Multimorbidity in Pregnancy: An Exploratory Study Among Women Attending Antenatal Clinics in Odisha, India

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Research article

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Abstract

Background: In recent years, the interplay of non-communicable diseases (NCDs) in pregnancy has gained global prominence, with documented risk for maternal and newborn wellbeing; especially, multimorbidity, the coexistence of two or more chronic conditions, is being recognized as a maternal health challenge. At the same time, pregnancy has remained as an exclusion criterion in most of the multimorbidity estimation studies resulting in deficient understanding of the problem in this vulnerable population. We aimed to estimate the prevalence of multimorbidity and identify its correlates among females presenting to antenatal care clinics, and assessed the outcomes in terms of health care utilization and expenditure.

Method: An exploratory cross-sectional study was conducted among 127 pregnant women attending three antenatal clinics of Bhubaneswar, Odisha from January – June 2016. Data was collected using "multimorbidity assessment questionnaire for antenatal care" (MAQ ANC) specifically developed and validated for the purpose. Multimorbidity was defined as two or more of the enlisted morbidities. Descriptive analysis was performed to determine prevalence and correlates. Outcomes were measured by number of healthcare visit, medications and healthcare expenditure.

Result: Multimorbidity was present in 15% of antenatal women. Anemia (58.62%), hypertension (21%), acid peptic diseases (21%) and thyroid (17.24%) were leading chronic conditions. A statistically significant association was found (p-value <0.05, Pearson's chi-square test) between multimorbidity and medical consultation, medicines consumed, and functional limitation. Health care expenditure was significantly higher among multimorbidity group, of which nearly half was incurred on diagnostics.

Conclusion: Multimorbidity is an emerging issue in pregnancy. Our findings suggest inclusion of comprehensive multimorbidity assessment in routine antenatal screening. The preconception care needs to establish linkages between maternal and reproductive health with NCD prevention, and identify ways to reduce health care utilization and expenditure Longitudinal studies to assess the trajectory and impact of multimorbidity on maternal and infant health are warranted.

Background

The hierarchical role of chronic and non-communicable diseases (NCD) replacing acute infectious diseases is becoming a major health care burden in low and middle-income countries (LMIC) [1]. Concomitantly, the number of individuals and populations with two or more chronic conditions i.e. multimorbidity are increasingly observed in these settings [2]. Multimorbidity is a novel concept that encompasses all long -term conditions(LTC) present in an individual. Contrary to comorbidity, it does not attribute centrality to any index condition; rather views the patient as a whole and provides insights for patient centered care [3]. Owing to its strong association with increased hospitalization, healthcare expenditure and mortality rates; as well as inferior physical and mental health and impaired quality of life; multimorbidity has been the recent focus of clinicians and public health researchers globally [4–6].

Within LMICs, India, the largest demography, is no exception, with studies documenting a steadily growing burden of multiple chronic conditions pervading all socioeconomic and geographic strata [7, 8]. Our previous study, first to assess multimorbidity in primary care, has estimated the prevalence to be one third while two-third of these patients were below fifty years of age exhibiting worse quality of life and greater health care utilization [9]. Even though multimorbidity increases with age, the non-chance coexistence of multimorbidity is greater at younger ages with many being diagnosed during late adolescence and early adult life [10].

While majority of epidemiological studies have investigated the variation of multimorbidity across age, and socioeconomic status, the role of gender has received comparatively lesser attention [11]. The burden and impact of multimorbidity particularly amongst women is not clearly elucidated, since most studies have adjusted for the effects gender on the association between multimorbidity and its outcomes [12]. A recent scoping review on multimorbidity in LMIC has highlighted the prevalence to be higher in females (25–52.2%) than males (13.4–38.6%) and more common in younger women [13]. Few recent studies in West Asia and India too have observed a higher prevalence in women [14, 15]. According to a report based on the National Family Health Survey, India, nearly 17. 5 per 100 women of reproductive age females have at least one morbidity[16]. This implies that many women of child bearing age would be entering into pregnancy with pre-existing multimorbidity.

The prenatal presence of chronic condition is known to decline functional capacity and overall health. It further increases the risk of complications during pregnancy and childbirth with potential long-term outcomes for both mother and child [17]. The diverse physiological changes during pregnancy can even unveil certain latent chronic conditions with significant impact on the physical and mental wellbeing [18]. The propensity of adverse outcomes gets amplified when a pregnant woman has multiple long-term conditions – multimorbidity, when the co-occurring diseases might exacerbate each other [19].

Interestingly, studies entailing multimorbidity either community or health care setting based usually have “pregnancy” as one of the exclusion criteria in participant recruitment [9, 10, 12]. Moreover, since women during pregnancy visit designated antenatal care (ANC) clinics, they naturally get excluded from any routine health facility-based survey. Such cumulative inadvertent exclusion has resulted in underrepresentation of this vulnerable population in any multimorbidity research [20]. Our systematic review that profiled multimorbidity across South Asia had noted paucity of studies focusing on reproductive age women [21]. Even, a recent systematic review of maternal morbidities in LMICs has highlighted conspicuous research gaps. Despite some progress, majority have investigated specific NCDs like gestational diabetes, pregnancy induced hypertension or other hormonal disorders. Some have dwelled either on mental health particularly depression, or chronic infectious diseases (e.g. HIV) or nutritional deficiencies, having implications on maternal health. However, none of these studies specifically aimed to study multimorbidity nor had used a comprehensive panel of chronic conditions to estimate the same [22]. For maternal health service providers, an understanding of the complex role of multimorbidity is indispensable to provide safe, efficient, and optimal care for both mother and child [23]. Thus, any epidemiological estimation of multimorbidity among pregnant women should ideally be carried

out across antenatal clinics. This knowledge is of considerable significance for a country like India, wherein both NCDs and maternal health indicators are being accelerated to achieve universal health coverage as articulated by Sustainable Development Goal (SDG) [24, 25].

With an aim to address the current research gap, we undertook the present study, first to describe epidemiology of multimorbidity among women attending antenatal care clinics in Odisha, an eastern state of India. Our objectives were three-fold: 1) to develop a comprehensive, contextualized tool for assessment of multimorbidity for antenatal care; 2) to estimate the prevalence and distribution of multimorbidity using this tool in ANC settings. 3) to explore the outcome of multimorbidity in terms of healthcare use and expenditure among these women.

Methods

Design and setting of the study:

This observational study was conducted among adult females (≥ 18 years' age) attending antenatal clinics in Khurda district (Odisha), from February to July 2016. Three antenatal clinics one each from North, South and Central zone were randomly selected. Since we did not have any data on the prevalence of multimorbidity in pregnancy we opted for an exploratory cross-sectional design spanning six months, and decided to include all adult females presenting for the first time to the selected antenatal clinics. This allowed us to accommodate nonresponse, ineligibility and incomplete interviews if any.

Each woman was briefed regarding the study objective, information to be assessed and written informed consent was obtained prior to data collection. In order to avoid any disruption or delay in the clinic's patient management system, we approached each participant when they were over with the physician consultation, and did the interviews at a quiet and comfortable place. The exit interviews also helped us to record the diagnosis in detail by going through the prescriptions. To prevent data duplication, each participant was given unique identification number and those who have already been interviewed under the present study were excluded during follow up visits.

Study tool and data collection:

Our study spanned 24 weeks which comprised three weeks for tool development and testing while subsequent 21 weeks encompassed data collection. We used a structured tool -Multimorbidity Assessment Questionnaire for Antenatal Care (MAQ-ANC) for collecting data. The MAQ-ANC was adopted and adapted from our previously validated Multimorbidity Assessment Questionnaire for Primary Care (MAQ-PC). We had developed and validated MAQ-PC (Additional File) through an iterative process and demonstrated a good concordance with clinical records and physician prescriptions [26]. MAQ-ANC was then translated into the vernacular language (Odia) followed by cognitive interviewing and pre-tested in a sample of non-study participants and finalized.

The MAQ- ANC comprised segments namely sociodemographic data, maternal health covariates, multimorbidity assessment and health outcomes - health care utilization, health care expenditure, self-rated health (SRH) and functional limitation. The sociodemographic section included information on participant's age, ethnicity, place of residence (rural/urban), the level of education (including not educated, primary, high school/ secondary and above), employment (yes/no) and having any social security scheme (whether issued with below poverty line card) [27]. Maternal health covariates consisted of past pregnancy, deliveries and birth outcomes [28]. The multimorbidity assessment collected information on whether the woman had been informed by a physician or a health care provider that she had any of the listed chronic conditions. These conditions were self-reported doctor diagnosed and cross-validated from the patient prescriptions and medicine wrappers. Health care utilization was measured in terms of physician / health care facility consultation(yes/no), prescription of medication (yes/no) and current use of medication (yes/no). Health care cost - out of pocket expenditure (OOPE) was calculated by using money spent on medications, physician consultation and laboratory investigations per month [29]. Self-rated physical and mental health was elicited using a Likert scale (e.g. excellent, very good, good, fair and poor) [30] and functional limitation (as an indicator of severity) was assessed by questioning how much a particular condition interferes in the daily activity and living (e.g. not at all, a little, somewhat, quite a bit and a lot) [19]. Two trained public health nurses with prior experience in multimorbidity as well as maternal health did all the interviews. They were well versed with local language and patient history taking. Each interview spanned from 20–25 minutes.

Ethical approval for the study was obtained from The Institutional Ethics Committee of Indian Institute of Public Health, Bhubaneswar, Odisha (Vide no: IIPHB-IEC-2015/018). Written informed consent was obtained from all participants, and necessary steps were taken to ensure confidentiality and anonymity of patients. Approval of the medical officer in charge of the clinic was solicited prior to the data collection.

Statistical analysis

For analysis, we defined multimorbidity as the presence of two or more long term conditions (LTCs) from which one is either: (1) A physical non-communicable disease of long duration, like hypertension. (2) A mental health condition of long duration, such as a mood disorder. (3) An infectious disease of long duration, such as HIV [31]. Two variables - the total count of chronic conditions for each person and the number of respondents who had two or more chronic conditions were computed. We summarized the study enrollment characteristics as frequency and percentages. Further Pearson's Chi-square test was performed to identify the association between multimorbidity and functional limitation. The p-value was two sided and < 0.05 was considered significant. All data analyses were carried out using STATA SE v.16 (STATA Corp, Texas).

Results

We approached 142 women, out of which 127 agreed to take part in the interview with a response rate of 90%. The most common reason cited for non-response was lack of time. Table 1 and Table 2 describe the socio-demographic characteristics and past-obstetric history of the study participants, respectively.

Additionally, these findings were supplemented with chi-square p-values to simultaneously study the association between selected variables and multimorbidity.

Table 1
Socio-demographic characteristics

Predictors	Total [N = 127]	Any one Morbidity [N = 99]	Multimorbidity [N = 19]	Chi-square p- value
Age group (in years)				
18–24	45 (35.43%)	34 (75.56%)	7 (15.56%)	
25–29	57 (44.88%)	45 (78.95%)	9 (15.79%)	
30–36	25 (19.69)	20 (80.00%)	3 (12.00%)	0.7603
Ethnicity				
Scheduled Castes/Tribes	16 (12.60%)	15 (93.75%)	1 (6.25%)	
Non-Scheduled Castes/Tribes	111 (87.40%)	84 (75.68%)	18 (16.22%)	0.127
Education				
Till high school	92 (72.44%)	71 (77.17%)	13 (14.13%)	
Secondary and above	35 (27.56%)	28 (80.00%)	6 (17.14%)	0.442
Employed				
Yes	18 (14.17%)	15 (83.33%)	2 (11.11%)	
No	109 (85.83%)	84 (77.06%)	17 (15.60%)	0.829
Socioeconomic Status				
Below Poverty Line	56 (55.91)	37 (66.07%)	13 (23.21%)	
Above Poverty Line	71 (44.09)	62 (87.32%)	6 (8.45%)	0.016
Type of House				
Kutcha	36 (28.35%)	27 (75.00%)	5 (13.89%)	
Pucca	91 (71.65%)	72 (79.12%)	14 (15.38%)	0.563
Place of Residence				

Predictors	Total [N = 127]	Any one Morbidity [N = 99]	Multimorbidity [N = 19]	Chi-square p- value
Urban	41 (32.28%)	35 (85.37%)	3 (7.32%)	
Rural	86 (67.72%)	64 (74.42%)	16 (18.60%)	0.211

Table 2
Pregnancy related outcomes

Past-obstetric Characteristics	Total	Any one Morbidity	Multimorbidity	Chi-square P value
Parity				
Primi gravida	56 (44.09%)	47 (83.93%)	7 (12.50%)	
Multigravida	71 (55.91%)	52 (73.24%)	12 (16.90%)	0.253
Type of delivery				
Not applicable	65 (51.18%)	52 (80.00%)	10 (15.38%)	
Vaginal	48 (37.80%)	36 (75.00%)	7 (14.58%)	
Caesarean	14 (11.02%)	11 (78.57%)	2 (14.29)	0.844
Outcome of last pregnancy				
Not applicable	54 (42.52%)	45 (83.33%)	7 (12.96%)	
Full term	55 (43.31%)	43 (78.18%)	6 (10.91%)	
Pre-term	6 (4.72%)	3 (50.00%)	3 (50.00%)	
Abortion	12 (9.45%)	8 (66.67%)	3 (25.00%)	0.202
History of preeclampsia				
Yes	6 (4.72)	5 (83.33%)	1 (16.67)	
No	121 (95.28%)	94 (77.69%)	18 (14.88%)	0.636
Total	127 (100.00%)	99 (77.95%)	19 (14.96%)	

The mean age of participants was 25.8 [standard deviation (SD) 4.03] years ranging from 18 to 36 years (Table 1). As presented, 35.4%, 44.8%, and 19.6% of the respondents belonged to the age-group 18–24, 25–29 and 30–36 years, respectively. Eighty-seven percent of the participants belonged to Non-Scheduled Castes/Tribes. Majority (72.4%) women had education up to high school level while 80% of

participants were not engaged in any employment. More than half of the interviewed women belonged to below poverty line (BPL) group while around 68% were residing in rural areas.

Findings from Table 2 illustrates that more than a half (55.9%) of the participants were multigravida (more than one pregnancy). Nearly 38% had history of normal vaginal delivery in their last child birth. Nearly 42.5% of the participants had a full-term baby while the rest had unfavorable pregnancy outcomes namely pre-term deliveries, abortions and still births. Almost all (95.3%) did not have any previous history of pre-eclampsia. (Table 2)

Multimorbidity And Health Care Outcomes

Table 3 depicts the summary statistics for different parameters of health care utilization in terms of number of medical consultation and medications being prescribed, and continuing medicines Additionally, Table 3 describes the self-perceived severity of the condition (functional limitation owing to morbidity), and self-rated health (SRH). Table 4 provides the summary statistics on health care expenditure.

Table 3
Healthcare utilization and outcome across the multimorbidity group

Characteristic	**Morbidity**		**p-value**
	Single Morbidity (N = 99)	**Multimorbidity (N = 19)**	
Medical Consultation	98 (78.40%)	19 (15.20%)	0.055
Medicines Taken	95 (79.17%)	19 (15.83%)	0.010
Continuing Medicine	88 (80.00%)	19 (17.27%)	0.000
Functional Limitation			
Not at all	27 (90.00%)	1(3.33%)	
A little	33 (75.00%)	5 (11.36%)	
Somewhat	19 (95.00%)	1 (5.00%)	
Quite a bit- a lot	20 (60.61%)	12 (36.96%)	0.001
Self-rated Health			
Excellent /very good	18 (78.26)	3(13.04)	
Good	51 (85.00%)	6 (10.00%)	
Fair/poor	30 (68.18%)	10 (22.73%)	0.360
Total	99 (77.95%)	19 (14.96%)	

Table 4
Share of expenditure (%) of total expenditure

Comparison Group	Median OOPE [IQR]	Percent share of total expenditure (Median [IQR])		
		Medicine	Consultation	Laboratory
No or One Morbidity	1880 (2160)	30.77 (28.33)	11.11 (12.12)	55.55 (31.19)
Multimorbidity	2975 (2270)	35.09 (39.59)	8.03 (10.22)	54.70 (31.68)

A statistically significant association was found (p-value < 0.05, Pearson's chi-square test) between multimorbidity and health care visits, medicines consumed, continuing medicine. Further, there was a significant difference in functional limitation between multimorbidity and no multimorbidity groups. Among those with multimorbidity, tribal and homemakers had significantly lower health care utilization vis-à-vis their non-tribal and employed counterparts. No significant association was observed between multimorbidity and self-rated health.

Figure 2 depicts box plots summarizing the distribution of different components of healthcare costs consisting of medicines, physician consultation, and diagnostics. The median expenditure on medicine, consultation and laboratory investigations were found to be higher (statistically significant difference) for the multimorbidity group than their peers without multimorbidity. The out of pocket expenditure (OOPE) on both drugs and laboratory investigations were found to be statistically significant at 5 and 10 percent level of significance, respectively. Furthermore, the percentage share of health care expenditure was found to be higher in women with multimorbidity being 39.5%, 8.0% and 31.6%, for medicine, consultation, and laboratory investigations, respectively [Table 4]. As presented, antenatal women with multimorbidity incurred significantly greater OOPE on medicine and laboratory investigations than their non-multimorbid counterparts (none or single morbidity).

Discussion

During the past few decades, many LMICs are experiencing colliding epidemics of chronic infectious, tropical and non-communicable diseases leading to growing number of population with multimorbidity [32, 33]. Alongside, an increasing prevalence of multiple chronic conditions in young females particularly maternal morbidities is a key health challenge in these settings [15, 16, 34]. Within LMICs, India contributes to major share of chronic conditions at the same time accounting for one quarter of maternal deaths globally [6, 35]. However, the exact burden of maternal multimorbidity is not yet well elucidated in India. Our study, exploratory in nature, intended to estimate the prevalence of multimorbidity among antenatal women in India using a specifically developed and validated tool (MAQ-ANC). A total of 127 pregnant women attending three ante-natal clinics (under public health care system) were interviewed. It may be noted that with most of the available literature on multimorbidity confined to older adults, it is challenging to compare our findings with similar studies.

The prevalence of a single morbidity was around 78%, whereas 15% of the interviewed women reported multimorbidity. This is lower than our previous primary care based multimorbidity estimate with a prevalence of 28.3% [36]. One of the reasons could be the slim and younger age range (18–36 years) of our study participants; as early child bearing is commonly seen in India [37]. However, our observed multimorbidity prevalence in antenatal women is higher than a recent report based on National Family Health Survey (NFHS) 4, India where in the prevalence of multimorbidity was 3.5 % in the reproductive age-group [16]. There could be few explanations for our higher estimates. First, the physiologic changes of pregnancy can unmask some underlying chronic conditions [18]. Second, previous ANC encounters of the pregnant women, might have detected these conditions resulting in higher prevalence [38]. Third, NFHS had included a smaller number of chronic conditions thus leading to possible underestimation [39].

Similar to other studies, we observed multimorbidity increasing with age demonstrating a positive association [40]. Though most pregnant women were in younger age bracket, nonetheless, the subgroup with higher age and multimorbidity possess a much greater risk of pregnancy related complications and hence need special attention from the maternal health care providers [41]. No other variables excepting for socio-economic status (SES) emerged as a correlate for multimorbidity. This could primarily be attributed to the small size of 127 and narrow age range (18–36 years) of our study sample. Another reason could be the homogeneity in the characteristics of the respondents, since majority women were coming from vicinity of the respective antenatal clinics.

The association between multimorbidity and socio-economic status (SES), revealed interesting observations. Though the prevalence of single LTC was more in women of higher SES, but the prevalence of multimorbidity was found to be greater in the lower SES group (below poverty line) or deprived women. Traditionally, maternal health indicators have remained inextricably linked to social disparity and gender inequity [42]. Similarly, social deprivation and multimorbidity are interwoven as evident from accumulating literature [11]. These women constitute the most vulnerable group with the triple burden of deprivation, multimorbidity and a compromised physiological state of pregnancy. Health systems must ensure care equity for this fragile population through ample financial as well as health protection measures.

In parallel with increasing number of chronic conditions, the health care utilization is seen to increase [5, 29]. We too observed, all three indicators of healthcare utilization (medical consultation, consumption of medicines, and continuation of medicines) to be significantly higher in women with multimorbidity. The added number of health care consultations for chronic conditions along with their scheduled ANC visits could be challenging [23]. Entwined screening and management for these LTCs with routine ANC could help reduce the frequency of health care visits. Among those with multimorbidity, tribal females and homemakers had significantly lower health care utilization vis-à-vis their non-tribal and employed counterparts. Health care utilization is influenced by care seeking behaviors and access to care which in turn are modulated by a woman’s health literacy and socio-economic status [43, 44]. Accordingly, gender inequity and social disparity through women empowerment and health literacy appears to be a sustainable strategy.

Overall, health care expenditure was significantly higher in women of multimorbidity group when compared to none or single morbidity. This is in congruence with reports of positive association between out of pocket expenditure (OOPE) and multimorbidity in LMIC settings [5, 29]. Further, the multimorbid women incurred higher OOPE on medicines and laboratory tests as compared to their non-multimorbidity counterparts. Interestingly, physician consultation costs did not reveal any significant difference between the two groups. While the consultation visits are similar for women in both the groups, due to the coexistent multiple conditions, additional costs for medicines and laboratory investigations are incurred, thus tilting the OOPE. In other words, it is the 'multimorbidity' per se which increases the health care resource use [29]. Moreover, the percent share of OOPE incurred on medicine, consultation and laboratory was greater than 10 percent, and therefore can be treated as catastrophic [45]. Various studies have demonstrated the catastrophic impacts of high OOPE among individuals with NCDs where nearly half of the OOPE was related to the purchase of medicines, diagnostics, and medical appliances [5, 46]. The high financial burden associated with multimorbidity might push these pregnant women's households into impoverishment. Despite various public funded maternal welfare schemes, such high OOPE by pregnant women is a matter of policy concern and warrants adequate financial protection measures incorporated into the current MCH program [38].

We could not find any emerging patterns within multimorbidity. This may be attributed to the exploratory nature of the study comprising a small sample size. Anemia, hypertension, acid peptic diseases and thyroid were the leading chronic conditions. Due to the frequency of health encounters, it is possible that they might have been diagnosed during pregnancy and since we did not elicit the chronology of LTCs; it is difficult to ascertain whether they were recently diagnosed or had been in the past. In our study, self-reported anemia was not graded according to its severity and hence, could result in higher prevalence [47]. Similarly, our prevalence estimates of hypertension (16.4%) was higher than reported in other studies (10%) [48]. The routine screening for hypertension and hyperglycemia in Antenatal Care under the National MCH program could have led to an increased detection [23].

We found a significant difference in functional limitation between multimorbidity and non-multimorbid group. Functional limitation is an acknowledged indicator of severity of a chronic condition which cumulatively leads to inferior quality of life and self-perceived health [19]. While designing chronic care model for antenatal women, conditions that have greater impact on functional limitation need to be prioritized for intervention [3]. Self-rated health (SRH) is considered as a proxy estimate of health-related quality of life [30]. Though we did not find any statistically significant difference in SRH, the overall health was rated low by all women either having single LTC or multimorbidity which is concerning. Pregnancy should be a psychologically sound state for better fetal and maternal outcomes and the low perception of one's health is a matter of concern. A woman during pregnancy experiences certain psychological changes as well thus requiring mental health care [49]. One option could be the incorporation of emotional and mental wellbeing into ANC by health workers or nurses in community- based settings or through group-sessions [50].

The prevalence of multimorbidity during pregnancy is a reliable marker for future multimorbidity in both mother and child. Offspring born to mothers with multimorbidity have substantially increased odds of developing chronic diseases in later life. Considering its effect on pregnancy outcomes and post-pregnancy period, maternal multimorbidity should be recognized as an issue significant public health concern. Both NCD prevention and MCH programs need to harmonize their service delivery towards a collaborative woman-centric care model by integrating chronic disease management with antenatal care. Pregnancy may be viewed as a window of opportunity for screening multimorbidity and its risk factors, by harnessing on the existing community level platforms like Village Health and Nutrition Days (VHND) [51]. Lastly, the emerging burden of chronic diseases entwined with prevailing compromised maternal health situation defines the need for current maternal, child and adolescent health program in India to renew its focus and infuse stronger financial protection measures [52].

Although limited to a particular geographic region, our study provides first of its kind epidemiological insights, into the hitherto unexplored dimension of gestational multimorbidity. Since the data presented is of five years old, the current magnitude may be higher than our estimated prevalence. Further research, preferably longitudinal, should therefore assess the magnitude of multimorbidity and investigate its short, intermediate and long-term health outcomes in this special population group. Establishing community-based young women cohorts would enable better understanding of directionality and strength of associations between different types of chronic conditions and the clustering effect within maternal multimorbidity.

Strengths And Limitations

The key strength of our study is being the first to report the prevalence and correlates of multimorbidity among pregnant women in India. Using a specifically developed and validated questionnaire (MAQ-ANC) is another strong point. One limitation is that the precision of the study was compromised due to its small sample size and hence, strong associations could not be elucidated. However, the random inclusion of ante-natal clinics could be considered as a representative indicator. Further, those who did not avail of public ANC services, could not be included in our study.

Conclusions

Our study reports multimorbidity to be quite prevalent in pregnant women attending routine antenatal care, associated with increased health care utilization and expenditure. The observed burden combined with greater health care resource use, offers a compelling case for recognizing gestational multimorbidity as an issue of concern and calls for catalyzing horizontal amalgamation between NCD prevention and reproductive health promotion programs. We suggest investing in innovative strategies and dedicated financing mechanism for sustainable improvements in women’s, children’s, and adolescents’ health. Future research, in the form of community based adolescent girl cohort is merited to better understand the epidemiology, trajectory and impact of multimorbidity among reproductive age women across varied regions and context.

Abbreviations

ANC-Antenatal Care; BPL- Below Poverty Line, LMIC- Low- and Middle-Income Countries; MAQ-PC-Multimorbidity assessment questionnaire for primary care; MAQ-ANC - Multimorbidity assessment questionnaire for antenatal care, NCDs-Non-communicable diseases; OOPE- Out of Pocket Expenditure; UHC- Universal Health Coverage; USD – United States Dollar; OOPE – Out of Pocket Expenditure, LTCs-Long Term Conditions , VHND – Village Health and Nutrition Day, NFHS - National Family Health Survey, HRQoL- Health Related Quality of Life, MCH – Maternal and Child Health, SRH –Self Rated Health, INR-Indian Rupees; SDG – Sustainable Development Goals; ST- Scheduled Tribe, SC- Scheduled Caste, OBC-Other Backward Class, APL- Above Poverty Line, JSY – Janani Suraksha Yojna; RSBY – Rastriya Swasthya Bima Yojna; APD – Acid Peptic Disease; ANM- Auxiliary Nursing Midwife

Declarations

Ethics approval and consent to participate

The study was approved by the institutional ethical committee of the Indian Institute of Public Health-Bhubaneswar (IEC No: IIPHB-IEC-2015/018). Necessary permission was obtained from the medical officer in charge of concerned clinics. Written informed consent was obtained from all participants prior to data collection. The respondents were briefed about the study's objective, potential benefits and harms. They were also informed that participation in the study was purely voluntary and that they could withdraw from the interview process at any time. Each participant was allotted a unique identification code to maintain anonymity. The study was carried out in a manner that ensured the privacy and data confidentiality at every stage.

Consent for publication

Not applicable, as no data is reported on an individual basis.

Availability of data and materials

The datasets used and/or analyzed during the current study are with the corresponding author and can be made available on reasonable request and approval from State Health & Family Welfare Department, Government of Odisha.

Competing interests

The authors declare they have no competing interests

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Authors' contributions

SP1, SP2 and SS conceptualized the study. SP1, PM, SS designed the study's tool. SS and SP2 were involved in the data collection. SS, PP, and PM analyzed the data. SS and PP wrote the first draft which was further refined by SP1, SP2, and PM. All were involved in writing and reviewing the manuscript. All authors have gone through the manuscript and approved the final version.

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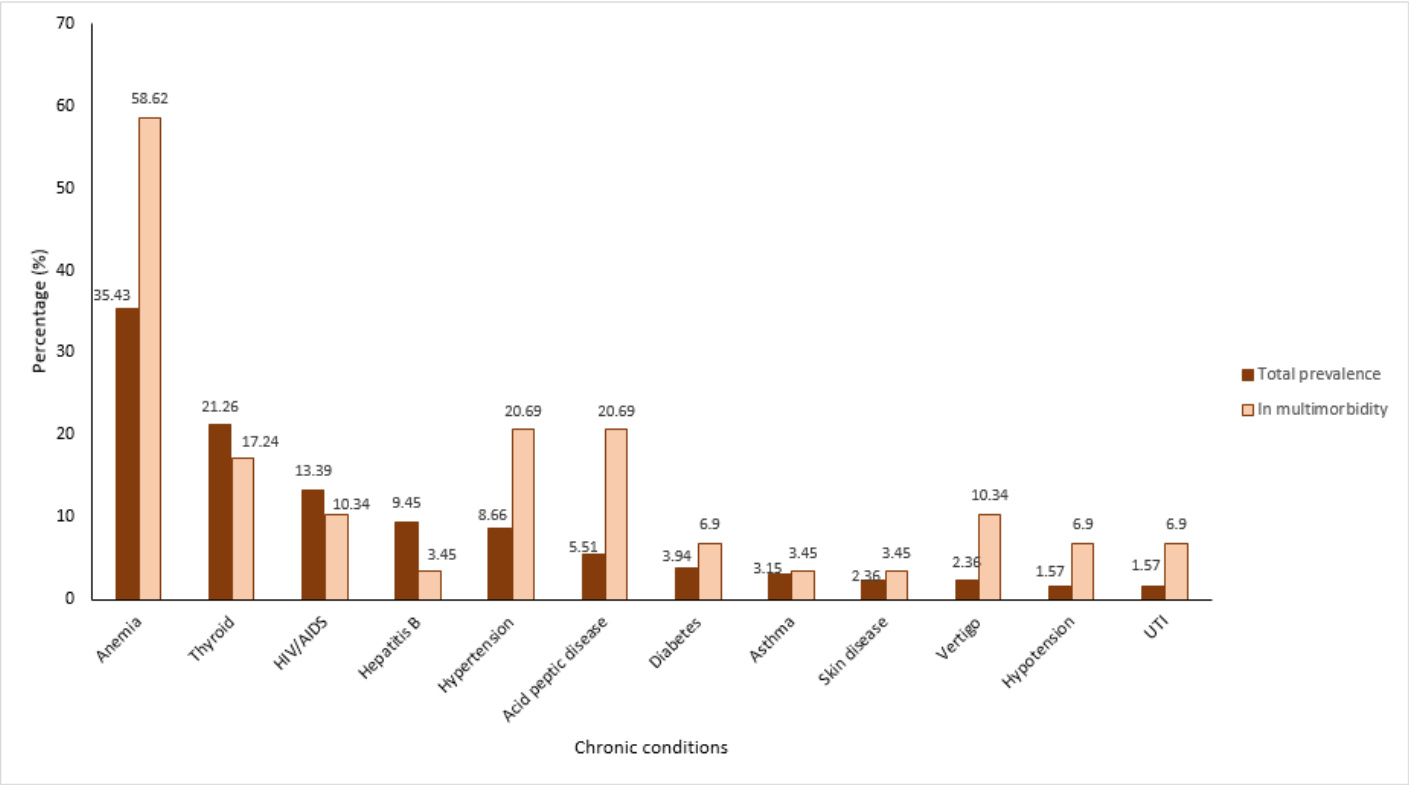
Figures



UTI: Urinary Tract Infection

Figure 1

Prevalence of leading chronic conditions overall and within multimorbidity (N=127)

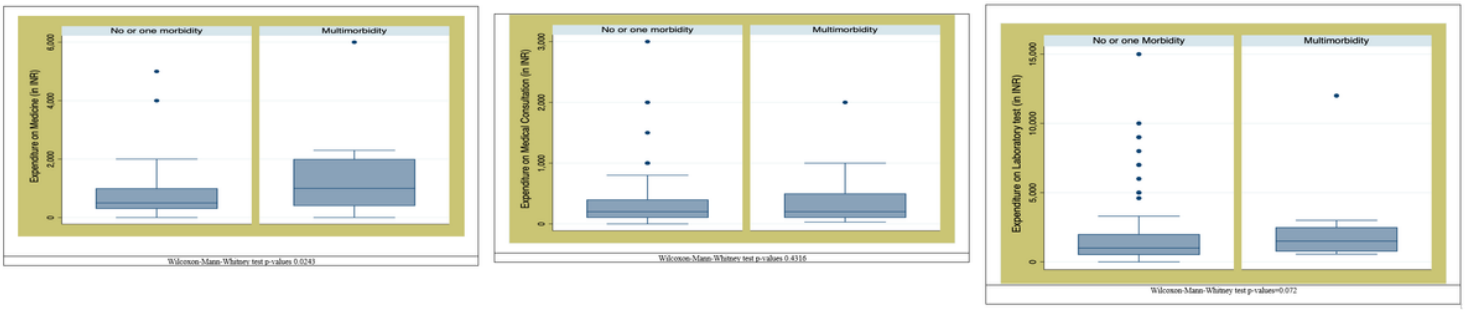


Figure 2

Healthcare expenditure in multimorbidity

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- MultimorbidityAssessmentQuestionnaireMAQPC.pdf