**QUALITY OF ANTENATAL CARE (ANC) SERVICES IN BAUCHI CENTRAL ZONE, BAUCHI, NIGERIA**

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ABSTRACT

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| **ABSTRACT****Aims**: this study was designed to assess the quality of antenatal care (ANC) among pregnant women in Bauchi Central Zone of Bauchi State. **Study design**: The study employed a retrospective descriptive study among pregnant women who had ANC and also delivered their babies or were brought to the Hospital at the onset of labour or during child birth from 1st January 2022 to 31st December 2022.**Place and Duration of Study:** Bauchi Central Zone of Bauchi State. The study examined pregnant women who had ANC and also delivered their babies or were brought to the Hospital at the onset of labour or during child birth from 1st January 2022 to 31st December 2022.**Methodology**: The instrument for data collection was a designed proforma which was used to extract information from patient antenatal cards, ANC registers, labour and delivery registers. The collected data were analysed using SPSS Version 21**Results**: The findings of the study show that less than one-third of the pregnant women60(30.30%) were between ages 21-25 years, while majority were married and 76(38.38%) attained secondary education. In addition, majority of the respondents 75.30% received Acceptable Minimum Package and Desirable Quality of ANC.**Conclusion**: The study therefore recommends improving the availability and accessibility of quality antenatal and delivery care services in our environment to improve pregnancy outcome. |

*Keywords: [*Antenatal Care, Pregnancy, Acceptable Minimum Package, Desirable Quality of ANC *}*

1. INTRODUCTION

“The desire of the World Health Organization (WHO) is a world where every pregnant woman and newborn receives quality care throughout the pregnancy, childbirth and the postnatal period. Antenatal care (ANC) provides a platform for important health-care functions, including health promotion, screening and diagnosis, and disease prevention. It has been established that by implementing timely and appropriate evidence-based practices, ANC can save lives. Crucially, ANC also provides the opportunity to communicate with and support women, families and communities at a critical time in the course of a woman’s life” (WHO, 2016).

“There is no consensus on the definition of the quality of maternal health care, partly due to the inherent complexities of measuring the concept” (Pokharel et al., 2007). “This includes diagnosis, patient education, communication and preventive care. Outcomes include health status, health behaviour, knowledge, and client satisfaction” (Kuhnt et al., 2017). Quality of care framework is instructive as it separates quality into two constituent parts: quality of the provision of care within the institution and quality of care as experienced by users. The framework identifies 10 elements in assessing the quality of maternal health services, six of which relate directly to the provision of care (human and physical resources; referral system; maternity information systems; use of appropriate technologies; internationally recognized good practice; and management of emergencies). The other four elements are related to women’s experience and include cognition; respect; dignity and equity; and emotional support.

“Antenatal care (ANC) is one of the evidence based interventions to decrease the probability of bad health outcomes for mothers and their newborns. Effectiveness of antenatal care, however, relies on the quality of care provided during each antenatal care visit” (FHI, 2012).

“The outcome variable in this study was the quality of ANC services. The quality of ANC was assessed in terms of the desirability and minimum acceptable levels. The desirable (good) quality of ANC was defined here as the receipt of all the 10 components as used in previous study while the receipt of the eight most critical of the components were defined to be minimum acceptable level. The two components that were considered less critical are: receiving of intestinal parasite drugs (IPD) and health talk on prevention of mother to child transmission (PMTCT).

Nigeria with maternal mortality ration (MMR) of 814 per 100,000 compared to global average of 210 undoubtedly needs an improved ANC coverage as well as high quality ANC service delivery” (WHO, 2013).

“Every single day, Nigeria loses about 145 women of childbearing age. This makes the country the second largest contributor of maternal mortality rate in the world. UNICEF . Inadequate ANC, both in terms of coverage and quality, has been associated with adverse pregnancy outcomes” (Osungbade et al., 2011). “The state of maternal and child health is an indicator of a society’s level of development, as well as an indicator of the performance of the health care delivery system” (NDHS, 2013).

“Globally, it has been estimated that about half a million women die each year of pregnancy related causes, 99 % of them in developing countries” (Tuladhar et al., 2011). “At least nine percent of the pregnancies are complicated by a disease which is aggravated by pregnancy, such as malaria, iron-deficiencyanaemia, hepatitis, tuberculosis (TB), and heart disease” (WHO, 2014). “The quality antenatal care received by a woman during antenatal can go a long way in reducing maternal and child death as well as related complications” (NDHS, 2013).

**Justification of Study**

“Several studies have determined factors affecting ANC use but only few have examined the quality of services rendered at various antenatal clinics in Africa. In Nigeria, the few studies on quality of ANC so far have been geographically restricted. For instance, some studies on ANC quality were carried out in South West Nigeria, in South East and a 2007 study in North Central Nigeria” (Osungbade et al., 2011). This necessitates the present study in Bauchi, North East Nigeria.

**Objective of Study**

The present study assesses the quality of antenatal care (ANC) in the General Hospitals in Bauchi Central Zone, Bauchi State.

**Null Hypotheses**

Ho1, There is no quality antenatal care of pregnant women attended ANC at the General Hospitals in Bauchi Central Zone

**What is ANC?**

“Antenatal care is the care that a woman receives during pregnancy and helps to ensure healthy outcomes for women and newborns” (WHO/UNICEF, 2013). “Antenatal care provides an important entry point for pregnant women to receive a broad range of health promotion and preventive health services, including nutritional support and prevention and treatment of anaemia, prevention, detection and treatment of malaria, tuberculosis and sexually transmitted infections (STIs)/HIV/AIDS (particularly prevention of HIV transmission from mother to child, and tetanus toxoid immunization” (WHO/UNICEF, 2013). A trained (skilled) health care provider helps to monitor and reduce the risks for both the mother and child during pregnancy. In Nigeria, it is estimated that only 37 percent of antenatal care providers are doctors, nurses and midwives, while about 35 percent of the mothers do not receive this care.

“World Health Organization has recommended at least four (4) quality antenatal care visits for women whose pregnancies are progressively normally, with the first visit in the first trimester (ideally before 12, weeks but no later than 16 weeks), and at 24-28 weeks, 32 weeks and 36 weeks” (Villar and Bergsjo, 2013). Over an eight year period (2005-2013) the average ANC coverage stood at 58 percent and only 35 percent of deliveries in Nigeria had skilled attendance (UNICEF, 2013). The figures for Ghana were 92 percent and 44 percent, and 75 percent and 60 percent for Cameroon. The NDHS data revealed that almost half of teenage (a period associated with high morbidity and mortality for mother and child) mothers did not receive ANC services at all (NDHS, 2013).A greater percentage of the populations in the developing countries are illiterates living in the rural areas. These women do not know the importance of Ante-natal care. It is therefore important to educate these categories of women about the usefulness of antenatal care delivery in hospitals (Harrison, 2009).

**Components of Antenatal Care (CAC)**

“Abdominal Examination- The objective of abdominal examination to help the health care providers to know those conditions that may adversely affect the health of the pregnant mother or her child and then assist in the subsequent management” (Chingle et al., 2017).

“The limitation of these screening examinations is that they must be carried out regularly throughout pregnancy to be useful. The transitory nature of these measurements makes evaluation of effectiveness very difficult” (Dimperio et al., 2012). “Palpating is the main method of estimating fetal position and wellbeing but the method has never been proven useful” (Harrison et al., 2009). “One study from Aberdeen found that 18% of breech position cases had been detected before labour” (Villar, et al., 2011). “In studies from Kasonga and the Gambia, mal-position was rarely identified correctly” (Rooney et al., 2012). “In Kenya a risk system which included identification of fetalposition produced a sensitivity of 4% of specificity of 87% and a predictive value of 13%. Finally, the identification of malposition will never alter the position of thefetal. The eventual outcome is dependent on the availability of efficient obstetric facilities with staff that can carry out caesarian sections” (Uzoigwe et al, 2010). “Measurement of fetal growth does not directly affect the mother, but if poor growth is identified it will inevitably result in stress and perhaps guilt for the mother, indirectly affecting her health. As a procedure, some have found it difficult to do well” (Chiphangwi, 2011) and an inadequate measure of fetal growth (Magadi et al., 2000). “In contrast, others found it an excellent method. Figures are scarce, intra-uterine growth retardation was suspected or diagnosed in loss tt half the women who subsequently delivered a small for gestational age baby, a ratio of 1:2.5 of correct prediction to incorrect” (Dimperio et al., 2012). “The large number of false positives places a load on the system and increases the tendency for unnecessary interventions and the stress on women” (Tuladhar et al., 2011).

**Quality of ANC**

“A review of the available results of the Demographic Health Survey from 14 countriesof questions on elements of ANC, showed that countries differ significantly in the content of ANC. Among the countries with data on the content of care, the most common elements are measurement of weight and blood pressure, and the least common elements are blood and urine tests along with information on danger signs” (Abou-Zahr, Carla and Wardlaw, 2003).

“Studies clearly indicated that countries with high maternal, perinatal and neonatal mortality have inadequate and poor quality health service, which can be associated with reduced utilization of health service. Reference on these studies show that the use of evidence-based guidelines leads to better process and outcomes of health, when appropriately implemented. Emphasis is therefore placed on the use of standards of care as a way of addressing barriers to quality care” (WHO, 2006). “Variation in ANC content received in less developed settings has been associated with the odds of skilled delivery, preterm births, perinatal mortality and birth-weight in grams suggesting that improving adherence to prenatal protocols may lead to important health implications” (Chingle et al 2017). “The WHO guidelines are specific as regards the timing and content of ANC visits according to gestational age” (WHO, 2006).

**Measures of quality of ANC**

“Services are said to be of good quality if providers adhere to the set standards designed by health professionals in providing care. Quality of care can be measured from the perspectives of clients or providers (perceived quality) or by measuring adherence levels to the set standards and guidelines. Donabedain gave the framework for assessing the quality of care based on the three attributes of structure (material, human, and financial 19 resources of the setting where care occurs), process (what is actually done in giving and receiving care) and outcome (effect of care on the status of the clients)” (FHI, 2012). “For ANC, quality care is based on the provision of full components or elements of care as recommended by the WHO and National guidelines in a manner that is friendly and acceptable to clients” (Dimperio et al., 2012). “Receiving fewer ANC procedures has been associated with increased perinatal deaths and low birth-weight, premature delivery and higher risk of intra-uterine growth retardation among women (Magadi et al., 2000). Client’s perception on ANC is also important in assessing the quality of care provided. Perceived poor quality of care partly motivates the choices by women not to seek ANC and to deliver at home. When attention on patients’ views on health services is increased and quality of services improved, satisfaction is enhanced and hence continuity and use of services” (Dimperio et al., 2012). “Women are more likely to seek and return for services if they feel cared and respected by their providers, and receive the care they need in full measure. Satisfaction with ANC is associated with positive perceptions of staff, perceived quality, short waiting time, ease in contacting the doctor and privacy” (Tuladhar et al., 2011). Clients’ expectations may depend on the type of service, socio-economic and demographic characteristics and hence intervention measures should be coined in relation to client needs. The assessment of the quality of ANC helps us to comprehend fully MCH issues, which will provide information that can guide new intervention measures.

2. material and methods

**Study Design**

 Retrospective cohort study was used for this study.

**Scope of Study**

This study was limited to pregnant women (15-49 years) attended ANC at General Hospitals in Bauchi Central Zone of Bauchi State

**Study Area**

Bauchi Central Zone comprised six (6) LGAs but the study was restricted in four main LGAs that includes Ningi LGA, Ganjuwa LGA Darazo LGA and Misau LGA, with a total population of 1,448386 as at 2006 National Population Census

**Study Population**

The population for this study was women who had (ANC) and who also delivered their babies or were brought to the Hospital at the onset of labor or during child birth between 1st January 2017 to 31st December 2017.

**Table 1: Target population of the study**

|  |  |  |
| --- | --- | --- |
| ZONE  | LGAs INVOLVED  | POPULATION  |
| Bauchi Central Zone  | Ningi LGAGanjuwa LGAMisau LGADarazo LGA  | 13500128001050011500  |

Source of data: Medical record office from various Local Government Areas (2017).

Sample Size

The minimum sample size was calculated based on the Yaro Yamane’s formula for sample size determinant

n = Z2 Pq

 d2

Where

n = minimum sample size

Z = 1.96 at 95% confidence interval

P = 11.3% i.e. the minimum acceptable quality of care received by ANC attendees from a previous study

q= 100 - p

d = degree of accuracy desired (0.05)

N = number of population

n = 3.8416 x 11.3 x 88.7

 52

n = 154

N = 48300

Using the finile correlation formula for proportions

n = n0

 (n0 – 1)

1 +

 N

Where

n0 = calculated sample size

n = 154

 (154 – 1)

 1 +

 48300

20 % will be added to the calculated sample size to adjust for non response

q = 1

 1 – f

q = 1.25

Multiplying the adjustment factor by the sample size will give us 153 x 1.25 = 191.25 approximately 200

Proportionate allocation (sample size for each facility)

Ningi General Hospital = 13500 x 200

 48300

 = 56

Ganjuwa General Hospital = 12800 x 200

 48300

 = 53

Darazo General Hospital = 11500 x 200

 48300

 = 48

Misau General Hospital = 10500 x200

 48300

 = 43

= 200

**Sampling Technique**

Method and instrument of Data collection: mixed methods approach was used including: (a) Retrospective cohort study of quality of care provided to women aged 15–49 years who had completed their ANC and delivered in 2017; (b) in-depth interviews with health professionals. The Instrument for the data collection will be antenatal cards, ANC registers, labor and delivery registers.

**Research Instrument**

 A structured questionnaire was used for this study

**Method for Data Analysis**

Data was manually selected out and coded for analysis using the statistical package for social science (SPSS) version 22, it was summarized using descriptive statistics and chi-square test associations between categorical variables

**Validity**

To determine the validity of the instrument, the researcher gave the questionnaire to his experts to ascertain the face validity of the instrument.

**Reliability**

The reliability index was determined using cronbach’s alpha test of internal consistency (SPSS Version 22).

**Inclusion Criteria**

The study included pregnant women between the age of 15-49 years from Bauchi Central Zone Local Government Areas who attended antenatal care and post natal services.

**Exclusion Criteria**

The study also excluded pregnant women who were not within the age of 15-49 years and are living outside Bauchi Central Zone.

3. results and discussion

Table 2 shows that less than one-third 60(30.30%) of the respondents were between the ages of 15-20 years followed by respondents in ages 26-30 years 51(25.76%), 21-25 years 50(25.25%) and 31-35 years 28(14.14%) respectively. Furthermore, majority of the respondents 188(94.95%) were married, while most 170(85.86%) practice Islam as their religion and above half of the respondents 102(51.52%) were from Hausa tribe. In addition, more than one-third of the respondents 76(38.38%) attained secondary education, followed by Primary education 57(28.79%) and 40(20.20%) had no formal education. Similarly, more than half of the respondents 106(53.54%) were unemployed, followed by self-employed 61(30.81%) and 31(15.66%) were civil servants.

**Table 2: Socio-demographic characteristics of the respondents**

|  |  |  |
| --- | --- | --- |
| Variables | Frequency (N=198) | Percentage |
| Age (Years)15-2021-2526-3031-3536-40 | 605051289 | 30.3025.2525.7614.144.55 |
| Marital StatusMarriedDivorced | 18810 | 94.955.05 |
| ReligionChristianIslamTraditional | 1817010 | 9.0985.865.05 |
| EthnicityHausaFulaniIgboYoruba | 1028574 | 51.5242.933.542.02 |
| Educational StatusNo formal EducationPrimarySecondaryTertiary | 40577625 | 20.2028.7938.3812.63 |
| OccupationUnemployedSelf employedCivil servant | 1066131 | 53.5430.8115.66 |

As shown in Table 3 below, 198(10.80%) of the respondents received Health talk on PMTCT, Health talk on Malaria, danger signs and complication during pregnancy, and Health talk on HIV/AIDS counseling, testing and collection of result. Furthermore, 194(10.60%) received TT injection, 192(10.50%) received BP measurement, 182(10.0%) received Iron supplement and Intermittent preventive during pregnancy. In addition, about fifty percent 117(50.09%) of the respondents had four antenatal contacts, while more than one-third 69(34.85%) were attended to by a midwife and 86(43.43%) affirmed that a midwife conducted their delivery. Furthermore, more than two-third 136(68.69%) of the pregnancy were booked ANC while less than one-third were unbooked ANC.

**Table 3: Quality of antenatal care investigation done during antenatal care** **(Quality ANC Measures)**

|  |  |  |
| --- | --- | --- |
| Variable | Frequency N=136 | Percentage |
| What did the hospital do during antenatal care for this patientUrinalysis for protein and sugarBP measurementIron SupplementIntestinal Parasite Drug (IPD)TT injectionIntermittent preventive during pregnancyHealth talk on PMTCTHealth talk on Malaria, danger signs and complication during pregnancyHealth talk on HIV/AIDS counseling testing and collection of resultBlood test for PCV and malaria | 149192182181194182198198198153 | 8.2010.5010.09.9010.6010.010.8010.8010.808.40 |
| Number of ANC contacts1234 | 152343117 | 7.5811.6221.7250.09 |

Measuring the Acceptable Minimum ANC Package which include the receipt of the eight most critical of the ANC components (Urinalysis for protein and sugar, BP measurement, Iron Supplement, TT injection, Intermittent preventive during pregnancy, Health talk on Malaria, danger signs and complication during pregnancy, Health talk on HIV/AIDS counseling testing and collection of result and Blood test for PCV and malaria) shows that majority of the respondents 149(75.30%) received the acceptable minimum ANC package while 49(24.70%) received less than the eight most critical components (Figure 1).

 **Figure 1: Acceptable Minimum ANC Package**

According to figure 2 below, most of the respondents 149(75.30%) received the desirable quality of ANC which include the ten components while 49(24.70%) received less than the ten desirable components of ANC.

 **Figure 2: Quality of ANC**

The World Health Organisation (WHO) in 2001 recommended focus antenatal care model for developing countries, which minimizes the number of investigations and clinical visits by women (World Health Organisation, 2012). The aim of the recommendation was to provide four focus ANC for women who do not present with symptoms or pregnancy complications and antenatal care is utilized as an entry point for interventions to improve maternal and child health care (World Health Organisation, United Nations Childrens Fund, 2003; Villar et al., 2001); while women considered as high risk would require more frequent visits in order to receive more specialist care, additional evaluation or follow up based on their individual needs (Villar and Bergsjo, 2004).

The findings of the study showed that majority of the respondents 75.30% received the acceptable minimum ANC package. This includes the eight most critical ANC components (Urinalysis for protein and sugar, BP measurement, Iron Supplement, TT injection, Intermittent preventive during pregnancy, Health talk on Malaria, danger signs and complication during pregnancy, Health talk on HIV/AIDS counseling testing and collection of result and Blood test for PCV and malaria). This finding was different from the findings of the Nigerian Demographic Health Survey, 2013 where only 11.30% received the eight critical components. Similarly, majority of the respondents also received desirable quality of ANC. This finding was also higher than the Nigerian Demographic Health Survey, 2013, where 37.50% received at least eight of the components. This shows improvement in the quality of ANC especially in Northern Nigeria where maternal mortality is very high. On the components of ANC received by the women, the findings show thatpregnant women received health talk on PMTCT, health talk on Malaria, danger signs and complication during pregnancy, health talk on HIV/AIDS, counseling, testing and collection of results, Tetanus Toxoid injection. This finding was slightly different from the finding of a previous study where the respondents received more of Blood Pressure measurement and Iron supplements. The finding of the study was also different from the findings of a study in Anambra State South-East Nigeria which reported Iron/Folic acid, Tetanus Toxoid immunization and haemoglobin assessment (Agu et al., 2015; Osungbade et al., 2011). The findings of the study showed that about half of the women had at least four ANC contacts. The finding was similar to the findings of the study in Anambra State where majority of the respondents had between 4-8 ANC contacts (Agu et al., 2015). Furthermore, the finding of the study was similar to the findings of the study in Gindiri (Chingle et al., 2017) which reported more than four visits. The finding was also similar to the study in Kiambu Kenya and Buea Health District Cameroon (Ekane Edie et al., 2015).

4. Conclusion

This study revealed that majority of the pregnant women had quality ANC experiences as well as an acceptable minimum antenatal package and desirable quality of antenatal. The study showed that there was a significant relationship between quality of ANC and maternal outcome of the pregnancy at P<0.005. Consequently, women with desirable ANC are more likely to be alive and well when compared with women with undesirable ANC.

**Ethical Approval**

Ethical clearance was obtained from the Department of Public and Community Health Novena University and Bauchi State Ministry of Health.

**Consent**

As per international standards or university standards, Participants’ written consent has been collected and preserved by the author(s).

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**References**

Agu, U., Agu, M. C., and Nnaji, G. A. (2015). Utilization of antenatal services at comprehensive health center Umunya, Anambra state: a retrospective study. Family Practice Reports. Central Intelligence Agency World Factbook.

Chigbu, B., Onwere, S., Kamanu, C. I., Aluka, C., Okoro, O., and Adibe, E. (2009). Pregnancy outcome in booked and unbooked mothers in South Eastern Nigeria. East African Medical Journal, 86(6), 267-71.

Chingle, M. P., Bupwatda, J. M. and Zoakah, A. I. (2017). Antenatal Care and Pregnancy Outcomes among Mothers Who Delivered in a Rural Hospital in Nigeria. International Journal of Innovative Research and Development, 6, 3.

Dimperio, D., Frentzen, B. and Cruz, A. (2012). Routine weighing during antenatal care: still justified? British medical journal 304: 460

Ekane Edie, G. E. H., Obinchemti, T. E., Tamufor, E. N., Njie, M. M., Njamen, T. N., and Achidi, E. A. (2015). Perceptions of antenatal care services by pregnant women attending government health centres in the Buea Health District, Cameroon: a cross sectional study. Pan African Medical Journal, 21, 45.

Fagbamigbe, A. F., and Idemudia, E. S. (2015). Assessment of quality of antenatal care services in Nigeria: evidence from a population-based survey. Reproductive Health, 12, 88.

Family Health International 360 (2012). Schooling in northern Nigeria: Challenges for girls' education. A brief written by Rachel Hatch Research Associate, Education Policy and Data Center.

Harrison, K.A (2009). Maternal mortality in Nigeria: paper commissioned by the United Nations Fund for population activities (UNFPA) for international conference of the society of gynecology and obstetrics of Nigeria at Abuja, Sept. 13, 2009

Kuhnt, J., and Vollmer, S. (2017). Antenatal care services and its implications for vital and health outcomes of children: evidence from 193 surveys in 69 low-income and middle income countries. BMJ Open, 7:e017122. doi:10.1136/ bmjopen-2017-017122.

Magadi, M. (2011). Analysis of factors as with maternal mortality in Kenyan hospitals. Journal of biosocial science 33: 375-389

Osungbade, K. O, Shaahu, V. N., and Uchendu, O. C. (2011). Clinical audit of antenatal service provision in Nigeria. Health Care Women International, 32(5):441-52.

Pokharel, H. P., Lama, G. J., Banerjee, B., Paudel, L. S., and Pokharel, P. K. (2007). Maternal and perinatal outcome among the booked and unbooked pregnancies from catchments area of BP Koirala Institute of Health Sciences, Nepal. Kathmandu Univ Med J (KUMJ).5(2), 173-6.

Rooney, C. (2012). Antenatal care and maternal health: how effective is it. Geneva: World Health Organization

Tuladhar, H., and Dhakal, N. (2011). Impact of Antenatal Care on Maternal and Perinatal outcome: A Study at Nepal Medical College Teaching Hospital. NJOG, 6(2), 37-43.

Uzoigwe, S.A. and John, C.T. (2004). A ten - year review of maternal mortality in the university teaching hospital, Uniport. Nigerian journal of medicine, vol. 13. No. 1

World Health Organization (2013). Regional Office for Europe's Health Evidence. What is the efficacy/effectiveness of antenatal care and the financial and organizational implications? [online]. Copenhagen: World Health Organization; 2003. Available from: http://www.euro.who.int/\_\_data/assets/pdf\_file/0007/74662/E82996.pdf (accessed 2014 June 6).

World Health Organization (2013). Making pregnancy safer: the critical role of skilled attendants. www.who.int/making\_pregnancy\_safer/documents/9241591692/en

World Health Organization, (2012). WHO Antenatal Care Randomized Trial: Manual for the Implementation of the New Model [online]. Geneva: World Health Organization; 2002. Available from: http://whqlibdoc.who.int/hq/2001/WHO\_RHR\_01.30.pdf

World Health Organization, (2006). Reproductive health indicators: guidelines for their generation, interpretation and analysis for global monitoring.