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Review

Review

Quality assessment indicators in antenatal care worldwide: a systematic review

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Abstract

Purpose: To describe indicators used for the assessment of antenatal care (ANC) quality worldwide under the World Health Organization (WHO) framework and based on a systematic review of the literature.
Data sources: Searches were performed in MEDLINE, SciELO, BIREME and Web of Science for eligible studies published between January 2002 and September 2016.
Study selection: Original articles describing women who had received ANC, any ANC model and, any ANC quality indicators were included.
Data extraction: Publication date, study design and ANC process indicators were extracted.
Results of data synthesis: Of the total studies included, 69 evaluated at least one type of ANC process indicator. According to WHO ANC guidelines, 8.7% of the articles reported healthy eating counseling and 52.2% iron and folic acid supplementation. The evaluation indicators on maternal and fetal interventions were: syphilis testing (55.1%), HIV testing (47.8%), gestational diabetes mellitus screening (40.6%) and ultrasound (27.5%). Essential ANC activities assessment ranged from 26.1% report of fetal heart sound, 50.7% of maternal weight and 63.8% of blood pressure. Regarding preventive measures recommended by WHO, tetanus vaccine was reported in 60.9% of the articles. Interventions performed by health services to improve use and quality of ANC care, promotion of maternal and fetal health, and the number of visits to the ANC were evaluated in 65.2% of the studies.
Conclusion: Numerous ANC content indicators are being used to assess ANC quality. However, there is a need to use standardized indicators across countries and efforts to improve quality evaluation.

Key words: antenatal care, quality of healthcare, indicators, quality, process assessment healthcare

Introduction

Antenatal care (ANC) is considered important in preventing adverse outcomes in pregnancy, childbirth and puerperium [1]. The World Health Organization (WHO) established that ANC provides a platform for various health functions, including health promotion and disease prevention, screening and diagnosis according to appropriate evidence-based practices [2, 3]. In order to achieve these functions, WHO developed ANC recommendations to be conducted in a minimum schedule of care. In 2002, WHO advocated for the implementation of at least four ANC consultations [4], that were to be

increased to a minimum of eight according to the recommendation update from 2016 [3].

Globally, more women are receiving ANC. During the period 2007–14, 83% of women worldwide received at least one ANC consultation and, 64% received a minimum of four visits [5]. Although, the WHO ANC model exists and serves as an international guideline, many countries have specific programs that differ in the recommended number, frequency and content of consultations. Therefore, the use of different definitions, indicators/indexes, country-specific standards and international recommendations to assess ANC quantity and quality of utilization has led to limited results comparability and interpretation [6, 7].

Evaluation of ANC quality in terms of adequacy (time of first ANC visit and completeness of ANC visit schedule by trimester), has been described in literature [8–11]. However, this approach is restricted and does not allow the identification of the quality of different procedures and interventions that are part of the ANC content. Therefore, there is a need to identify in the literature which indicators are being used to monitor and evaluate the quality of the ANC content. In addition, few studies have provided information on the most comprehensive and appropriate indicators to assess it considering evidence-based indicators, presenting a knowledge gap in this field [12–14]. This study aims to describe the indicators used for the assessment of ANC quality worldwide under the WHO framework and based on a systematic review of the literature.

Methods

This systematic review was conducted according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines [15]. It was submitted to the International Register of Systematic Prospective Reviews (PROSPERO) and approved with registration number: CRD42016050935.

Search strategy

In September 2016, we searched MEDLINE (using the free access tool PubMed®), SciELO, BIREME and Web of Science for eligible studies published since 2002 (date of launch of the WHO basic ANC model). Included search terms were: 'Prenatal Care', 'Quality of Health Care' and 'Health Evaluation' selected from the Medical Subject Headings (MeSH) and descriptors in Health Sciences (DECS). Terms could be found anywhere in the article, title or abstract. The search equations used for each of the databases can be found in Supplementary Table 1S. EndNote X7 software was used (Thomson Reuters, http://www.endnote.com/) to organize the list of references, remove the duplicates and, obtain the full documents to review.

Inclusion and exclusion criteria

Inclusion criteria

Original articles describing: 1. Any study design; 2. Women who had received ANC, without restriction of age or ethnicity; 3. Any ANC model; and, 4. Any aspect about ANC quality indicators (use of services, clinical or laboratory diagnostic procedures, educational and prophylactic interventions), were included. No language or country restrictions were applied.

Exclusion criteria included: 1. Studies evaluating ANC quality in high-risk pregnant women; 2. Studies evaluating ANC satisfaction, without data about process indicators; 3. Studies using the same database in different publications—studies with most complete indicators were kept for data extraction; and, 4. Studies with data before 2002.

Two researchers conducted the screening process independently, applying pre-established inclusion and exclusion criteria to select studies for a complete reading. Disagreements were solved by a third researcher.

Outcome definition

Process indicators used to describe ANC delivery and quality (including the set of activities that occur during ANC) [16, 17].

Evaluation of study quality

The quality of the studies was measured according to the 'Checklist for Measuring Quality' proposed by Downs and Black [18]. A modified version of the Downs and Black scale was used composed of 17 items was used. Questions related to experimental studies were excluded, leading to a list of 14 items evaluated (maximum score of 14 points). Supplementary Table 2S.

Data extraction

Two independent researchers extracted data from selected studies using a standardized data extraction format. Characteristics related to: 1. Publication (title, author, year, study site); 2. Study (design, sample size, source of data); 3. Process indicators (ANC content including: blood pressure, maternal weight and fetal heart rate assessment, uterine height, breast and gynecological examination, blood typing/Rh Factor, serology for syphilis (VDRL), type I urine test (SAE), fasting glycaemia, hemoglobin, hematocrit, HIV, hepatitis B (HBsAg), toxoplasmosis, folic acid and iron supplementation, tetanus immunization, ultrasonography and preventive counseling); and, 4. indicators of ANC service utilization including number of ANC consultations according to the trimester of pregnancy and calendar of ANC visits, were extracted.

ANC process indicators were classified into four categories: 1. diagnostic approach, 2. Medical history and physical exam, 3. Medication and prophylactic vaccines administration, and 4. General health education and preventive measures counseling. Afterwards, indicators were classified by degree of recommendation (recommended, not recommended or recommended according to the specific context) and, according to the five relevant areas in the prenatal care routine defined in the report 'New guidelines on ANC for a positive pregnancy experience' of the World Health Organization. The areas were: A. nutritional interventions; B. maternal fetal evaluation; C. preventive measures; D. interventions in the health systems to improve the use and quality of prenatal care; and, E. interventions on physiological and common symptoms

The countries of the studies were grouped according to the WHO regions (EURO—European Regional Office of the World Health Organization; AFRO—African Regional Office of the World Health Organization; PAHO—Pan American Health Organization of the World Health Organization; EMRO—Eastern Mediterranean Regional Office of the World Health Organization; WPRO—Western Pacific Regional Office of the World Health Organization; SEARO—South-East Asia Regional Office of the World Health Organization). A multiple regions category was created to be able to include in the analyses those studies that covered multiple WHO regions.

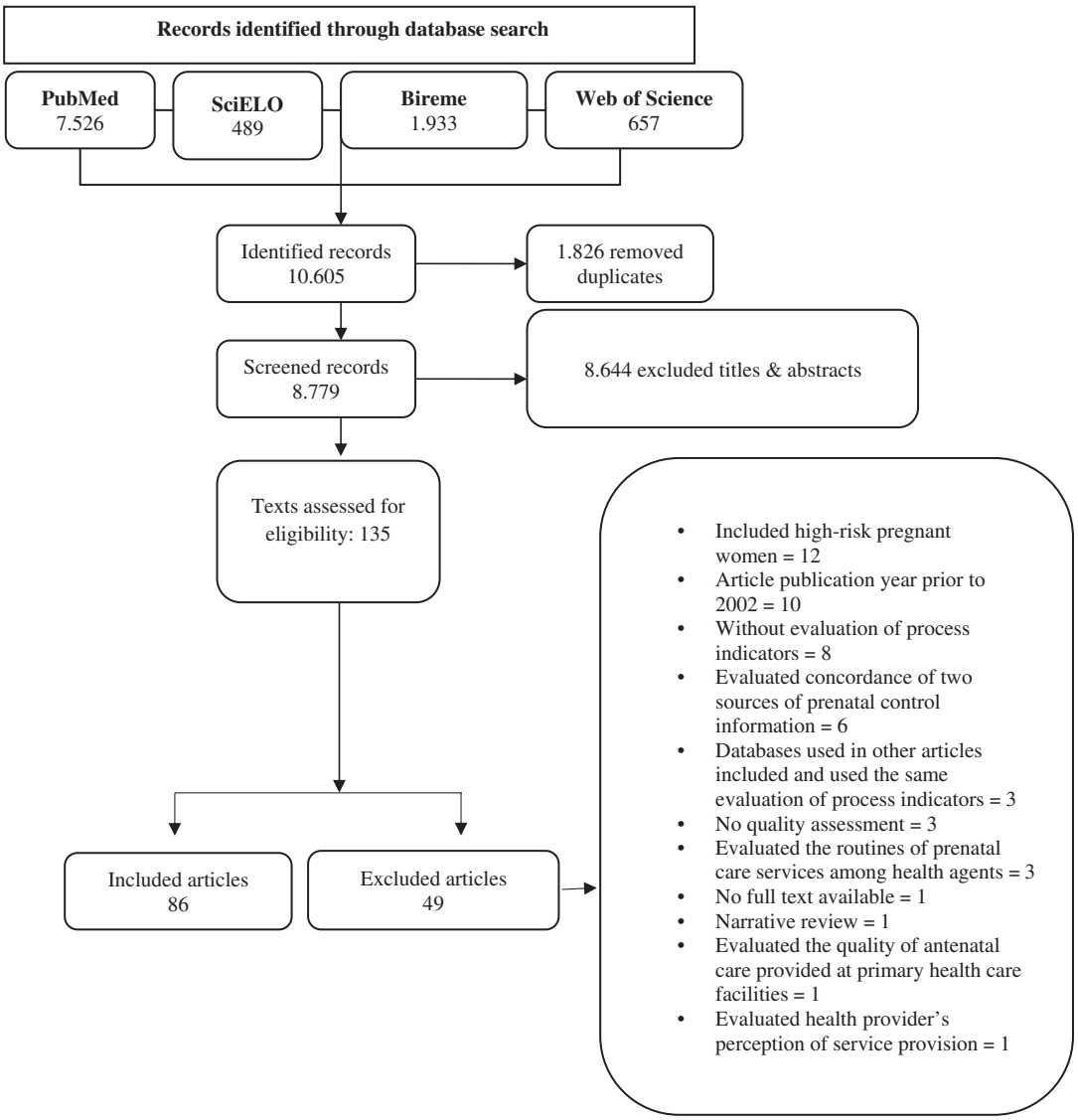

Figure 1 Flowchart of studies selection.

Analyses

Results were described with a qualitative and descriptive approach using frequencies and percentages.

Results of data synthesis

The search strategy resulted in 10.605 titles to be examined. After removing duplicates (1.826), a list of 8.779 unique citations was created. Of these, 8.636 articles were excluded by title/summary and, 135 articles were identified for abstract review according to inclusion and exclusion criteria. Eighty-six articles were selected for full text review (Fig. 1).

Table 1 presents the characteristics of the articles included in the review. The region with the highest number of articles was PAHO ($n = 46$), followed by the AFRO region ($n = 18$). The countries with the highest number of studies were Brazil ($n = 38$), Ethiopia ($n = 6$), China ($n = 4$) and Mexico ($n = 4$). According to study type, cross sectional studies were the most frequent ($n = 76$), followed by cohorts ($n = 5$), interventions ($n = 3$) and cases and controls ($n = 2$). Sample size ranged from 23 to 312.507. Information sources included prenatal care and clinical records, birth certificates, interviews, demographic health surveys, national health information systems.

ANC process indicators

Of the total of included studies, 69 evaluated ANC process indicators. The primary sources of the recommendations on the indicators used were 72.5% national, 15.2% WHO and 8.7% WHO-national, and not specified sources 2.9%. Supplementary Table 3S presents ANC quality definitions.

Measure of diagnostic approach indicators was most frequently reported ($n = 64$), followed by medical history and physical exam indicators ($n = 50$), prophylactic interventions with medication prescription ($n = 50$), and general health education and preventive measures counseling ($n = 45$). Regarding ANC utilization of services, total number of visits were reported in 77 studies and, ANC visit calendar in 48 studies.

Indicators of blood pressure measurement (88%), weight measurement (70%), tetanus vaccine record (84%) and folic acid and

Box 1. Future perspectives for ANC quality assessment

Recommendations for governments: Strengthen national information and surveillance systems to produce data that can respond to health priorities timely. Also, they should include in their surveillance systems reproductive and maternal health structure, process, service utilization and access indicators.
Recommendations for policymakers: Raise awareness and train health workers to provide safe, competent and respectful maternal and perinatal care. Supervise the development of ANC by monitoring indicators of quality of care, as well as indicators of maternal and neonatal morbidity and mortality at the state level, and correct deficiencies; establish theoretical and practical considerations of ANC quality indicators, defining data sources, methods and frequency of collection, disaggregation, uses and common limitations to contribute to ANC monitoring and evaluation.
Recommendations for researchers: It is necessary to create an index that assesses ANC quality based on the entirety of components recommended by WHO, in order to monitor, evaluate and compare the quality at a global level. It is necessary to use a conceptual and operational model for this evaluation the model established by the WHO can be used to standardize ANC quality assessment.

iron supplementation (72%), were reported in most studies. HIV screening (51.6%), syphilis screening (59.4%), uterine fundal height (40%), ultrasound (28.1%) and fetal heart rate (36%) were less reported. In general, most articles reported health education and preventive measures counseling (93.3%). Reports were fewer in specific aspects such as education about breastfeeding (48.9%), and advice on emergency signs (40%).

Service utilization indicators

Of the included studies, 17 measured indicators about service utilization without evaluating another type of indicator. The most frequent was the Kessner and APNCU of Kotelchuck indexes and their modifications. The Kessner index measures follow-up by trimester and the number of consultations according to gestational age. It categorizes care as appropriate, intermediate and inappropriate [19, 20]. The APNCU index measures the relationship between the number of ANC visits performed and the number of expected visits, according to ANC start and pregnancy duration, classifying care as adequate, intermediate and inadequate (APNCUI) [20–24]. The other studies reported indicators based on national or international recommendations [25–36]. Studies that included indexes prepared by the authors and/or adapted by other researchers were found Supplementary Table 4S.

ANC process recommendations according to WHO

Counseling on healthy eating and supplementation with iron and folic acid should be given to pregnant women. This study shows that 8.7% of the articles reported healthy eating counseling and 52.2% iron and folic acid supplementation (Table 2) (Supplementary Table 5S shows indicators report by studies).

When assessing the report of indicators about maternal and fetal recommended interventions, it was found that the most prevalent intervention was syphilis testing (55.1%), followed by HIV testing (47.8%), gestational diabetes mellitus testing (40.6%) and ultrasound (26.1%). Recommended activities in specific contexts were reported as follows: anemia identification (73.9%), asymptomatic bacteriuria testing (68.1%) and measurement of symphysis-fundal height (29.0%). Essential ANC activities such as the measurement of blood pressure, maternal weight and the verification of fetal heart sounds, were reported in 63.8%, 50.7% and 26.1% articles, respectively (Table 2; Supplementary Table 5S shows indicators report by studies).

Regarding preventive measures, tetanus vaccine was reported in 60.9% of the articles. Specific contexts measures were reported in four articles (malaria prevention and anthelmintic treatment). Interventions performed by health services to improve use and quality of ANC care, maternal and fetal health promotion, and number of ANC visits were evaluated in 65.2% of the studies (Table 2; Supplementary Table 5S shows indicators report by studies).

Discussion

To our knowledge, this study is the first to examine indicators and indices reported in the ANC quality assessments worldwide. Findings show a highly diverse and region-specific description of indicators, where relevance and use depend on the country-specific context. Most of the articles were from low- and middle-income countries, predominantly affected by maternal and child mortality [37].

Our review indicated that four of the WHO five relevant areas in the prenatal care routine (Table 2) have been broadly assessed, particularly in the PAHO and AFRO regions. Numerous indicators were found to assess ANC quality ranging from services utilization exclusively to its combination with content evaluation indicators. Quality of routine ANC were based on national, international or WHO guidelines.

Less than one fourth of the studies measured indicators about service utilization, the most frequent being the Kessner and APNCU of Kotelchuck indexes and adaptations. These indexes have often been used in medical literature to assess ANC, although they can only measure ANC use and not the quality of the received care. Therefore, ANC coverage rates should not be interpreted as suggesting similar levels of quality and should be more comprehensive than only including the number of visits and the date of ANC start, as those indexes recommend [38].

In some studies, the use of scores and indexes about service utilization was combined with indicators of ANC content providing a more comprehensive view of care. The use of these criteria represents an advance in ANC care monitoring. Although, diversity and a lack of standardization in the use of these indicators suggested that is still no consensus on what the central indicators are to be considered as markers of ANC quality as show in table, making it difficult to compare within and between countries, as well as identifying critical points to improve the quality of care of pregnant women [39]. The existence of multiple indicators may also be related to the

Table 1 Characteristics of the studies and description of antenatal care indicators.

	n	%
Total of studies	86	100.0
World Health Organization region covered		
The Americas-PAHO	46	53.5
Africa-AFRO	18	20.9
Western Pacific-WPRO	6	7.0
Europe-EURO	5	5.8
Eastern Mediterranean-EMRO	4	4.7
South East Asia-SEARO	4	4.7
Multiple regions	3	3.5
Study type		
Cross sectional	76	88.4
Cohort	5	5.8
Intervention	3	3.5
Case control	2	2.3
Sample size (number of participants range)	23–312.507	
Data Sources (Prenatal care and clinical records, birth certificates, interviews, demographic health surveys, national health information systems)		
One information source	38	44.2
Two information sources	33	38.4
Three information sources	15	17.4
Antenatal care services utilization assessment	77	86.5
Description of antenatal care visits number	77	86.5
Description of antenatal care visit schedules	48	55.8
Antenatal care procedures assessment	69	80.0
Description of antenatal care procedures by blocks (n = 69)		
Block 1. Diagnostic approach	64	74.4
Haemogram	62	96.9
Syphilis-VDRL blood sample	38	59.4
HIV blood sample	33	51.6
Glycaemia	28	43.8
ABO-Rh	20	31.3
Ultrasound	18	28.1
Hepatitis B and rubella antibodies	14	21.9
Glycosuria/Albuminuria	11	17.2
Cervix cytopathology	10	15.6
Other tests (Liver function tests, Indirect Coombs)	7	10.9
Stool sample	5	7.8
Gonorrhea, chlamydia, trichomoniasis and group B streptococcus screening	4	6.3
Prenatal genetic screening	3	4.7
Block 2. Medical history and physical exam	50	58.1
Blood pressure assessment	44	88.0
Weight measurement	36	72.0
Fetal heart rate measurement and presentation by abdominal palpation	26	52.0
Uterine height measurement	20	40.0
Height measurement	16	32.0
Breast exam and maternal heart rate measurement	13	26.0
Gynecology-pelvic exam and questioned about bleeding/vaginal discharge	9	18.0
General physical exam (no specifics described)	5	10.0
Dental examination	4	8.0
Hands and legs swelling assessment	4	8.0
Block 3. Medication and prophylactic vaccines administration	50	58.1
Tetanus toxoid immunization	42	84.0
Iron and folic acid supplements	36	72.0
Anti-malarial preventive medications	5	10.0
Intestinal parasites treatment	4	8.0
Vitamins supplement and micronutrient formulation	6	12.0
Hepatitis B and influenza immunization	3	6.0

Table continued

Table 1 Continued

	n	%
Block 4. General health education and preventive measures counseling	45	52.3
General health education (no specifics described)	42	93.3
Birth preparedness and complication readiness	38	84.4
Breastfeeding	22	48.9
HIV and Syphilis-VDRL prevention during pregnancy	8	17.8
Postnatal care and family planning	7	15.6
Dietary/nutritional education	6	13.3
Malaria prevention	4	8.9
Assessment of recorded information on health card	2	4.4
Smoking and use drug counseling	2	4.4
Immunization according to national guidelines	1	2.2

different processes involved in the development of guidelines or protocols for the care of pregnant women across countries [40].

We found that indicators of maternal assessment recognized as good clinical practice were less frequent in ANC quality assessment, as well as aspects related to promotion and preventive health measures. These recommendations are not only supported by scientific evidence but are inexpensive and can be easily implemented in the first levels of attention in different countries.

For example, half of the studies reported weight measurement, less than half fetal heart sounds assessment and, two thirds blood pressure assessment. Iron and folic acid supplementation indicators were reported mostly in the AFRO and PAHO regions where maternal iron deficiency and iron deficiency anemia are frequent [41].

Additionally, a low use gestational age, multiple pregnancy or possible fetal abnormalities assessment by ultrasound was found. In the AFRO region, no article reported this indicator [42–45], possibly due to difficulties in the adequacy of the structure and provision of the ANC care services and difficulties related to infrastructure, economic resources, training and cultural acceptance particularly in rural and remote areas [46]. Studies show that ultrasound services are more widely available in urban sub-Saharan Africa, where 30.0% of women have access to the service compared to 6.9% in rural areas [46].

Also, an infrequent report of indicator of maternal tetanus vaccination indicator was found. This is an internationally recognized indicator for the strategy of global eradication of maternal and neonatal tetanus and that helps reducing neonatal deaths [47]. The greatest concern of the lack of monitoring and evaluation of this indicator is in countries with low coverage of institutional deliveries, ANC and tetanus vaccination, where most neonatal tetanus deaths could potentially occur [48]. These deaths occur mainly in remote areas that lack vital registration or community surveillance systems, resulting in cases and deaths that are not systematically reported. Due to this, a misperception that neonatal tetanus is not a disease of public health importance, leads decision-makers to scale down the disease priority in favor of visible diseases [49]. In addition, the lack of adequately trained staff, can limit the implementation of vaccination and ANC programs [50].

Finally, topics for individualized counseling and support on healthy eating, physical activity, nutrition, caffeine, tobacco and substance use, physiological symptoms, malaria and HIV prevention, and blood test results have been reported in few studies. Counseling was most frequent on breastfeeding and, it was also common to find counseling about general health education without specifying topics covered during ANC. ANC programs should cover these non-clinical components, not just as general principles, but as interventions with the same clinical value [3].

The study strengths include: 1. The characterization of process indicators to assess ANC quality that included process and service utilization indicators, intervention rates, use of national and international guides and recommendations, allows to measure the delivery of healthcare to target populations; 2. The use of process indicators known to be more specific than structure and outcome indicators represent an approximation of how healthcare should be provided on a daily basis; 3. The collection of the most current and high-quality data available in the topic allows to develop evidence-based public policies to improve ANC worldwide [51]; 4. The standardization of indicators/ indices and its analyses allow comparability between countries about the minimum required ANC attention and quality. Box 1 presents recommendations for governments, policymakers and researchers.

Results must be interpreted acknowledging some limitations:

- Comprehensive search strategy with broad search terms that could limit the loss of any relevant study, however relevant literature (including gray literature) may have been left out.
- Varied data sources used to monitor ANC quality (questionnaires designed to assess quality, prenatal care records, clinical charts, demographic and health surveys, and health management information systems) which poses a limitation for information standardization. This reflects the variability in definitions, indicators construction, reliability and representativeness of the data, which may limit any quality assessment.
- Indicators used to characterize ANC quality were only those related to ANC content. These indicators are useful for assessing whether or not women are receiving essential ANC services, but they do not capture the experience of women with the health system (how they are treated, and the nature of interactions with the system and health professionals). The quality of maternal healthcare, and in particular the patient's experience with health professionals, has received relatively little attention and there are few validated instruments that can be easily incorporated into surveys [52].
- Use of indicators that reflected services received during or at least once during pregnancy to measure ANC quality, limits determining whether pregnant women were adequately followed through out pregnancy. In addition, it was common to find the use of general indicators such as the blood test without specifying the type of screening test performed. This led to group all these women as having received the essential ANC tests, potentially misclassifying the ANC as of quality.

These limitations represent the need to develop and validate standardized instruments with indicators that can measure the quality of

Table 2 Regional description of antenatal care indicators included in the studies, according to the World Health Organization Antenatal Care Guidelines

Indicator	Total		Region													
			AFRO		EMRO		EURO		PAHO		SEARO		WPRO		Multiple regions	
	N	%	*N*	%	*N*	%	*N*	%	*N*	%	*N*	%	*N*	%	*N*	%
Total	69	100.0	13	18.8	4	5.8	4	5.8	37	53.6	3	4.4	5	7.3	3	4.4
A. Nutritional interventions																
Counseling about healthy eating	6	8.7	2	15.4	0	0.0	0	0.0	1	2.7	1	33.3	2	40.0	0	0.0
Prescription of iron and folic acid supplements	13	18.8	5	38.5					4	10.8	1	33.3	2	40.0	1	33.3
Prescription of iron supplements	20	29.0	4	30.8	2	50.0			10	27.0	2	66.7	1	20.0	1	33.3
Prescription of folic acid supplements	3	4.3					1	25.0	1	2.7			1	20.0		
Multiple micronutrient supplements (not recommended)	3	4.3	0	0.0	0	0.0	0	0.0	2	5.4	0	0.0	1	20.0	0	0.0
B. Maternal and fetal assessment																
Blood pressure measurement	44	63.8	11	84.6	3	75.0	3	75.0	18	48.7	2	66.7	5	100.0	2	66.7
Weight measurement	35	50.7	6	46.2	2	50.0	2	50.0	19	51.4	1	33.3	4	80.0	1	33.3
Anemia testing using blood sample (recommended in specific contexts)	51	73.9	10	76.9	3	75.0	2	50.0	27	73.0	2	66.7	5	100.0	2	66.7
Human immunodeficiency virus (HIV) assessment	33	47.8	5	38.5	0	0.0	0	0.0	23	62.2	0	0.0	3	60.0	2	66.7
Syphilis assessment	38	55.1	5	38.5	0	0.0	1	25.0	27	73.0	1	33.3	3	60.0	1	33.3
Asymptomatic bacteriuria assessment (recommended in specific contexts)	47	68.1	7	53.9	3	75.0	0	0.0	29	78.4	2	66.7	4	80.0	2	66.7
Gestational diabetes mellitus assessment	28	40.6	3	23.1	0	0.0	1	25.0	21	56.8	0	0.0	3	60.0	0	0.0
Symphysis-fundal height measurement (recommended in specific contexts)	20	29.0	3	23.1	0	0.0	1	25.0	14	37.8	0	0.0	2	40.0	0	0.0
Ultrasound scan	18	26.1	0	0.0	1	25.0	2	50.0	11	29.7	1	33.3	4	80.0	0	0.0
Fetal heart sounds assessment	18	26.1	4	30.8	0	0.0	1	25.0	10	27.0	0	0.0	3	60.0	0	0.0
C. Preventive measures																
Prescription of preventive anthelminthic treatment (recommended in specific contexts)	4	5.8	3	23.1	0	0.0	0	0.0	0	0.0	1	33.3	0	0.0	0	0.0
Tetanus toxoid vaccination	42	60.9	9	69.2	2	50.0	0	0.0	24	64.9	3	100.0	2	40.0	2	66.7
Malaria prevention with intermittent preventive treatment in pregnancy (recommended in specific context)	5	7.2	4	30.8	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	33.3
D. Health systems interventions to improve the utilization and quality of antenatal care																
Promotion of health-related behaviors for maternal and newborn health*	45	65.2	13	100.0	3	75.0	0	0.0	20	54.1	3	100.0	4	80.0	2	66.7
Report of antenatal care number of visits	31	44.9	3	23.1	0	0.0	4	75.0	20	54.1	1	3.3	3	60.0	0	0.0
Report of antenatal care visit schedules																
Report of first visit during the first trimester of pregnancy**	9	13.0	0	0.0	0	0.0	1	25.0	5	13.5	0	0.0	3	60.0	0	0.0
Report of a complete schedule of antenatal care visits through out pregnancy	11	15.9	0	0.0	0	0.0	1	25.0	10	27.0	0	0.0	0	0.0	0	0.0
No report		71.0	13	100.0	4	100.0	2	50.0	22	59.5	3	100.0	2	40.0	3	100.0

*Including promotion of the following: care-seeking behavior and ANC utilization; birth preparedness and complication readiness; sleeping under insecticide-treated bed nets; skilled care for childbirth; companionship in labor and childbirth; nutritional advice; nutritional supplements; other context-specific supplements and interventions; HIV testing during pregnancy; exclusive breastfeeding; postnatal care and family planning; immunization according to national guidelines.

**Minimum number of ANC visits assessed (Studies have differences between nulliparous and multiparous women. See Supplementary Table 4S, supplement for detailed information).

***The area on interventions in physiological and common symptoms was not included in the table because that information was not found in the evaluated articles.

prenatal care that capture service delivery and patient experience, and that may be incorporated into major health surveys in developing countries to ensure comparability.

Conclusion

Quality assessment of ANC content is a worldwide concern, particularly in the utilization of services across countries. The use of content indicators based on national or international guidelines for assessing the quality of ANC means an important advance, although there is still a need for appropriation of these indicators and the construction of structured and standardized indices that can be used in the different countries allowing international comparability and monitoring. It is necessary to make efforts to assess health promotion counseling quality to clearly identify opportunities to advice and provide individualized support during pregnancy in a timely fashion.

Supplementary material

Supplementary material is available at *International Journal for Quality in Health Care* online.

Key messages

Advancing work on quality assessment of ANC is critical due to lack of standardized measures across countries.

Evidence to establish which are the best indicators for ANC quality assessment is warranted.

Contributions

All authors except O.S., conceived of the study. L.S.M.D., A.R.V. and O.D. carried out data extraction. All authors (L.S.M.D., A.R.V., O.S. and M.S.F.) were instrumental in the study's development, in reviewing successive drafts of the paper, and in approval of the final manuscript.

The information presented in this manuscript has not been presented elsewhere.

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Conflicts of interest

The authors declare no conflict of interest.

References

1. Hollowell Jennifer OL, Kurinczuk Jennifer J. Brocklehurst Peter, Ron G. The effectiveness of antenatal care programmes to reduce infant mortality and preterm birth in socially disadvantaged and vulnerable women in high-income countries: a systematic review. *BMC Pregnancy Childbirth* 2011: 11–3. doi:10.1186/1471-2393-11-13.
2. World Health Organization. Integrated management of pregnancy and childbirth. In: *Standards for Maternal and Neonatal Care*. Geneva: World Health Organization, 2006.
3. World Health Organization. *Recommendations on antenatal care for a positive pregnancy experience*. Geneva: World Health Organization, 2016. Available from: https://www.ncbi.nlm.nih.gov/books/NBK409108/.
4. Villar J, Piaggio G, Lumbiganon P *et al*. WHO antenatal care randomised trial for the evaluation of a new model of routine antenatal care. *Lancet* 2001;**357**:1551–64.
5. World Health Organization. *World Health Statistics.2*. Geneva: World Health Organization, 2015.
6. Ricketts SA, Murray EK, Schwalberg R. Reducing low birthweight by resolving risks: results from Colorado's prenatal plus program. *Am J Public Health* 2005;**95**:1952–7. http://doi.org/10.2105/AJPH.2004.047068.
7. Lavado RF, Lagrada LP, Ulep VGT *et al* Who provides good quality prenatal care in the Philippines? (Discussion Paper Series No. 2010-18). Makati City: Philippine Institute for Development Studies. 2010
8. Beeckman K, Louckx F, Masuy-Stroobant G *et al*. The development and application of a new tool to assess the adequacy of the content and timing of antenatal care. *BMC Health Serv Res* 2011;**11**:213. http://doi.org/10.1186/1472-6963-11-213.
9. Handler ARK, Rosenberg D, Sinha K. Extent of documented adherence to recommended prenatal care content: provider site differences and effect on outcomes among low-income women. *Matern Child Health J* 2012;**16**:393–405.
10. Sword W, Heaman M, Biro MA *et al*. Quality of prenatal care questionnaire: psychometric testing in an Australia population. *BMC Pregnancy Childbirth* 2015;**15**:214.
11. Heaman MI, Sword WA, Akhtar-Danesh N *et al*. Quality of prenatal care questionnaire: instrument development and testing. *BMC Pregnancy Childbirth* 2014;**14**:1–16.
12. Hodgins S, D'Agostino A. The quality–coverage gap in antenatal care: toward better measurement of effective coverage. *Glob Health Sci Pract* 2014;**2**:173–81. http://doi.org/10.9745/GHSP-D-13-00176.
13. Wildman KBB, Nijhuis J, Defoort PCB. European indicators of health care during pregnancy, delivery and the postpartum period. *Eur J Obstet Gynecol Reprod Biol* 2003;**111**:S53–65.
14. Bloch JR, Dawley K, Suplee PD. Application of the Kessner and Kotelchuck prenatal care adequacy indices in a preterm birth population. *Public Health Nurs* 2009;**26**:449–59.
15. Moher D, Shamseer L, Clarke M *et al*, PRISMA-P Group. Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015 statement. *Syst Rev* 2015;**4**:1. http://doi.org/10.1186/2046-4053-4-1.
16. Flowers JHP, Pencheon D. Public health indicators. *Public Health* 2005;**119**:239–45.
17. Donabedian A. *An Introduction to Quality Assurance in Health Care*. Oxford. Oxford: University Press, 2003.
18. Downs SH, Black N. The feasibility of creating a checklist for the assessment of the methodological quality both of randomised and non randomised studies of health care interventions. *J Epidemiol Community Health* 1998;**52**:377–84.
19. Bassani DG, Surkan PJ, Olinto MT. Inadequate use of prenatal services among Brazilian women: the role of maternal characteristics. *Int Perspect Sex Reprod Health* 2009;**35**:15–20.
20. Santos E, AOliveira A, Zandonade E *et al*. Access to prenatal care: assessment of the adequacy of different indices. *Cad. Saúde Pública* 2013;**29**:1664–74.
21. Kotelchuck M. An evaluation of the Kessner Adequacy of Prenatal Care Index and a proposed Adequacy of Prenatal Care Utilization Index. *Am J Public Health* 1994;**84**:1414–20.
22. Ribeiro ER, Guimarães AMD, Bettiol H *et al*. Risk factors for inadequate prenatal care use in the metropolitan area of Aracaju, Northeast Brazil. *BMC Pregnancy Childbirth* 2009;**9**:31. http://doi.org/10.1186/1471-2393-9-31.
23. Kurtzman JH, Wasserman EB, Suter BJ *et al*. Measuring adequacy of prenatal care: does missing visit information matter? *Birth* 2014;**41**:254–61. doi:10.1111/birt.12110.
24. Feijen-de J, Jansen DE, Baarveld F *et al*. Determinants of prenatal health care utilisation by low-risk women: a prospective cohort study. *Women Birth* 2015;**28**:87–94. doi:10.1016/j.wombi.2015.01.005.
25. Gonçalves R, Belletti M, Urasaki M *et al*. Avaliação da efetividade da assistência pré-natal de uma Unidade de Saúde da Família em um município da Grande São Paulo. *Rev Bras Enferm* 2008;**61**:349–53.
26. Liu X, Zhou X, Yan H *et al*. Use of maternal healthcare services in 10 provinces of rural western China. *Int J Gynecol Obstet* 2011;**114**:260–4. doi:10.1016/j.ijgo.2011.04.005.
27. Corrêa C, Bonadio I, Tsunechiro M. Avaliação normativa do pré-natal em uma maternidade filantrópica de São Paulo. *Revista da Escola de Enfermagem da USP* 2011;**45**:1293–1300. https://dx.doi.org/10.1590/S0080-62342011000600003.
28. Zhao Q, Huang ZJ, Yang S *et al*. The utilization of antenatal care among rural-to-urban migrant women in Shanghai: a hospital-based cross-sectional study. *BMC Public Health* 2012;**12**:1012. http://doi.org/10.1186/1471-2458-12-1012.
29. Bernardes A, da Silva R, Coimbra L *et al*. Inadequate prenatal care utilization and associated factors in São Luís, Brazil. *BMC Pregnancy Childbirth* 2014;**14**:266.
30. Fonseca C, Wany M, Carvalho L *et al*. Adequacy of antenatal care and its relationship with low birth weight in Botucatu, São Paulo, Brazil: a case-control study. *BMC Pregnancy Childbirth* 2014;**14**:255. http://www.biomedcentral.com/1471-2393/14/255.
31. Gudayu TW. Proportion and factors associated with late antenatal care booking among pregnant mothers in Gondar Town, North West Ethiopia. *Afr J Reprod Health* 2015;**19**:94–100.
32. Abegunde D, Orobaton N, Shoretire K *et al*. Monitoring maternal, newborn, and child health interventions using lot quality assurance sampling in Sokoto State of northern Nigeria. *Glob Health Action* 2015;**8**:27526. http://doi.org/10.3402/gha.v8.27526.

33. Dutamo Z, Assefa N, Egata G. Maternal health care use among married women in Hossaina, Ethiopia. *BMC Health Serv Res* 2015;**15**:365.
34. Biza N, Mohammed H. Pastoralism and antenatal care service utilization in Dubti District, Afar, Ethiopia, 2015: a cross-sectional study. *Pastoralism* 2016;**6**:15.
35. Saad–Haddad G, DeJong J, Terreri N *et al*. Patterns and determinants of antenatal care utilization: analysis of national survey data in seven countdown countries. *J Glob Health* 2016;**6**:010404. http://doi.org/10.7189/jogh.06.010404.
36. Dansereau E, McNellan CR, Gagnier MC *et al*. Coverage and timing of antenatal care among poor women in 6 Mesoamerican countries. *BMC Pregnancy Childbirth* 2016;**16**:234.
37. United Nations. UN Sustainable Development Goal 3: Ensure healthy lives and promote well-being for all at all ages. 2015. [Internet]. http://www.un.org/sustainabledevelopment/health/
38. Renfrew MJ. Midwifery and quality care: findings from a new evidence-informed framework for maternal and newborn care. *Lancet* 2014;**384**:1129–45.
39. Tuncalp Ö, Were WM, MacLennan C *et al*. Quality of care for pregnant women and newborns—the WHO vision. *BJOG* 2015;**122**:1045–9.
40. Abalos E, Chamillard M, Diaz V *et al*. Antenatal care for healthy pregnant women: a mapping of interventions from existing guidelines to inform the development of new WHO guidance on antenatal care. *BJOG* 2016;**123**:519–28.
41. Hodgins STJ, Rankin K, Robinson A *et al*. A new look at care in pregnancy: simple, effective interventions for neglected populations. *PLoS One* 2016;**11**:e0160562. https://doi.org/10.1371/journal.pone.0160562.
42. Villadsen S, Negussie D, GebreMariam A *et al*. Antenatal care strengthening for improved quality of care in Jimma, Ethiopia: an effectiveness study. *BMC Public Health* 2015;**15**:360. https://doi.org/10.1186/s12889-015-1708-3.
43. Tetui M, Ekirapa K, Bua J *et al*. Quality of antenatal care services in eastern Uganda: implications for interventions. *Pan Afr Med J* 2012;**13**:27.
44. Naariyong S, Poudel K, Rahman M *et al*. Quality of antenatal care services in the Birim North District of Ghana: contribution of the community-based health planning and services program. *Matern Child Health J* 2012;**16**:1709–17. doi:10.1007/s10995-011-0880-z.
45. Wilunda C, Quaglio G, Putoto G *et al*. Determinants of utilisation of antenatal care and skilled birth attendant at delivery in South West Shoa Zone, Ethiopia: a cross sectional study. *Reprod Health* 2015;**12**:74. doi10.1186/s12978-015-0067-y.
46. Aliyu LD, Kurjak A, Wataganara T *et al*. Ultrasound in Africa: what can really be done? *J Perinat Med* 2016;**44**:119–23.
47. Thwaites CL, Loan HT. Eradication of tetanus. *Br Med Bull* 2015;**116**:69–77.
48. Blencowe H, Lawn J, Vandelaer J *et al*. Tetanus toxoid immunization to reduce mortality from neonatal tetanus. *Int J Epidemiol* 2010;**39**:i102–9.
49. Khan R, Vandelaer J, Yakubu A *et al*. Maternal and neonatal tetanus elimination: from protecting women and newborns to protecting all. *Int J Womens Health* 2015;**7**:171–80. http://doi.org/10.2147/IJWH.S50539.
50. Downe S, Finlayson K, Tunçalp Ö *et al*. Factors that influence the uptake of routine antenatal services by pregnant women: a qualitative evidence synthesis: a qualitative evidence synthesis. *Cochrane Database Syst Rev* 2016: CD012392. doi:10.1002/14651858.CD012392.
51. EURO-PERISTAT Project with SCPE and EUROCAT.2013. *European Perinatal Health Report*. Brussels: The Health and care of pregnant women and babies in Europe in, 2010.
52. Souza JP, Gülmezoglu AM, Vogel J *et al*. Moving beyond essential interventions for reduction of maternal mortality (the WHO Multi-country Survey on Maternal and Newborn Health): a cross sectional study. *Lancet* 2013;**381**:1747–55.