feeding during ANC (0.06 instance). Counselling on adequate nutrition during pregnancy was observed in less than half (44%) of first visits and one-third (33%) of later ANC visits (4th and onwards)⁽²⁴⁾. In Australia, in a study of pregnant women, at 36 weeks' gestation, only 21% of women 'sometimes-always' received counselling on the amount of food to eat, and half of these women were encouraged to be physically active^(25,26). In Haiti, only 5% of counselling messages were received during the first ANC visits, and 50% of counselling messages (five of ten messages) were received at follow-up ANC visits⁽²⁷⁾.

Quality of content on maternal nutrition counselling

Counselling on maternal dietary intake, weight gain and physical exercise during antenatal care and postnatal care

Data from nine studies reveal that health providers gave no to little generalised information on maternal nutrition, based on women's experiences of ANC and PNC⁽²⁶⁻³³⁾. In Ethiopia, women who did not receive any dietary counselling were 3+ times more likely to have inadequate

Table 1 List of studies include in the maternal nutrition counselling gap analysis

Author, year	Country	Sample size and respondent group	Study methods	Key findings
Capacity building for health providers on maternal nutrition counselling				
Jennings <i>et al.</i> , 2011	Benin	<i>n</i> 409 pregnant women: 206 women who counselled by nurse-midwives and 203 women counselled by lay nurse aides <i>n</i> 48 healthcare provider, including 21 nurse-midwives and 27 lay nurse aides	<ul style="list-style-type: none"> • Non-inferiority quasi-experimental design, sub-study of Jennings <i>et al.</i>, 2010 • Task shifting intervention: nurse-midwives and lay nurse aides were trained for 3 d (separately) on similar curricula, included a description of task delegation, peer and group role playing, interpersonal communication, and quality of care. 	Lay nurse aides <i>v.</i> nurse-midwives for provision of any ANC message <ul style="list-style-type: none"> • +19.7 ppt (12.9–26.5) in providing message on 'at least four prenatal visits' • +13.4 ppt (7.0–19.8) in providing message on 'eat more and varied' on maternal nutrition
Malta <i>et al.</i> , 2016	Brazil	<i>n</i> 42 doctors and nurses	<ul style="list-style-type: none"> • Controlled, non-randomised intervention study • Intervention: 16-h training course and 3 workshops on healthy eating and physical activity during pregnancy for providers <i>v.</i> traditional health units 	Intervention <i>v.</i> control group: <ul style="list-style-type: none"> • Knowledge scores for walking were 7.3 and 3.9, respectively, and 3.9 and 3.6, respectively, for healthy eating • Patients were more likely to receive guidance regarding leisure-time walking and healthy eating at an antenatal care visit
Frequency of maternal nutrition counselling				
Joseph <i>et al.</i> , 2020	Malawi	<i>n</i> 24 230 women	<ul style="list-style-type: none"> • 2013–2014 Malawi Multiple Indicator Cluster Survey • 2013 Malawi Service Protection Provision Assessment Survey • Direct observations of ANC visits and interviews with women following ANC 	<ul style="list-style-type: none"> • Nutrition counselling during pregnancy observed in 44 % of first ANC visits and 32 % of fourth or later ANC visits • 1 instance of counselling on diet during pregnancy • 5.7 % of women received counselling on early and exclusive breast-feeding • 0.06 instances of counselling on proper breast-feeding practices • Receipt of 1.6 interventions on IFA (interventions defined as prescriptions for supplements or counselling on IFA adherence and side effects with and without IFA)
Mirkovic <i>et al.</i> , 2017	Haiti	<i>n</i> 931 pregnant and postpartum women <i>n</i> 1411 antenatal charts <i>n</i> 38 healthcare providers	<ul style="list-style-type: none"> • Client through exit interviews, antenatal chart abstraction and provider knowledge assessment questionnaires 	<ul style="list-style-type: none"> • Among pregnant women, 5 % received all 10 counselling messages (included nutrition counselling, estimated due date, growth of baby, birth plan, delivery danger signs, postpartum family planning and birth interval), and 42 % received at least 5 messages • No specific information on the type and content of nutrition counselling provided
Yeneabat <i>et al.</i> , 2019	Ethiopia	<i>n</i> 759 respondents	<ul style="list-style-type: none"> • Community-based cross-sectional study • Quantitative data were collected on women's dietary diversity and food security 	<ul style="list-style-type: none"> • Prevalence of inadequate dietary diversity was 55.7 % • Pregnant women who had not received dietary counselling were more than 3 times more likely to have inadequate dietary diversity • Non-educated pregnant women were about 7.3 times more likely to have inadequate dietary diversity, compared to women who completed college • Women who were poorest, poorer, poor and richer were more likely to have inadequate dietary diversity compared to those in the richest wealth index

**Table 1** *Continued*

Author, year	Country	Sample size and respondent group	Study methods	Key findings
Quality of content on maternal nutrition counselling				
Chang <i>et al.</i> , 2013	USA	<i>n</i> 10 prenatal care providers	<ul style="list-style-type: none"> Semi-structured qualitative interviews that included ranking of important prenatal issues and open-ended questions addressing general perceptions, approach with patients and clinical care challenges 	<ul style="list-style-type: none"> No provider knowledge of IOM guidelines on weight gain, action only taken for excessive weight gain Lack of resources for patients, especially nutritional education/counselling Lack of provider belief in behaviour change
de Jersey <i>et al.</i> , 2013	Australia	<i>n</i> 664 pregnant women	<ul style="list-style-type: none"> Self-completed questionnaires assessed pre-pregnancy weight, eating and physical activity behaviour, and knowledge 	<ul style="list-style-type: none"> 4 % of participants achieved the maximum knowledge score for pregnancy-specific nutrition knowledge and 5 servings/d of vegetables 44 % of participants met guidelines for minutes of physical activity
Deputy <i>et al.</i> , 2018	USA	<i>n</i> 7125 pregnant women	<ul style="list-style-type: none"> Data from the 2010–2011 Pregnancy Risk Assessment Monitoring System (PRAMS) 	<ul style="list-style-type: none"> 26.3 % of women reported receiving healthcare provider advice consistent with the 2009 IOM recommendations 26.0 % did not receive advice 31.5 % of women had appropriate weight gain; 22.6 % had inadequate weight gain; and 45.9 % had excessive weight gain
Emery <i>et al.</i> , 2018	USA	<i>n</i> 191 women with pre-pregnancy overweight or obesity	<ul style="list-style-type: none"> Prenatal and 6 months postpartum questionnaires: on knowledge of gestational weight gain (GWG) – baseline, height and weight (both time points) At 6 months: questions on healthcare provider's advice about GWG 	<ul style="list-style-type: none"> 46 % of all women reported knowing how much gestational weight to gain during pregnancy. 39 % of women reported GWG advice from a healthcare provider, and 11 % did not receive specific amount for GWG
Ferrari <i>et al.</i> , 2013	USA	<i>n</i> 58 pregnant African American, Caucasian and Hispanic women	<ul style="list-style-type: none"> Two focus groups per race/ethnicity and BMI grouping barriers and enablers to healthy eating and physical activity 	<ul style="list-style-type: none"> African American and Caucasian women: reported dietary advice was overwhelming, confusing or frequently changing Advice on physical activity was perceived as vague, told 'to walk'
Ferrari <i>et al.</i> , 2013	USA	<i>n</i> 1454 pregnant women	<ul style="list-style-type: none"> Data came from the Pregnancy, Infection and Nutrition Study 3 (PIN), a longitudinal cohort study of risk elements for pre-term birth Data collected via clinic visits, in-depth phone interviews and self-administered questionnaires 	<ul style="list-style-type: none"> Less than 25 % of the population gained within IOM recommendations, while 10 % gained less and 2/3 gained more Of the 52 % of women who received weight gain advice, 75 % reported was from a doctor, 8 % from a nurse and 18 % from 'other health professional' 91 % of women reported following advice that was given
Hui <i>et al.</i> , 2014	Canada	<i>n</i> 113 women	<ul style="list-style-type: none"> Participants were randomised into intervention and control groups Intervention included community-based weekly exercise programme and one-on-one private dietary consultation at baseline and 2 months after 	<ul style="list-style-type: none"> Amount of GWG was about 20 % lower Rate of excessive GWG (EGWG) was 27 % points lower Daily intakes among normal pre-pregnancy BMI were lower in total calories: 2016 ± 496 kcal <i>v.</i> 2551 ± 1044 kcal; carbohydrates: fat: saturated fat: and cholesterol:

Table 1 Continued

Author, year	Country	Sample size and respondent group	Study methods	Key findings
Jennings <i>et al.</i> , 2010	Benin	<i>n</i> 686 pregnant women <i>n</i> 55 health providers	<ul style="list-style-type: none"> • Pre-post randomised group design • Fourteen health facilities randomised to intervention (i.e. health providers had 3-d training on job aids with role playing and support for communication skills/challenges) v. control group. Pictorial job aids targeted women on care during and after pregnancy • Observations of ANC visits • Client exit Interviews (baseline and endline) • Provider interviews on perceptions of tools 	<ul style="list-style-type: none"> • Participants with pre-pregnancy BMI ≥ 25, intake was significantly lower in total calories: 1986 \pm 470 kcal v. 2258 \pm 546 kcal; as well as total fat saturated fat: and cholesterol intake • Intervention v. control arm – provision of any ANC message • +10.9 v. +6.2 ppt women given message on ‘eat more and varied’ • +33.9 v. +8.6 ppt had at least 4 prenatal visits • +37.6 v. +5.6 ppt for early initiation of breast-feeding • +45.8 v. +4.4 ppt for avoid pre-lacteal feeding/exclusive breast-feeding
LeFevre <i>et al.</i> , 2018	Tanzania	<i>n</i> 41 postpartum care clients	<ul style="list-style-type: none"> • Non-randomised programme assessment • Client exit interviews • Direct observations • Provider interviews 	<p>Programme health centres v. comparison health centres – provider knowledge v. delivery of the following counselling messages:</p> <ul style="list-style-type: none"> • 81 % v. 31 %: important types of food to eat • 50 % v. 27 %: taking regular meals • 82 % v. 12 %: eating a variety of food at meals • Similar pattern in comparison sites • Clients (women’s knowledge), tended to be lower for maternal nutrition in programme sites
McDonald <i>et al.</i> , 2015	Canada	<i>n</i> 131 pregnant women	<ul style="list-style-type: none"> • Prospective cohort study comparing women receiving a knowledge translation (KT) tool to historical controls in a non-randomised comparison (from the same clinics from 1 year prior to the present study) • Intervention included a website (‘Me and My Baby’) that included inputting a woman’s pre-pregnancy height and weight to output a graph that shows the women’s specific upper and lower limits for recommended weight gain according to the IOM guidelines • Self-administered surveys by participants to evaluate knowledge of tool 	<p>KT group v. control group</p> <ul style="list-style-type: none"> • 60.5 % v. 29.2 % reported receiving GWG counselling from their healthcare provider to gain a specific amount or range • 85.7 % v. 47.2 % reported their healthcare provider discussing GWG-related topics, such as nutrition/health eating, appropriate weight gain, risks of gaining too much weight and/or exercise • 34.4 % v. 21.3 % believed there were risks to excess GWG • 62.4 % v. 37.8 % believed there was a risk with inadequate GWG • 24.0 % v. 17.9 % reported being counselled to consume a specific amount or range of additional calories each day by their healthcare provider • 51.6 % v. 48.4 % of women recommended to gain within the IOM guidelines

Table 1 *Continued*

Author, year	Country	Sample size and respondent group	Study methods	Key findings
Mercado <i>et al.</i> , 2017	USA	<i>n</i> 355 women	<ul style="list-style-type: none"> • Sub-study on prenatal sources of information • Participants enrolled in “Fit for Delivery” clinical trial – prenatal lifestyle intervention (<i>v.</i> standard care) could reduce EGWG in normal weight • Questionnaires at 6-week postpartum • Anthropometric measures at study entry, 35 weeks’ gestation (during pregnancy) 	<ul style="list-style-type: none"> • Receipt of advice was 55.6 %, 48.2 % and 33.9 % of physicians, dieticians or nurses, respectively • 48 % of women reported receiving information from a physician, yet experienced excessive weight gain during pregnancy • 60.6 % women reported receiving diet, physical activity and weight control information from a book and also from the internet (58.3 %)
Mirkovic <i>et al.</i> , 2017	Haiti	<ul style="list-style-type: none"> <i>n</i> 931 pregnant and postpartum women <i>n</i> 1411 antenatal charts <i>n</i> 38 healthcare providers 	<ul style="list-style-type: none"> • Client through exit interviews, antenatal chart abstraction and provider knowledge assessment questionnaires 	<ul style="list-style-type: none"> • Among pregnant women, 5 % received all 10 counselling messages (included nutrition counselling, estimated due date, growth of baby, birth plan, delivery danger signs, postpartum family planning and birth interval), and 42 % received at least 5 messages • No specific information on the type and content of nutrition counselling provided • Among women seeking postnatal care, 67 % knew the recommended duration of exclusive breast-feeding
Morris <i>et al.</i> , 2017	Canada	<i>n</i> 508 general practitioners, obstetricians, midwives, nurse practitioners and registered nurses	<ul style="list-style-type: none"> • Concurrent mixed methods design, online survey and semi-structured qualitative interviews on practices, knowledge, and attitudes related to GWG, nutrition and physical activity 	<ul style="list-style-type: none"> • 21 % of health providers reported routinely providing women with a GWG target based on pre-pregnancy BMI • 76 % of providers weighed women at every visit, while half routinely relayed GWG information every women were weighed • 46 % of health providers routinely discussed physical activity, and 28 % routinely discussed appropriate extra food requirements
Nikolopoulos <i>et al.</i> , 2017	Canada	<i>n</i> 26 women, pregnant and postpartum	<ul style="list-style-type: none"> • 5 focus group discussions on weight gain during pregnancy and weight loss postpartum, and counselling from healthcare providers (HPC) on weight gain during and after pregnancy 	<ul style="list-style-type: none"> • Reported beliefs that weight gain is 25–35 pounds, confusion on weight gain range and access to online resources to learn about weight gain • Some women stated non-receipt of information about appropriate weight gain from health providers • Health providers communicated when too much weight was gained, many did not offer strategies to help support women, nor create plans/actions and nor discuss expectations • Nearly, all women recalled lack of discussion on weight loss after giving birth
Phommachanh <i>et al.</i> , 2019	Lao PDR	<ul style="list-style-type: none"> <i>n</i> 77 ANC providers <i>n</i> 421 observation sessions with 421 pregnant women <i>n</i> 50 participants (couples with pregnant women and mothers with children under 1 year of age, and health providers and policy-makers) 	<ul style="list-style-type: none"> • A health facility based, cross-sectional observational study in 16 public health facilities • Qualitative study with semi-structured interviews 	<ul style="list-style-type: none"> • Only 4 % of the observed ANC session took privacy into consideration. Less than 10 % of available information materials were used during each ANC session. • None of the health providers in both rural and urban areas performed specific counselling.

Table 1 Continued

Author, year	Country	Sample size and respondent group	Study methods	Key findings
Pligt, 2016	Australia	<i>n</i> 448, first-time mothers	<ul style="list-style-type: none"> Enrolled in Melbourne InFANT Extend trial, food frequency questionnaire at 3–4 months postpartum, Active Advice Survey administered 	<ul style="list-style-type: none"> Receipt of healthy eating advice during pregnancy compared with postpartum period (87.1 % <i>v.</i> 47.5 %, <i>P</i> < 0.01) Receipt of physical activity advice during pregnancy (82.8 %) <i>v.</i> during postpartum period (51.9 %) <i>P</i> < 0.01 No significant association between nutrition/physical activity advice and increased fruit/vegetable/soft drink intake nor time spent walking or total physical activity time or meeting nutrition or physical activity recommendations
Power <i>et al.</i> , 2017	USA	<i>n</i> 317 practicing obstetrician-gynecologists	<ul style="list-style-type: none"> Questionnaires sent to participants on knowledge, practice and opinions regarding weight gain during pregnancy 	<ul style="list-style-type: none"> 91.2 % counsel their patients about weight gain 81.8 % were aware of the 2009 IOM guidelines and those that were aware If aware, it was associated with using BMI and counselling on weight gain during pregnancy often or always (81.3 w/awareness <i>v.</i> 61.4 % no awareness); 55 % confident in their ability to affect patient's weight gain 85.8 % of providers counsel on exercise during pregnancy often/always No mention of type or content of nutrition counselling, with a few referring patients
Ramakrishnan <i>et al.</i> , 2012	India	<ul style="list-style-type: none"> <i>n</i> 31 key informant policy and decision-makers <i>n</i> 15 auxiliary nurse-midwives, local doctors, Accredited Social Health Activists (ASHA) and local leaders <i>n</i> 35 community health workers and women of reproductive age 	<ul style="list-style-type: none"> Data from interviews and focus group discussions 	<ul style="list-style-type: none"> Health workers (nurses and doctors) advised consumption of papaya does not cause abortion Anganwadi officials reported that an 10–14 kg is 'adequate weight gain' Whereas women in Tamil Nadu and Uttar Pradesh estimated adequate weight gain as 4 to 10 kg, while women in Uttar Pradesh reported no knowledge of how much a pregnant woman should gain
Kunath <i>et al.</i> , 2019	Germany	<i>n</i> 250 pregnant women	<ul style="list-style-type: none"> Cluster-randomised controlled trial Intervention programme included 2 individual counselling sessions focused on diet, physical activity and weight monitoring 	<p>Intervention <i>v.</i> control group</p> <ul style="list-style-type: none"> Lower proportion of women exceeding IOM guidelines: 38 % <i>v.</i> 60 % 17 % <i>v.</i> 31 % of postpartum women showed substantial weight retention of > 5 kg Women maintained a stable intake of energy, while women in control group increased daily energy intake from an average 2110 kcal at baseline to 2328 kcal at end of pregnancy
Santo <i>et al.</i> , 2017	USA	<i>n</i> 2669 (<i>n</i> 1584 is data physical activity during pregnancy)	<ul style="list-style-type: none"> Secondary data from 2008 PRAMS analysed on physical activity frequency during 3rd trimester, and also provider advice on physical activity during pregnancy 	<ul style="list-style-type: none"> Overweight women were more likely than normal-weight women to receive advice about physical activity during pregnancy (aOR 3.1, 95 % CI (1.2, 7.7)), but obese women were less likely to receive advice (aOR 0.65, 95 % CI (0.4, 1.2)).

**Table 1** *Continued*

Author, year	Country	Sample size and respondent group	Study methods	Key findings
Stotland <i>et al.</i> , 2012	USA	<i>n</i> 311 pregnant women	<ul style="list-style-type: none"> • Secondary data analysis on Keep Fit, a secondary arm of Health in Pregnancy randomised controlled trial • Participants asked if 'healthy eating', exercise ('keeping active') or weight gain during pregnancy had been discussed with health provider 	<ul style="list-style-type: none"> • Receipt of advice on GWG was strongly associated with receiving advice about physical activity (aOR 15.2, 95 % CI (8.7, 26.6)) • All associations were not attenuated by adjustment by sociodemographic and pregnancy elements • 67.4 % of women reported receipt of ANC counselling on weight gain during pregnancy. 68.2 % on nutrition, and 65.3 % on exercise during pregnancy • Overweight and obese women were significantly more likely to be counselled on exercise ($P < 0.05$), though not nutrition nor weight gain during pregnancy
Swift <i>et al.</i> , 2016	England	<i>n</i> 193 pregnant women	<ul style="list-style-type: none"> • Participants completed a questionnaire on weight monitoring behaviour and advice; awareness of guidance and sources of information • Anthropometric measurements of weight and height taken 	<ul style="list-style-type: none"> • 15.8 % of women reported receipt of specific advice about their weight • Women classified as obese were significantly more likely to receive specific advice about their weight compared to women classified as 'recommended' weight ($X^2 = 9.04$, $P < 0.01$) • 39.4 % of women being aware of guidance around weight change during pregnancy
Vinturache, 2019	Canada	<i>n</i> 2909, pregnant women at least 24 weeks gestational age	<ul style="list-style-type: none"> • Data from the All Our Families – prospective, community-based pregnancy cohort study • Questionnaires explored aspects of prenatal counselling and linked to electronic medical records 	<ul style="list-style-type: none"> • Two-thirds of women received advice on nutrition, exercise and active living, and appropriate weight gain, which did not differ whether weight gain was adequate, inadequate or excessive
Wennberg <i>et al.</i> , 2015	Sweden	<i>n</i> 17 midwives	<ul style="list-style-type: none"> • Telephone interviews regarding when, what and how dietary advice was given; challenges experienced in dietary counselling • Face-to-face interviews included more in-depth conversation with providers 	<ul style="list-style-type: none"> • Obese women or those who put on too much weight, as well as underweight women who were underweight were described as '<i>challenging for counselling on nutrition</i>', with weight described as '<i>delicate</i>' subject • Midwives felt their advice had an uncertain impact on the women's behaviour • Most midwives did not rely on specific counselling methods and used common sense and had no solutions for diet-related issues
Whitaker <i>et al.</i> , 2016	USA	<i>n</i> 188 pregnant women	<ul style="list-style-type: none"> • Mixed methods study design • Internet-based survey to assess provider advice on weight gain, physical activity and nutrition 	<ul style="list-style-type: none"> • About 52 % of women reported receipt of provider advice on pregnancy weight gain, 63 % on physical activity and 56 % on nutrition • 79 % of women reported provider recommendations within the IOM guidelines, 9 % below the guidelines and 11 % above the guidelines

Table 1 Continued

Author, year	Country	Sample size and respondent group	Study methods	Key findings
Yamamoto <i>et al.</i> , 2014	USA	<i>n</i> 33 187 preventive care visits for women of childbearing age	<ul style="list-style-type: none"> • Combined the 2005–2010 National Ambulatory Medical Care Survey (NAMSC) and the National Hospital Ambulatory Medical Care Survey (NHAMCS) to obtain estimates of outpatient preventive care visits for women of childbearing age • Compared proportions of preventive visits that included diet/exercise counselling for pregnant women <i>v.</i> non-pregnant women 	<ul style="list-style-type: none"> • 45 % of women reported receipt of advice to eat plenty of fruits and vegetables, 34 % reported increase protein intake and 34 % reported consume a well-balanced or healthy diet • 17.9 % of visits for pregnant women included diet/exercise counselling • Lean pregnant and non-pregnant women received less counselling than their overweight counterparts: 20.0 % <i>v.</i> 26.0 % and 19.4 % and 36.2 %, respectively
Delivery platforms Aker <i>et al.</i> , 2012	Bangladesh	<i>n</i> 115 women, attended Maternal and Child Health Training Institute in Dhaka, which provides maternity care for nominal fee or free of charge Women were in 7 th month of pregnancy	<ul style="list-style-type: none"> • Experimental study with a 3-month providing group nutrition education (i.e. intervention) to women on: increasing frequency of food intake from three times to five times daily during pregnancy, food hygiene, rest during the daytime, avoidance of prelacteal feeds, early initiation (1 h) of breast-feeding and exclusive breast-feeding. • Education emphasised home preparation of <i>khichuri</i>, local recipe with lentils, eggs, soya oil and leafy vegetables • Comparison group did not receive nutrition education intervention 	<ul style="list-style-type: none"> • Intervention <i>v.</i> comparison group • + 34 % increased meal frequency from 3 to 5 times a day • + 27 percentage point in exclusive breast-feeding 1-month post-delivery • + 45 % had greater pregnancy weight gain (5.61 <i>v.</i> 3.88 kg, <i>P</i> = 0.001).
Frongillo <i>et al.</i> , 2019	Bangladesh	<i>n</i> 2000 recently delivered women with children < 6 months <i>n</i> 600 pregnant women in the second and third trimester	<ul style="list-style-type: none"> • Cluster-randomised, non-blinded design, cross-sectional baseline and endline surveys • Intervention: interpersonal communication (on increase diet quality, breast-feeding and monitoring of weight gain) • Frontline workers and health volunteers were trained to counsel pregnant and recently delivered women on diet plans and rest, provided free IFA and Ca supplements, and measured weight during antenatal care visits • Community mobilisation included husbands' forums (importance of proper nutrition during pregnancy and postpartum, encourage purchase diversified foods, supporting wives in quantity of diversified foods, taking iron and folic acid/Ca tablets) 	<ul style="list-style-type: none"> • Nutrition-focused MNCH group <i>v.</i> standard MNCH group • Prevalence of any food insecurity was 22.3 and 19.7 percentage points lower for recently delivered and pregnant women, respectively, in the nutrition-focused MNCH group compared to the standard MNCH group at endline (<i>P</i> < 0.01)
Nair <i>et al.</i> , 2017	India	<i>n</i> 5781 pregnant women	<ul style="list-style-type: none"> • Cluster-randomised controlled trial • In the intervention clusters, 	<ul style="list-style-type: none"> • Food restrictions during pregnancy (61 %), anaemia (48 %) and malaria during pregnancy

Table 1 *Continued*

Author, year	Country	Sample size and respondent group	Study methods	Key findings
			community-based workers counselled women on maternal nutrition and growth promotion for children under the age of 2 years	(40 %) were prioritised problems Intervention v. Control Groups • No difference on average maternal mid-upper arm circumference in the third trimester of pregnancy, or on maternal BMI 9 months post-partum was detected • Pregnant women were slightly more likely to achieve minimum dietary diversity: 37 % v. 32 %
Nguyen <i>et al.</i> , 2017	Bangladesh	<i>n</i> 600 pregnant women <i>n</i> 2000 recently delivered women with children less than 6 months of age	<ul style="list-style-type: none"> • Cluster-randomised, non-blinded design • Baseline and endline household surveys (content of intervention/comparison same as Nguyen <i>et al.</i>, 2018) 	Nutrition-focused MNCH v. routine care MNCH at endline <ul style="list-style-type: none"> • 82.3 % v. 22.9 % reported receipt of nutrition information • 97.8 % v. 89.1 % reported receipt of messages on breast-feeding practices • +9.8 pp consumed IFA (nutrition-focused v. routine care) • +12.8 ppt consumed Ca (nutrition-focused v. routine care) • Consumed 6.5 ± 1.6 food groups v. 5.1 ± 1.3 food groups • +23.7 ppt consumed ≥5 food groups
Nguyen <i>et al.</i> , 2018	Bangladesh	<i>n</i> 2000 women with children less than 6 months of age <i>n</i> 1307 husbands	<ul style="list-style-type: none"> • Cluster-randomised, non-blinded, impact evaluation design • Cross-sectional household surveys at baseline and endline • Intervention group: 1. specific diet plan, 2. Providing free supplements and advice on using them, 3. Measuring weight and explaining optimal weight-gain patterns, 4. Counselling on adequate rest, and 5. Engaging husbands and other family members to ensure enough varied foods and supplements being available • Community mobilisation in the nutrition-focused MNCH group included 2 husbands' forums on maternal nutrition • Routine care MNCH group – no community mobilisation or husband engagement 	Nutrition-focused MNCH intervention v. routine care MNCH at endline, husbands reported: <ul style="list-style-type: none"> • +2.74 % greater improvement in awareness scores of proper diet during pregnancy, messages on iron folic acid and Ca supplements, weight gain, and rest during pregnancy • +34.6 ppt obtained 5 varieties food • +33.9 ppt obtained IFA and Ca supplements • +23.7 ppt in aiding to consume adequate amount of food and +37.5 ppt for supporting wives to take IFA and Ca supplements points higher, respectively • +6.8 ppt – ensuring availability of diversified foods
Nikiéma <i>et al.</i> , 2017	Burkina Faso	<i>n</i> 2293 pregnant women <i>n</i> 2253 children born to the pregnant women	<ul style="list-style-type: none"> • Cluster-randomised trial • All healthcare providers in intervention arm: a training on communication/counselling skills and maternal and child nutrition, focused on pregnant women's diet, breast-feeding, complementary feeding practices 	Intervention v. control group: <ul style="list-style-type: none"> • Exposure to all the counselling themes was higher • 32.2 % of pregnant women received counselling on proper diet during pregnancy (and were 3x more likely to be exposed) v. 16.1 % in control group, <i>P</i> = 0.004 • Improvements in dietary practices was higher at 11.5 % v. 7.1 %



dietary diversity (aOR = 3.31, 95 % CI (1.49, 7.35))⁽²⁶⁾. Specific content of the maternal nutrition counselling provided during ANC and PNC was not reported – beyond breast-feeding counselling which was received by three-fourths of women during PNC⁽²⁷⁾. In Laos, a cross-sectional study revealed that while counselling materials were available in half of rural clinics, these materials were used in less than 10 % of counselling sessions on diet during pregnancy (10 %) and after childbirth (3 %)⁽³¹⁾. Moreover, counselling was received by about one-third of rural women⁽³¹⁾. In two studies, women described receipt of non-specific, dietary advice, which included ‘eat a variety of food’, ‘don’t restrict food’ and ‘walk’, which was perceived as ‘confusing’ and ‘difficult to interpret’ in relation to their dietary intakes and levels of physical activity^(28,29). In a singular study in Australia, receipt of advice on nutrition during pregnancy and physical activity was nearly 30 percentage points (ppts) higher than advice provided during the postnatal period⁽³³⁾.

In Tanzania, a programme evaluation revealed that health provider knowledge on women’s nutrition was substantially greater (range + 23–70 ppts) than the provision of counselling messages on ‘important types of food to eat’, ‘eat a variety of foods at meals’ and ‘take regular meals’ during PNC⁽³²⁾. In contrast, in India, where pregnant women were ‘encouraged to eat well as an important part of a healthy pregnancy’⁽³⁴⁾. Foods such as pulses, chapattis, milk, yogurt, green leafy vegetables, fruits and *kichidi* (i.e. rice and lentils) were advised for consumption primarily by family members and health providers⁽³⁴⁾.

Fifteen studies revealed information gaps in counselling on weight gain during pregnancy from women’s and providers’ experiences^(26,35–48). In India, some women stated they had no knowledge of gestational weight gain, while others reported that 4–10 kg (kg) was ‘adequate weight gain’, which differed from facility and community health workers’ knowledge of optimal weight gain during pregnancy (i.e. 10–15 kg)⁽²⁹⁾. Evidence reveals that in high-income countries, counselling on weight gain during pregnancy varies widely, with 16–67 % of women receiving guidance^(35–39,43,46,47). Women lack knowledge on how much weight to gain during pregnancy and often receive incorrect and/or insufficient advice from health providers^(30,36–40). In a few high-income countries, pregnant women were more likely to be advised on gestational weight gain, and physical activity if they were affected by overweight/obesity in comparison with women of normal weight^(35–38,43,46–48). Providers described not being comfortable discussing ‘delicate topics’ (i.e. women affected by obesity were perceived to ‘gain too much weight’ or women are underweight)^(37,41). Providers held views that they had ‘too little knowledge and/or training’ for conducting dietary counselling, as diet is viewed as ‘hard to change’.^(37,41–43) From the perspective of pregnant women, information on weight gain during pregnancy is often from experience in prior pregnancy⁽³⁶⁾, culture and

habits^(37,43), and advice from family or friends (i.e. ‘eating for two’)^(7,36).

Delivery platforms for maternal nutrition counselling

Six studies showed that an integrated package of nutrition counselling interventions delivered through multiple delivery platforms – including group and interpersonal counselling, home visits and food demonstrations – improved maternal diet and/or weight gain during pregnancy^(20,49–53). Three studies in Bangladesh showed that intensive and frequent counselling by both health facility workers and community volunteers, engagement with key influencers (i.e. fathers), and provision of free-of-charge micronutrient supplements improved maternal, infant and young child nutrition outcomes and reduced household food insecurity in nutrition-intensive *v.* routine care groups^(20,50,51). Significantly higher numbers of women visited by health workers early in pregnancy (6.0 *v.* 3.7 times) and at home by health volunteers in the nutrition-focused MNCH, in comparison with the routine care group (8.1 *v.* 3.2 times)⁽²⁰⁾. In addition, greater than 90 % of women, who recently delivered, received counselling on nutrition during pregnancy and breast-feeding⁽²⁰⁾. A significantly greater proportion of mothers in the nutrition-intensive group *v.* routine care received messages on nutrition during pregnancy, including eat a variety of foods and measure weight, only feed breastmilk after birth, consume iron folic acid (IFA) and Ca supplements, and consume a diversified maternal diet (see Table 2)⁽²⁰⁾. Fathers reported significantly increased awareness and knowledge of dietary diversity (i.e. lentils, flesh foods and yellow/orange fruit). Fathers also had increased awareness of maternal diet during pregnancy, micronutrient supplementation, weight gain and rest during pregnancy and supported food, IFA and Ca supplement consumption⁽⁵⁰⁾.

Moreover, three studies reinforced the potential of multiple delivery platforms to deliver maternal nutrition counselling interventions^(49,52,53). In Bangladesh, one study revealed that the provision of a nutritious and easy-to-prepare local food recipe (i.e. khichuri, comprised of two fistfuls of rice, one fistful of dal (lentils), one egg, five teaspoons of soya oil and one fistful of leafy vegetables) combined with group counselling during pregnancy (i.e. adequate weight gain, frequency of food intake from three to five times daily, food hygiene, maternal rest, early initiation of and exclusive breast-feeding for breast-feeding) resulted in significantly increased pregnancy weight gain (+ 1.73 kg) and meal frequency (34 % of women) in the intervention *v.* the control group⁽⁵³⁾. In India, a singular home counselling visit in conjunction with frequent participatory women’s group meetings (i.e. two to three meetings per month) during pregnancy resulted in significantly higher minimum dietary diversity in intervention *v.* comparison areas (adjusted OR 1.40; 95 % CI (1.03, 1.90),

**Table 2** Programme considerations for strengthening quality of maternal nutrition counselling delivered via antenatal and postnatal care health contacts, based on gap analysis findings**Capacity building**

- Train and mentor local health workforce to implement quality nutrition counselling, which includes culturally tailored, locally relevant messages
- Address incorrect information or beliefs that health providers may hold regarding maternal dietary intake and weight gain during pregnancy, perceptions or beliefs
- Encourage use of evidence-informed counselling materials on maternal nutrition, based on global recommendations
- Train health providers on counselling skills, in addition on 'how to' and 'what' to counsel on maternal nutrition, tailoring to women's needs

Content

- Provide culturally appropriate and tailored counselling on maternal nutrition, micronutrient supplementation, weight gain (total weight gain, how much should be gained at each month and progress achieved), maternal rest and physical activity, early in pregnancy in tandem with healthy eating postpartum, based on formative research/assessments
- Ensure counselling materials are updated according to local context as well as global recommendations emanating from WHO

Frequency

- Encourage early and frequent ANC visits
- Provide consistent and frequent information on healthy, nutritious diets to sustain adequate weight during pregnancy and postnatal period, tailored to local context
- Ensure sufficient workforce and the adequate amount of time to counsel at various health contact points⁽⁶⁵⁾.
- Build interpersonal and counselling skills to equip health providers' with skillsets to relay information to women with higher frequency and quality
- Discuss and develop strategies to maximise providers' time and reach of women/adolescents (i.e. managing client flow at clinics, task shifting to community providers)
- Consider task shifting for maternal nutrition counselling* to reach eight ANC contacts. Ensure WHO's recommendations for healthy eating, exclusive breast-feeding, physical activity alongside iron folic acid/multiple micronutrient supplementation, intermittent preventative treatment in pregnancy for malaria prevention and anthelmintics (i.e. deworming) are provided via a broad range of cadres (i.e. lay health workers, auxiliary nurses, nurses, midwives and doctors) and health contacts

Delivery platforms

- Deliver maternal nutrition counselling content through multiple platforms, such as participatory group counselling, 1:1 counselling complemented by home visits to improve frequency/intensity of counselling
- Involve family and community members through community forums and/or media, which can provide broader support for breast-feeding, while improving food consumption, dietary diversity and intrahousehold allocation of food during critical stages of women's life stages – inclusive of adolescence, pregnancy and lactation.
- Document the implementation of nutrition counselling via delivery platform(s) – 'who' engages, frequency, intensity, interventions provided and successes/challenges. Collect this information with routine programme monitoring and evaluation that ascertains intervention coverage, maternal nutritional status and associated nutrition and health outcomes
- Conduct routine supportive supervision and mentoring to ensure quality

IFA, iron folic acid.

*According to WHO, task shifting is defined as 'the redistribution of tasks among health workers' (WHO 2008).

$P=0.0311$)⁽⁴⁹⁾. In Burkina Faso, a facility-based, 1:1 maternal counselling intervention, on portion size, meal frequency, and dietary diversification, resulted in a threefold increase in women's exposure to nutrition counselling in comparison with the control group⁽⁵²⁾. However, effects of this interventions were limited as only 9.4% of women improved food intake or dietary diversity due to late ANC attendance (2nd or 3rd trimester)⁽⁵²⁾.

Discussion

This gap analysis examines key elements related to delivery of quality maternal nutrition counselling through country health systems. Our findings corroborate those documented in previous papers which showed that information on the type, quality and coverage of maternal nutrition counselling is limited in selected country contexts, such as Bangladesh, Burkina Faso, India, Nepal and Pakistan^(7,54). Our analysis also confirms earlier findings that inadequate health provider training on maternal diet, weight gain during pregnancy, and/or physical activity,

lack of counselling skills and time to counsel due to client load and/or insufficient use of existing health resources may contribute to gaps in maternal nutrition counselling content and frequency of delivery^(7,18,26–30). Findings from this gap analysis further reveal that despite global recommendations on maternal nutrition counselling, counselling on adequate dietary intake, weight gain during pregnancy and physical activity are not delivered with the desired content nor quality. When women do not receive specific dietary counselling with key actions or plans, they are less equipped with information to improve their own dietary intake and diversity⁽²⁶⁾. This is particularly salient given the glaring absence of maternal nutrition counselling tailored to the nutritional status of pregnant women – particularly those who suffer from overweight and obesity in LMIC – who require continued nutritional guidance through the postnatal period. While recent compiled data reveal that pregnant women across North and sub-Saharan Africa, Asia and the Middle East regions experience lower weight gain in comparison with Europe and Latin America, it is increasingly recognised and established that excessive weight gain is occurring with greater frequency in LMIC^(55–57).



Our findings on gestational weight gain counselling also show that while weight is often recorded by health providers, it is often not disclosed or discussed with women, leading to confusion on the amount of weight to gain during pregnancy and 'why' this is important, regardless of pre-pregnancy BMI^(35,38). Inadequate health provider knowledge or familiarity with gestational weight gain recommendations affected whether women were counselled, and specifically on 'how' to achieve recommendations, a problem of global significance^(35,38,42). Further, while US-based Institute of Medicine guidelines are recommended as part of WHO ANC standards, there is a need for greater understanding and evidence to inform on the development of global and regional standards on weight gain during pregnancy which reflect the variation in populations^(15,57).

Moreover, information and counselling on attaining adequate weight gain during pregnancy was a source of confusion for both health providers and women – a neglected, yet critical component of ANC. A recent global review of maternal weight gain policies in fifty-three countries showed that only half of countries were aware of country guidelines on weight gain during pregnancy⁽⁵⁸⁾. Moreover, only 13% of country policies included guidance on healthy postpartum weight⁽⁵⁸⁾. On a positive note, this analysis found that health providers in high-income countries tended to provide targeted counselling on gestational weight gain for pregnant women affected by overweight and obesity, showing that context-specific and tailored counselling is feasible. However, such counselling was often not given to underweight or normal-weight pregnant women. This sheds insight into the need to equip providers with counselling skills and peer-to-peer mentorship to provide culturally resonant, tailored advice to women. Moreover, taking into account excessive energy intakes among some pregnant and lactating women is needed⁽⁵⁹⁾. Obesogenic consumption patterns, defined as eating ultra-processed foods, processed foods and/or food groups rich in carbohydrates, fats and sugars, can comprise up to 37% of foods consumed during pregnancy^(59,60). Yet, such food consumption patterns are often not routinely addressed with women during ANC and PNC, especially among overweight and obese women – a key gap in current health service provision globally^(59,60).

Health provider capacity to counsel women during routine ANC and PNC health contacts is often hindered by lack of staff and time at health facilities. This situation is likely to be exacerbated by the predicted shortage of 18 million healthcare professionals in the workforce by 2030^(61,62). Task shifting to community-level providers from nurses and physicians has been shown to enhance access, demand and use of health services at facility and community level and mitigate shortages in health personnel and limited time for counselling while building trust within communities^(63,64). A singular study showed lay nurses provided significantly more maternal nutrition counselling than nurse-midwives on the following key messages: 'eat

more and varied foods' (85.7% *v.* 73.3%), 'at least 4 prenatal visits' (85.2% *v.* 65.5%) and 'take IFA supplements' (90.1% *v.* 75.7%)⁽⁶⁵⁾.

Other studies have shown that community health workers provided better care in comparison with medical personnel, in terms of child health outcomes (i.e. integrated management of childhood illness, malaria), improved key nutrition practices and support (i.e. breast-feeding promotion and support, micronutrient supplementation, identification and treatment of acute malnutrition) and were more likely to motivate mothers to complete four ANC visits (OR = 1.85, 95% CI (1.14, 3.00), *P* = 0.012)^(63,64,66,67). Moving forward, it is critical that community-based providers (i.e. community health volunteers) have clear roles and expectations with respect to maternal nutrition counselling, including remuneration within communities, health systems and non-governmental organisations^(7,63). In addition, building community-based providers' skillsets on the provision of communication on maternal nutrition via group counselling and/or home visits, with ongoing supportive supervision and mentoring from facility providers, is an important step in task shifting^(7,63).

Involvement of community and health facility providers to deliver both individual and group nutrition counselling interventions has demonstrated improvements in maternal dietary diversity and pregnancy weight gain, and engagement of key family members, as documented in this analysis. These findings are similar to a recent meta-analysis of clinical trials from high-income countries which found that mixed and multi-pronged interventions (diet, lifestyle, gestational weight gain monitoring and behaviour change component) reduced risk of excessive weight gain for women with lower educational levels (OR 0.735; 95% CI (0.561, 0.963), *P* = 0.026) and reduced kilograms gained per week (β -0.053, *P* < 0.001) among women with high educational levels⁽⁶⁸⁾. Yet, few studies have documented maternal nutrition counselling interventions and approaches within the context of health service delivery and programmes, which remains a key gap in the evidence base.

Considerations to strengthen delivery of maternal nutrition counselling

While there is less available evidence for a few elements (i.e. provider capacity building and frequency) described in this gap analysis, key insights into how to strengthen delivery of quality maternal nutrition counselling can be gleaned from available information and experience, as outlined in Table 2^(7,16,69–71).

Moving forward, concerted efforts are needed to integrate maternal nutrition counselling into pre- and in-service curricula, while documenting effectiveness of standard health provider training, supportive supervision and mentoring via MIYCN programming (i.e. nutrition-specific and nutrition-sensitive interventions).



Development of global and/or regional weight gain standards alongside practical tools that can feasibly track weight gain for women and health providers alongside information on nutritional status, dietary intake and physical activity may be considered as part of future programming, as was recently explored in Brazil⁽⁷²⁾. Understanding how to feasibly estimate pre-pregnancy BMI via maternal recall is also a critical piece, as most women present mid to late in pregnancy for ANC⁽⁷³⁾.

Countries may also explore incorporating measures of quality maternal nutrition counselling, as a part of Quality of Care standards developed by the maternal and newborn health communities (i.e. WHO Maternal Newborn Health Quality of Care standards) – as lack of standardised ANC and PNC quality improvement measures is a key gap highlighted in this analysis⁽²¹⁾. Such quality measures may consider timing, frequency and duration of counselling, and health provider knowledge. In addition, the lack of standard monitoring indicators for maternal, infant, and young child nutrition to guide, monitor and inform on programmatic efforts is a gap in routine data collection. There is a globally recognised need for frequent and consistent collection of maternal nutrition indicators through large surveys (i.e. Women's Minimum Dietary Diversity – MDD-W) and via routine health systems to monitor programmes and to guide changes in country programming at national and subnational levels^(7,74). Moving forward, the development and use of standardised MIYCN indicators through the first-ever global District Health Information System-2 (DHIS-2) Standard Nutrition Module (i.e. indicators for maternal nutrition counselling and maternal counselling on health and nutrition topics for ANC/PNC) will be crucial to ascertaining country progress⁽⁷⁵⁾.

Finally, from a programmatic perspective, attention is sorely needed to improve provider capacity to counsel, and in the attainment of quality health service delivery for maternal nutrition interventions. Efforts that link health systems strengthening to food systems interventions which widen the diversity of local food supplies, as well as the access, availability and affordability of nutritious foods, should be conjoined in the future for maximal impact.

Limitations

This gap analysis has several limitations. Information provided in this analysis has been extracted from studies which reveal information gaps on provider training (i.e. pre- and in-service content), supportive supervision, mentoring and quality improvement for maternal nutrition counselling. Lack of data on the extent, frequency and content on counselling on maternal dietary intake, weight gain during pregnancy and/or physical activity, as well as information on counselling provided during PNC, are limitations to this gap analysis. We also note that there may be unpublished programme or project findings, used for internal

project/programme monitoring and use, that are not available on public domains, which may have been omitted from this analysis.

Conclusion

This gap analysis reveals that delivering maternal nutrition counselling via multiple platforms (individual, group, facility and community) has the potential for success and may be considered in the design of future programmes. Evidence in this analysis also shows that women affected by overweight and obesity in high-income countries receive targeted nutrition counselling, whereas tailored, context-specific counselling is often not carried out in LMIC. This gap analysis highlights considerations for improving maternal nutrition counselling by addressing health providers' time to counsel, cultivating interpersonal communication/counselling skills to contextualise counselling to respond to the changing face of malnutrition, as well as task shifting and engagement with and support from family and community members. Strengthening the enabling environment to support quality of ANC and PNC services can aid with better integration of maternal nutrition counselling (i.e. content, frequency and timing) into primary health services.

This gap analysis did not cover the important pre-conception period, which offers an opportunity to counsel adolescent girls, women and their families on the importance of nutritious diets, physical activity and entering pregnancy at an adequate weight. Identifying and creating opportunities to improve the nutrition of adolescent girls and women before they are pregnant while securing the increased nutritional needs of those who become pregnant and/or decide to breastfeed are crucial for all adolescent girls and women. For example, the development of a country-led and culturally informed approach focused on promoting healthy eating habits (i.e. eat locally available and diverse fruits and vegetables, physical activity, and adequate weight) conjoined with multisectoral, nutrition-sensitive efforts, such as income generation schemes, agriculture (i.e. local gardening), social protection, and youth movements may empower women's and girl's agency and create greater sustainability long term⁽⁷⁶⁾. In sum, the integrated delivery of maternal nutrition counselling as part of routine healthcare can be emboldened by country identification of multiple delivery platforms – including linking community structures with social protection systems and food systems – to improve women's access to nutritious diets and nutrition services.

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References

1. Victora CG, Christian P, Vidaletti LP *et al.* (2021) Revisiting maternal and child undernutrition in low-income and middle-income countries: variable progress towards an unfinished agenda. *Lancet* **397**, 1388–1399.
2. Heidkamp RA, Piwoz E, Gillespie S *et al.* (2021) Mobilising evidence, data, and resources to achieve global maternal and child undernutrition targets and the sustainable development goals: an agenda for action. *Lancet* **397**, 1400–1418.
3. Keats EC, Das JK, Salam RA *et al.* (2021) Effective interventions to address maternal and child malnutrition: an update of the evidence. *Lancet Child Adolesc Health* **5**, 367–384.
4. Osendarp S, Akuoku JK, Black RE *et al.* (2021) The COVID-19 crisis will exacerbate maternal and child undernutrition and child mortality in low- and middle-income countries. *Nat Food* **2**, 476–484.
5. Lee SE, Talegawkar SA, Meriardi M *et al.* (2013) Dietary intakes of women during pregnancy in low- and middle-income countries. *Public Health Nutr* **16**, 1340–1353.
6. Jaacks LM, Kavle J, Perry A *et al.* (2017) Programming maternal and child overweight and obesity in the context of undernutrition: current evidence and key considerations for low- and middle-income countries. *Public Health Nutr* **20**, 1286–1296.
7. Kavle JA & Landry M (2018) Addressing barriers to maternal nutrition in low- and middle-income countries: a review of the evidence and programme implications. *Matern Child Nutr* **14**, e12508.
8. Abarca-Gómez L, Abdeen ZA, Hamid ZA *et al.* (2017) Worldwide trends in body-mass index, underweight, overweight, and obesity from 1975 to 2016: a pooled analysis of 2416 population-based measurement studies in 128.9 million children, adolescents, and adults. *Lancet* **390**, 2627–2642.
9. UNICEF, World Food Program, GTAM *et al.* (2020) Protecting Maternal Diets and Nutrition Services and Practices in the Context of COVID-19, Brief No. 4. <https://www.unicef.org/laos/media/4136/file/Protecting%20maternal%20diets%20and%20nutrition%20services%20.pdf> (accessed January 2022).
10. Akseer N, Kandru G, Keats EC *et al.* (2020) COVID-19 pandemic and mitigation strategies: implications for maternal and child health and nutrition. *Am J Clin Nutr* **112**, 251–256.
11. Robertson T, Carter ED, Chou VB *et al.* (2020) Early estimates of the indirect effects of the COVID-19 pandemic on maternal and child mortality in low-income and middle-income countries: a modelling study. *Lancet Glob Health* **8**, e901–e908.
12. FAO, IFAD, UNICEF *et al.* (2022) The State of Food Security and Nutrition in the World 2022. <http://www.fao.org/documents/card/en/c/cc0639en> (accessed January 2022).
13. UNICEF (2021) Global Nutrition Database.
14. Fox EL, Davis C, Downs SM *et al.* (2019) Who is the woman in women's nutrition? A narrative review of evidence and actions to support women's nutrition throughout life. *Curr Dev Nutr* **3**, nzy076.
15. World Health Organization (2016) *WHO Recommendations on Antenatal Care for a Positive Pregnancy Experience*. Geneva: WHO. <https://www.who.int/publications/i/item/9789241549912> (accessed January 2022).
16. Kavle J, Picolo M & Dillaway C (2019) *Maternal Nutrition Operational Guidance: Program Considerations for Low- and Middle-Income Countries*. Washington, DC: USAID's Maternal and Child Survival Program.
17. Shekar M, Condo J, Pate MA *et al.* (2021) Maternal and child undernutrition: progress hinges on supporting women and more implementation research. *Lancet* **397**, 1329–1331.
18. Goldstein RF, Abell SK, Ranasinha S *et al.* (2017) Association of gestational weight gain with maternal and infant outcomes: a systematic review and meta-analysis. *JAMA* **317**, 2207.
19. Torlesse H, Benedict RK, Craig HC *et al.* (2021) The quality of maternal nutrition and infant feeding counselling during antenatal care in South Asia. *Matern Child Nutr* **17**, e13153.
20. Nguyen PH, Kim SS, Sanghvi T *et al.* (2017) Integrating nutrition interventions into an existing maternal, neonatal, and child health program increased maternal dietary diversity, micronutrient intake, and exclusive breastfeeding practices in Bangladesh: results of a cluster-randomized program evaluation. *J Nutr* **147**, 2326–2337.
21. World Health Organization (2016) *Standards for Improving Quality of Maternal and Newborn Care in Health Facilities*. Geneva: World Health Organization.
22. Jennings L, Yebadokpo AS, Affo J *et al.* (2010) Antenatal counseling in maternal and newborn care: use of job aids to improve health worker performance and maternal understanding in Benin. *BMC Pregnancy Childbirth* **10**, 75.
23. Malta MB, Carvalhaes MADBL, Takito MY *et al.* (2016) Educational intervention regarding diet and physical activity for pregnant women: changes in knowledge and practices among health professionals. *BMC Pregnancy Childbirth* **16**, 175.
24. Joseph NT, Piwoz E, Lee D *et al.* (2020) Examining coverage, content, and impact of maternal nutrition interventions: the case for quality-adjusted coverage measurement. *J Glob Health* **10**, 010501.
25. de Jersey SJ, Nicholson JM, Callaway LK *et al.* (2013) An observational study of nutrition and physical activity behaviours, knowledge, and advice in pregnancy. *BMC Pregnancy Childbirth* **13**, 115.
26. Yeneabat T, Adugna H, Asmamaw T *et al.* (2019) Maternal dietary diversity and micronutrient adequacy during pregnancy and related elements in East Gojjam Zone, Northwest Ethiopia, 2016. *BMC Pregnancy Childbirth* **19**, 173.
27. Mirkovic KR, Lathrop E, Hulland EN *et al.* (2017) Quality and uptake of antenatal and postnatal care in Haiti. *BMC Pregnancy Childbirth* **17**, 52.
28. Ferrari RM, Siega-Riz AM, Evenson KR *et al.* (2013) A qualitative study of women's perceptions of provider advice about diet and physical activity during pregnancy. *Patient Educ Couns* **91**, 372–377.
29. Kunath J, Günther J, Rauh K *et al.* (2019) Effects of a lifestyle intervention during pregnancy to prevent excessive gestational weight gain in routine care – the cluster-randomised GeliS trial. *BMC Med* **17**, 5.
30. Morris J, Nikolopoulos H, Berry T *et al.* (2017) Healthcare providers' gestational weight gain counselling practises and the influence of knowledge and attitudes: a cross-sectional mixed methods study. *BMJ Open* **7**, e018527.





31. Phommachanh S, Essink DR, Wright EP *et al.* (2019) Do health care providers give sufficient information and good counseling during ante-natal care in Lao PDR? An observational study. *BMC Health Serv Res* **19**, 449.
32. LeFevre A, Mpembeni R, Kilewo C *et al.* (2018) Program assessment of efforts to improve the quality of postpartum counselling in health centers in Morogoro region, Tanzania. *BMC Pregnancy Childbirth* **18**, 282.
33. van der Pligt P, Olander EK, Ball K *et al.* (2016) Maternal dietary intake and physical activity habits during the postpartum period: associations with clinician advice in a sample of Australian first-time mothers. *BMC Pregnancy Childbirth* **16**, 27.
34. Ramakrishnan U, Lowe A, Vir S *et al.* (2012) Public health interventions, barriers, and opportunities for improving maternal nutrition in India. *Food Nutr Bull* **33**, Suppl. 1, S71–S92.
35. Emery RL, Benno MT, Salk RH *et al.* (2018) Healthcare provider advice on gestational weight gain: uncovering a need for more effective weight counselling. *J Obstetr Gynaecol* **38**, 916–921.
36. Swift JA, Pearce J, Jethwa PH *et al.* (2016) Antenatal weight management: women's experiences, behaviours, and expectations of weighing in early pregnancy. *J Pregnancy* **2016**, 1–9.
37. Chang T, Llanes M, Gold KJ *et al.* (2013) Perspectives about and approaches to weight gain in pregnancy: a qualitative study of physicians and nurse midwives. *BMC Pregnancy Childbirth* **13**, 47.
38. Nikolopoulos H, Mayan M, MacIsaac J *et al.* (2017) Women's perceptions of discussions about gestational weight gain with health care providers during pregnancy and postpartum: a qualitative study. *BMC Pregnancy Childbirth* **17**, 97.
39. Ferrari RM & Siega-Riz AM (2013) Provider advice about pregnancy weight gain and adequacy of weight gain. *Matern Child Health J* **17**, 256–264.
40. Mercado A, Marquez B, Abrams B *et al.* (2017) Where do women get advice about weight, eating, and physical activity during pregnancy? *J Women's Health* **26**, 951–956.
41. Wennberg AL, Hörmsten Å & Hamberg K (2015) A questioned authority meets well-informed pregnant women – a qualitative study examining how midwives perceive their role in dietary counselling. *BMC Pregnancy Childbirth* **15**, 88.
42. Power ML & Schulkin J (2017) Obstetrician/gynecologists' knowledge, attitudes, and practices regarding weight gain during pregnancy. *J Women's Health* **26**, 1169–1175.
43. Stotland NE, Gilbert P, Bogetz A *et al.* (2010) Preventing excessive weight gain in pregnancy: how do prenatal care providers approach counseling? *J Women's Health* **19**, 807–814.
44. McDonald SD, Park CK, Pullenayegum E *et al.* (2015) Knowledge translation tool to improve pregnant women's awareness of gestational weight gain goals and risks of gaining outside recommendations: a non-randomized intervention study. *BMC Pregnancy Childbirth* **15**, 105.
45. Washington Cole KO, Gudzone KA, Bleich SN *et al.* (2017) Influence of the 5A's counseling strategy on weight gain during pregnancy: an observational study. *J Women's Health* **26**, 1123–1130.
46. Whitaker KM, Wilcox S, Liu J *et al.* (2016) Provider advice and women's intentions to meet weight gain, physical activity, and nutrition guidelines during pregnancy. *Matern Child Health J* **20**, 2309–2317.
47. Yamamoto A, McCormick MC & Burris HH (2014) US provider-reported diet and physical activity counseling to pregnant and non-pregnant women of childbearing age during preventive care visits. *Matern Child Health J* **18**, 1610–1618.
48. Santo EC, Forbes PW, Oken E *et al.* (2017) Determinants of physical activity frequency and provider advice during pregnancy. *BMC Pregnancy Childbirth* **17**, 286.
49. Nair N, Tripathy P, Sachdev HS *et al.* (2017) Effect of participatory women's groups and counselling through home visits on children's linear growth in rural eastern India (CARING trial): a cluster-randomised controlled trial. *Lancet Glob Health* **5**, e1004–e1016.
50. Nguyen PH, Frongillo EA, Sanghvi T *et al.* (2018) Engagement of husbands in a maternal nutrition program substantially contributed to greater intake of micronutrient supplements and dietary diversity during pregnancy: results of a cluster-randomized program evaluation in Bangladesh. *J Nutr* **148**, 1352–1363.
51. Frongillo EA, Nguyen PH, Sanghvi T *et al.* (2019) Nutrition interventions integrated into an existing maternal, neonatal, and child health program reduce food insecurity among recently delivered and pregnant women in Bangladesh. *J Nutr* **149**, 159–166.
52. Nikiema L, Huybregts L, Martin-Prevel Y *et al.* (2017) Effectiveness of facility-based personalized maternal nutrition counseling in improving child growth and morbidity up to 18 months: a cluster-randomized controlled trial in rural Burkina Faso. *PLoS ONE* **12**, e0177839.
53. Akter SM, Roy SK, Thakur SK *et al.* (2012) Effects of third trimester counseling on pregnancy weight gain, birthweight, and breastfeeding among urban poor women in Bangladesh. *Food Nutr Bull* **33**, 194–201.
54. Sanghvi T, Nguyen PH, Tharaney M *et al.* (2022) Gaps in the implementation and uptake of maternal nutrition interventions in antenatal care services in Bangladesh, Burkina Faso, Ethiopia and India. *Matern Child Nutr* **18**, e13293.
55. Asefa F, Cummins A, Dessie Y *et al.* (2020) Gestational weight gain and its effect on birth outcomes in sub-Saharan Africa: systematic review and meta-analysis. *PLoS ONE* **15**, e0231889.
56. Wang D, Wang M, Darling AM, *et al.* (2020) Gestational weight gain in low-income and middle-income countries: a modelling analysis using nationally representative data. *BMJ Glob Health* **5**, e003423.
57. Goldstein RF, Abell SK, Ranasinha S *et al.* (2018) Gestational weight gain across continents and ethnicity: systematic review and meta-analysis of maternal and infant outcomes in more than one million women. *BMC Med* **16**, 153.
58. Scott C, Andersen CT, Valdez N *et al.* (2014) No global consensus: a cross-sectional survey of maternal weight policies. *BMC Pregnancy Childbirth* **14**, 167.
59. Miele MJ, Souza RT, Calderon IM *et al.* (2021) The food patterns of a multicenter cohort of Brazilian nulliparous pregnant women. *Sci Rep* **11**, 15554.
60. Kavle JA, Mehanna S, Khan G *et al.* (2018) Program considerations for integration of nutrition and family planning: beliefs around maternal diet and breastfeeding within the context of the nutrition transition in Egypt. *Matern Child Nutr* **14**, e12469.
61. World Health Organization (2016) *Working for Health and Growth: Investing in the Health Workforce. Report of the High-Level Commission on Health Employment and Economic Growth*. Geneva: WHO. <https://www.who.int/publications/i/item/9789241511308> (accessed January 2022).
62. Liu J, Goryakin Y, Maeda A *et al.* (2016) Global Health Workforce Labor Market Projections for 2030 (Policy Research Working Paper 7790). World Bank. <http://documents.worldbank.org/curated/en/546161470834083341/Global-health-workforce-labormarket-projections-for-2030> (accessed January 2022).
63. Tulenko K, Møgedal S, Afzal MM *et al.* (2013) Community health workers for universal health-care coverage: from fragmentation to synergy. *Bull World Health Organ* **91**, 847–852.
64. Perry HB, Zulliger R & Rogers MM (2014) Community health workers in low-, middle-, and high-income countries: an



- overview of their history, recent evolution, and current effectiveness. *Annu Rev Public Health* **35**, 399–421.
65. Jennings L, Yebadokpo AS, Affo J *et al.* (2011) Task shifting in maternal and newborn care: a non-inferiority study examining delegation of antenatal counseling to lay nurse aides supported by job aids in Benin. *Implement Sci* **6**, 2.
 66. Stansert Katzen L, Tomlinson M, Christodoulou J *et al.* (2020) Home visits by community health workers in rural South Africa have a limited, but important impact on maternal and child health in the first 2 years of life. *BMC Health Serv Res* **20**, 594.
 67. Horwood C, Butler L, Barker P *et al.* (2017) A continuous quality improvement intervention to improve the effectiveness of community health workers providing care to mothers and children: a cluster randomised controlled trial in South Africa. *Hum Resour Health* **15**, 39.
 68. O'Brien EC, Segurado R, Geraghty AA *et al.* (2019) Impact of maternal education on response to lifestyle interventions to reduce gestational weight gain: individual participant data meta-analysis. *BMJ Open* **9**, e025620.
 69. United Nations Children's Fund (2022) *UNICEF Programming Guidance. Prevention of Malnutrition in Women Before and During Pregnancy and While Breastfeeding*. New York: UNICEF.
 70. United States Agency for International Development (2015) *Maternal Nutrition for Girls & Women: Technical Guidance Brief*. Washington, DC: USAID. <https://www.usaid.gov/sites/default/files/documents/1864/maternal-nutrition-for-girls-women-508-3.pdf> (accessed January 2022).
 71. USAID Advancing Nutrition (2021) *Strengthening Maternal Nutrition in Health Programs: A Guide for Practitioners*. Arlington, VA: USAID Advancing Nutrition.
 72. Kac G, Carilho TRB, Rasmussen KM *et al.* (2021) Gestational weight gain charts: results from the Brazilian maternal and child nutrition consortium. *Am J Clin Nutr* **113**, 1351–1360.
 73. Alive and Thrive (2022) What We Know About Weight Gain During Pregnancy in Low- and Middle-Income Countries – Technical Brief. Alive and Thrive & FHI Solutions. <https://www.aliveandthrive.org/en/resources/weight-gain-during-pregnancy-in-low-and-middle-income-countries> (accessed January 2022).
 74. Gillespie S, Menon P, Heidkamp R *et al.* (2019) Measuring the coverage of nutrition interventions along the continuum of care: time to act at scale. *BMJ Glob Health* **4**, Suppl. 4, e001290.
 75. UNICEF (2021) District Health Information Software (DHIS)-2, Standard Nutrition Module. <https://data.unicef.org/resources/strengthening-nutrition-information-systems/>; <https://dhis2.org/metadata-package-downloads/> (accessed January 2022).
 76. Barker M, Dombrowski SU, Colbourn T *et al.* (2018) Intervention strategies to improve nutrition and health behaviours before conception. *Lancet* **391**, 1853–1864.