ORIGINAL RESEARCH – QUANTITATIVE

Functional status of women with and without severe maternal morbidity: A prospective cohort study☆

Mohd Noor Norhayati [a,*], Nik Hussain Nik Hazlina [a], Abd. Aziz Aniza [b]

[a] Women's Health Development Unit, School of Medical Sciences, Universiti Sains Malaysia, Health Campus, Kota Bharu, Kelantan, Malaysia
[b] Faculty of Medicine, Health Campus, Universiti Sultan Zainal Abidin, Kuala Terengganu, Terengganu, Malaysia

ABSTRACT

Background: Little is known regarding the impact on maternal functional status in women who have survived severe obstetric complications.
Objective: To compare the maternal functional status score between women with and without severe morbidity at one month and six months postpartum in Kelantan, Malaysia.
Methods: A prospective cohort study design was applied at two tertiary referral hospitals over a six-month period. The study population included all postpartum women who gave birth in 2014. Postpartum women with severe maternal morbidity and without severe maternal morbidity were selected as the exposed and non-exposed group, respectively. Functional ability based on the Inventory of Functional Status after Childbirth was used as the main outcome measure. Repeated measure analysis of variance was performed.
Results: A total of 145 and 187 women with and without severe maternal morbidity, respectively, were measured. There were significant differences in Inventory of Functional Status after Childbirth score changes ($P < 0.001$) between women with and without severe maternal morbidity at one month and at six months. Functional ability score of women with severe maternal morbidity was lower at one month postpartum ($P = 0.001$). The most affected domain was infant care ($P = 0.002$).
Conclusions: Healthcare providers are recommended to assess the short-term functional ability of severe morbid mother in addition to existing routine physical examination. Provision of physical support from spouse and family of the high risk mothers particularly on infant care during their early postpartum period is crucial to optimise health and minimise the negative health outcomes.

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Summary of relevance:

Problem

The immediate and long-term impact on maternal functional status in women who survived severe maternal complications is understudied.

What is already known

The WHO has recently developed a standard definition and internationally accepted identification criteria for severe maternal morbidity.

What this paper adds

Evidence that severe morbid conditions predicted impairment of immediate maternal functional ability suggest that assessment of functional ability may be useful in postpartum health care management.

1. Introduction

Recovery following childbirth has often been viewed in relation to physiological changes that occur within the woman's body; little emphasis has been placed on the functional status of the mother.

Motherhood, one of many roles in a woman's lifetime, is the most significant, time-consuming and demanding. Unlike physiological recovery, return to full status following childbirth takes longer that six weeks, and women who experienced complications during childbirth usually require a longer period to recover. Mothers frequently act as the primary care givers in childcare apart from other household, self-care, professional and social activities.

Functional status is of broad interest to health care providers and the public as it reflects productivity and health.[1] Functional status describes the actual performance of daily living activities,[2] and in the case of postpartum women, an additional domain, infant care, is considered. As such, functional status after childbirth is defined as mother's readiness to assume infant care responsibilities as well as resuming self-care, household, social, community and occupational activities.[3]

A review on functional status after childbirth reported on the influencing factors, such as social support and anxiety, changes in functional status over time and qualitative experience of new mothers. Additionally, number of children in the household, maternal age, race, social support, and physical and mental health may either assist or impede recovery during the first six months following childbirth. In view of the suboptimal return to full functional status following childbirth, reconsideration of the traditional six weeks recovery period was suggested.[4]

Maternal morbidity refers to a continuum that begins with the occurrence of complications occurring during pregnancy, childbirth and puerperium and ends with recovery or death.[5] Severe maternal morbidity is defined as 'potentially life-threatening conditions during pregnancy, childbirth or after termination of pregnancy from which maternal near miss cases would emerge', whereas, maternal near miss is defined as a 'woman who nearly died but survived a complication that occurred during pregnancy, childbirth or within 42 days after termination of pregnancy'.[6,7] This study will identify the immediate and long-term impact of women who survived severe maternal complications. Women with severe maternal morbidities may possibly be unprepared to address the complications that could affect their quality of life.

The current body of published work has provided limited information on maternal functional status in developed and developing countries. However, no study has reported the impact of severe maternal morbidity on maternal functional status. Therefore, such a finding would contribute to clarifying some of the gaps in current knowledge. The objective of this study was to compare the maternal functional status score between women with and without severe morbidity at one month and six months postpartum.

2. Methods

A prospective cohort study design was applied to two tertiary referral hospitals over a six-month period. The study population included all postpartum women aged 18 and older who delivered in 2014. The exposure factor was the occurrence of severe maternal morbidity. The two cohorts of postpartum women with and without severe maternal morbidity exposure were compared and followed to determine what proportion of each group developed immediate and long-term consequences. The immediate and long-term postpartum periods[8,9] were defined as one month and six months following childbirth. Postpartum women with and without severe maternal morbidity who fulfilled the inclusion and exclusion criteria were selected as the exposed and non-exposed groups, respectively. The study excluded women at less than 22 weeks of gestation, more than 42 days after the termination of pregnancy, with personal or family histories of diagnosed psychiatric disorders. Non-Malaysian citizens were excluded because of its minority group and the possibility of the presence of cultural variation. Mothers less than 18 years were excluded due to ethical issues related to informed consent. For each woman with severe maternal morbidity identified, one woman without severe maternal morbidity with a similar mode of childbirth (vaginal or caesarean section) was selected in the same facility.

Postpartum women with severe morbidity who fulfilled the inclusion and exclusion criteria were approached. Because of the follow-up nature of this study and the possibility of a high refusal for follow-up, consecutive sampling was applied for the women with severe maternal morbidity group. It is worth noting that significant proportions (26–43.6%) of severe maternal morbidities were observed to deliver via caesarean section in previous studies.[10,11] Therefore, the researchers decided that it was important to have an approximate similar mode of childbirth between women with and without severe maternal morbidity groups for a valid comparison of groups because caesarean section was related to poorer physical functioning.[12] Hence, for each woman with severe maternal morbidity identified, one woman without severe maternal morbidity with a similar mode of childbirth (vaginal or caesarean section) was selected in the same facility.

Sample size calculation was done by comparing two means using the Power and Sample Size Calculation software version 3.0.43 (Microsoft Corp., 2012). Taking the alpha of 0.05, power of 80%, standard deviation of 4.2[13] and detactable difference of 1.5, the minimum required sample size was 124. However, after considering a non-response rate of 30% in telephone-based survey[14,15] and six months follow-up,[16] the calculated sample size was 162 per group. Computer-based simple random sampling from a predefined estimate of daily vaginal and caesarean deliveries was applied for the women without severe maternal morbidity group.

Hospital- and home-based medical records were reviewed to identify the severe maternal morbidity and maternal near miss criteria and to retrieve patients' information. The extracted information included the sociodemographic characteristics (age, race, marital status, place of residence, education level, employment status, household income), current obstetric history (parity, booking, multiple pregnancies, antenatal care, period of gestation, mode of childbirth) and past obstetric history (history of caesarean section, pregnancy complications). The identification of the women with severe maternal morbidity was performed as per WHO criteria for severe maternal morbidity on the four major groups of haemorrhagic disorders, hypertensive disorders, other systemic disorders and severe management indicators (Table 1).[7] At one month and six months following childbirth, study participants were contacted to complete a structured telephone interview that incorporated the Inventory of Functional Status after Childbirth (IFSAC) and the MOS Social Support Survey.

Maternal functional status after childbirth is defined as mother's readiness to assume infant care responsibilities as well as resuming self-care, household, social, community and occupational activities.[3] The most widely used instrument to assess functional status is IFSAC. The original English version of IFSAC consists of 36 items and five subscales (infant care, self-care, household activities, social and community activities, occupational activities) presented on a 4-point scale. The mean IFSAC scores range from 1 to 4[3] and the Cronbach's alpha ranged from 0.79 to 0.81.[4] Not all respondents will engage in all activities; therefore, a mean score for each individual participant is calculated for each scale based on the items that are applicable to their individual situations. This system's approach means that scores are not inadvertently low simply because women did not engage in all of the activities. Hence, the mean scores range from 1 to 4 with higher scores indicating better functional status.[3]

In this study, the Malay version of IFSAC questionnaire based on 18 items was used. It was translated from the English version and

Table 1
World Health Organization severe maternal morbidity conditions.

Haemorrhagic disorders
Abruptio placentae
Placenta accrete/increta/percreta
Ectopic pregnancy
Postpartum haemorrhage
Ruptured uterus
Hypertensive disorders
Severe pre-eclampsia
Eclampsia
Severe hypertension
Hypertensive encephalopathy
HELLP syndrome
Other systemic disorders
Endometritis
Pulmonary oedema
Respiratory failure
Seizures
Sepsis
Shock
Thrombocytopenia <100,000
Thyroid crisis
Severe management indicators
Blood transfusion
Central venous access
Hysterectomy
Intensive care unit admission
Prolonged hospital stay (>7 postpartum days)
Intubation not related to anaesthetic procedure
Return to operating room
Laparotomy (includes hysterectomy, excludes caesarean section)

HELLP, haemolysis, elevated liver enzymes, low platelet count.

validated among 108 postpartum mothers with caesarean section during the one month postpartum follow-up at an obstetrics and gynaecology clinic in a tertiary teaching hospital. The final model consists of four constructs, namely infant care responsibilities, self-care activities, household activities, social and community activities with internal consistency reliability of 0.907, 0.813, 0.920 and 0.626, respectively. The confirmatory factor solution showed that the four constructs with 18 items demonstrated acceptable factor loadings, domain to domain correlation and good fit. The detail assessment of the reliability and validity process of the Malay version were explained elsewhere.[17] The occupation construct was identified to not be relevant in this culture setting because generally, Malaysian mothers did not start working within a month or 40 days postpartum as they were still in the confinement period.[17]

The Medical Outcome Study Social Support Survey measures perceived availability of functional social support[18] and has also been used in postpartum mothers.[19,20] It rates items on a 5-point scale ranging from 1 (none of the time) to 5 (all of the time), with higher scores indicating more support.[18] The Malay version of the questionnaire demonstrated acceptable factor loadings, domain-to-domain correlation and best fit. The internal consistency reliability of the four constructs ranged from 0.616 to 0.902.[21]

The data were entered and analysed using IBM SPSS Statistics version 22.0 (SPSS Inc., 2013). Analysis of variance (ANOVA) was used for comparing the outcome scores between women with and without severe maternal morbidity. RM ANOVA was used to compare the outcome scores between women with and without severe maternal morbidity at one month and six months postpartum while controlling for social support.[12] Values of descriptive means were obtained for each group and values of estimated marginal means (EMM) while controlling for the confounders were obtained for group-time interaction effect. Findings were presented with descriptive mean and EMM, 95% CI and P value. The level of significance was set at 0.05 with two tails.

The study protocol was approved by the Human Research Ethics Committee, Universiti Sains Malaysia (USM/PPSP®/2012/JKP-62[62.3(4)]) on 6th November 2012 and Medical Research Ethics Committee, Ministry of Health (KKM/NIHSEC/800-2/2/2/Jld 2 P13-215) on 25th September 2015. Confidentiality was ensured by allocating each woman a study reference number at the time of recruitment and written informed consent was obtained before hospital discharge.

3. Results

Of 395 women with severe maternal morbidity, 48 were excluded as they were at less than 22 weeks of gestation ($n = 32$), were non-Malaysian citizens ($n = 10$), less than 18 years old ($n = 3$), had a history of diagnosed psychiatric disorder ($n = 1$) and a family history of psychiatric disorder ($n = 3$). Of the 347 eligible women with severe maternal morbidity, 129 refused to partici-pate and an additional 55 women agreed to participate but were not able to be contacted (because nobody answered the telephone on more than three attempts or telephone services had been disconnected) at one month. Accordingly, 347 women without severe maternal morbidity were identified. However, 104 women refused participation, and four women were not contactable. Oversampling was conducted earlier in order to overcome the possibility of unexpected dropouts and to achieve the calculated sample size. All of the remaining 163 women with severe maternal morbidity and 239 women without severe maternal morbidity were recruited into the study and were interviewed at one month postpartum.

At six months postpartum, 145 women with severe maternal morbidity and 187 women without severe maternal morbidity were interviewed and successfully provide complete information. The response rate for samples with completed data over the six months study period compared with the number of all eligible women with severe maternal morbidity was 41.8% (145/347) and was 53.9% (187/347) of all women without severe maternal morbidity.

Therefore, in order to determine the changes in the physical and mental health scores of women at one month and six months surveys, only data obtained from women who responded to both of the surveys were analysed. Thus, the final samples consisted of 145 exposures and 187 non-exposures. The obtained samples were considered adequate for the calculated sample size ($n = 162$ per group) [3.3.4(f)] and fulfilled the pre-determined ratio between women without severe maternal morbidity and women with severe maternal morbidity groups, which was approximately one.

Non-response bias analysis based on sociodemographic profile was performed to assess the differences in characteristics between respondents and non-respondents [332 (47.8%) vs. 362 (52.2%)] in order to justify the representativeness of the present participants used for analysis. In general, the sociodemographic character-istics of non-respondents were almost similar to those of the respondents. Age ($P = 0.885$), parity ($P = 0.602$), education level ($P = 0.291$), occupation ($P = 0.671$) and marital status ($P = 0.359$) did not differ significantly between the respondents and non-respondents. The sociodemographic characteristics and obstetric history of women with and without severe maternal morbidity are shown in Table 2.

3.1. Univariable analysis of IFSAC subscales

The IFSAC overall mean score for women with severe maternal morbidity was normally distributed ranging from 1.50 to 3.33 with a mean (SD) of 2.2 (0.29) at one month and ranging from 1.94 to 3.50 with a mean (SD) of 3.1 (0.20) at six months. The IFSAC overall mean score for women without severe maternal morbidity was

Table 2
Sociodemographic characteristics and obstetric history of women with and without severe maternal morbidity.

Variables	SMM ($n = 145$)		Non-SMM ($n = 187$)	
	Mean (SD[a])	n (%)	Mean (SD[a])	n (%)
Sociodemographic characteristics				
Age (year)	31.6 (6.26)		29.2 (5.65)	
Household income (RM/month)	2405.2 (1892.06)		2321.1 (2066.54)	
Education level				
Nil and Primary		7 (4.8)		5 (2.7)
Secondary		87 (60.0)		104 (55.6)
Tertiary		51 (35.2)		78 (41.7)
Occupation				
Unemployed		74 (51.0)		99 (52.9)
Self-employed		8 (5.5)		19 (10.2)
Implementory		41(28.3)		42 (22.5)
Professional		22 (15.2)		27 (14.4)
Past and present obstetric history				
Parity	3.1 (2.35)		2.7 (1.78)	
Hospital stay (day)	5.9 (3.79)		3.6 (2.23)	
Period of gestation (week)	37.6 (2.72)		38.8 (1.77)	
Booking				
Early (≤12 weeks)		88 (60.7)		114 (61.0)
Late (>12 weeks)		57 (39.3)		73 (39.0)
Past pregnancy complications				
Absent		105 (72.4)		150 (80.2)
Present		40 (27.6)		37 (19.8)
Period of gestation				
Term (≥37 weeks)		110 (75.9)		174 (93.0)
Preterm (<37 weeks)		35 (24.1)		13 (7.0)

SMM, severe maternal morbidity; RM, ringgit Malaysia.
[a] Standard deviation.

normally distributed, ranging from 1.67 to 3.39 with a mean (SD) of 2.3 (0.27) at one month and ranging from 2.28 to 3.94 with a mean (SD) of 3.1 (0.20) at six months. ANOVA analysis showed a significant difference in IFSAC score between women with and without severe maternal morbidity at one month ($P = 0.012$) but not at six months ($P = 0.746$).

The highest mean scores for IFSAC subscales at one month were in the area of infant care and self-care. At six months, household activities had the highest score followed by self-care. The lowest mean scores for functional status at both one month and six months were in the area of social and community activities. An increase in the overall mean for IFSAC was observed from one month to six months with a difference of 0.8–0.9 scores for both groups (Table 3).

3.2. RM ANOVA in assessing IFSAC score

The group-time interaction of RM ANOVA showed a marginally insignificant difference ($P = 0.053$) in IFSAC score changes between women with and without severe maternal morbidity ($n = 332$) at one month [EMM (95% CI): 2.2 (2.15, 2.25) vs. 2.3 (2.24, 2.32)] and

at six months [EMM (95% CI): 3.1 (3.07, 3.14) vs. 3.1 (3.09, 3.15)] after adjusting for social support. At the one month follow-up, the maternal functional status as indicated by the mean IFSAC score was slightly poorer for women with severe maternal morbidity compared to women without severe maternal morbidity. However, the group effect of RM ANOVA between women with and without severe maternal morbidity at both time levels showed a significant difference in the mean IFSAC score [mean (95% CI): 2.6 (2.62, 2.69) vs. 2.7 (2.67, 2.73); $P = 0.029$].

The residual plots showed that the overall model fitness was not met. The equal variance assumption was satisfied. The normality of standardised residuals was appropriate. The variable functional form for MOS social support score was appropriate. There were several outliers when plotting standardised residuals against the predicted value. The list of 11 outliers was identified. However, the changes in F statistic (12.72) changed the significance level ($P < 0.001$) after removal of the outliers. Therefore, the outliers were removed from the model.

Following the removal of outliers, the analysis was performed again, resulting in Model 2. In this model, ANOVA analysis showed a significant difference in IFSAC score between women with and

Table 3
IFSAC subscale-based description of maternal functional ability.

IFSAC subscales	One month			Six months		
	SMM ($n = 145$)	Non-SMM ($n = 187$)	P value[a]	SMM ($n = 145$)	Non-SMM ($n = 187$)	P value[a]
	Mean (SD[b])	Mean (SD[b])		Mean (SD[b])	Mean (SD[b])	
Household	1.5 (0.53)	1.6 (0.47)	0.112	3.6 (0.29)	3.6 (0.24)	0.423
Social	1.0 (0.06)	1.0 (0.16)	0.394	1.3 (0.35)	1.3 (0.44)	0.785
Infant care	3.1 (0.48)	3.2 (0.38)	0.002	3.0 (0.63)	3.0 (0.43)	0.660
Self-care	2.9 (0.26)	2.9 (0.32)	0.103	3.5 (0.28)	3.4 (0.45)	0.115
Overall IFSAC	2.2 (0.29)	2.3 (0.27)	0.012	3.1 (0.20)	3.1 (0.20)	0.746

IFSAC, Inventory of Functional Status after Childbirth; SMM, severe maternal morbidity.
[a] Analysis of variance.
[b] Standard deviation.

Table 4
Comparison of maternal functional ability between women with and without severe maternal morbidity (Model 2).

Groups	n	Desc Mean[a] (SD[b])		EMM[c] (95% CI[d])		F stat[e] (df[f])	P value[g]
		One month	Six months	One month	Six months		
SMM	139	2.2 (0.24)	3.1 (0.17)	2.2 (2.14, 2.22)	3.1 (3.11, 3.17)	12.51 (1, 318)	<0.001
Non-SMM	182	2.3 (0.25)	3.1 (0.18)	2.3 (2.24, 2.31)	3.1 (3.09, 3.14)		

SMM, severe maternal morbidity.
  [a] Descriptive mean.
  [b] Standard deviation.
  [c] Estimated marginal mean.
  [d] Confidence interval.
  [e] F statistic.
  [f] Degree of freedom.
  [g] Group-time interaction of repeated measure analysis of variance. Adjusted for social support.

without severe maternal morbidity at one month ($P = 0.002$) but not at six months ($P = 0.244$). The group-time interaction of RM ANOVA showed a significant difference in IFSAC score changes ($P < 0.001$) between women with and without severe maternal morbidity ($n = 321$) at one month [EMM (95% CI): 2.2 (2.14, 2.22) vs. 2.3 (2.24, 2.31)] and at six months [EMM (95% CI): 3.1 (3.11, 3.17) vs. 3.1 (3.09, 3.14)] after adjusting for social support (Table 4). At the one month follow-up, the maternal functional status, as indicated by the mean IFSAC score, was slightly poorer for women with severe maternal morbidity compared to women without severe maternal morbidity. The group effect between women with and without severe maternal morbidity at both time levels showed a marginal insignificant difference in the mean IFSAC score [mean (95% CI): 2.7 (2.63, 2.69) vs. 2.7 (2.67, 2.72); $P = 0.051$]. Because the group-time interaction was significant, subsequent analysis with ANCOVA was further performed in order to confirm the difference between the two groups by adjusting for social support.

3.3. Final model and interpretation

The final model for the difference in maternal functional ability between women with and without severe maternal morbidity at one month and six months postpartum was based on Model 2 ($n = 321$). The group-time interaction of RM ANOVA showed a significant difference in IFSAC score changes ($P < 0.001$) between women with and without severe maternal morbidity at one month and six months postpartum after adjusting for social support (Table 4). Based on the EMM result and plot, women with severe maternal morbidity had lower maternal functional ability compared to women without severe maternal morbidity.

4. Discussion

In the present study, we found that women who experienced severe maternal morbidity had lower overall functional ability at one month postpartum compared to women without severe maternal morbidity, but the difference disappeared six months following childbirth. We have considered social support in this relationship, as suggested in the literature, that the availability of support provisions might reduce the need to resume postpartum women's activities. To our knowledge, no other studies have investigated the relationship between maternal morbidity status and functional ability. Hence, this study is presumably the first to suggest that severe maternal morbidity associated impaired maternal functional ability during the postpartum period.

The descriptive findings of the current study showed that infant care responsibilities, apart from being significantly affected with severe maternal conditions at one month postpartum, have attained the highest score compared to the other subdomains. This indicated that despite their illness, mothers were especially concerned about infant care, and it demands more effort above and beyond the multiple demands of household, social and personal activities. Women with severe maternal morbidity tried to provide normal infant care despite their morbidities, but the level of care provided was lower compared to women without severe maternal morbidity.

In the present study, in comparing the mean within groups over time, an increase in maternal functional ability was observed in subdomains of household, social and community and self-care activities from one month to six months postpartum. This indicated the resumption of past role-related activities to some extent by all the mothers; severe morbidity conditions did not adversely affect multiple roles at six months. Gradual resumption of the activities reflects the normal adjustments of the mothers.

Although the present study reported small differences in the overall functional ability scores, they were statistically significant. The confidence intervals were narrow, and the researchers were confident that the differences in functional ability scores were also clinically significant. Moreover, no studies have reported the minimum score for a significant clinical difference in functional ability using IFSAC. However, the optimum overall full functional status was not achieved for most women six months following childbirth. This pattern may be by choice as women may choose to be less engaged in social and community activities compared to others. Mothers not only resumed the previous activities but also attended to the demands of infant care responsibilities.

Based on the minimum–maximum score range, unlike women without severe maternal morbidity, none of the women with severe maternal morbidity achieved full functional status by six months following childbirth in the present study. Two studies have reported on the functional ability status among postpartum women from childbirth until one year postpartum.[22,23]

A prospective cohort study ($n = 337$) by Filippi et al.,[22] showed that women with severe obstetric complications (anaemia, hypertension, haemorrhage, dystocia and infection) generally reported feeling worse than women with uncomplicated deliveries. Self-reported health conditions include subjective elements such as fatigue, exhaustion and deterioration of strength or reproductive organs. These conditions peaked at different times in different groups of women. For example, women with early pregnancy loss reported perceived health problems at six and 12 months, suggesting a delayed onset of the health problems. However, no significant difference was found between women with severe obstetric complications and women with uncomplicated deliveries in performing household tasks. The insignificance was possibly because the women ignored the perceived difficulties of doing them or did not complaining of having to do them. It was postulated that the different constellations of health problems may affect women at different times following severe obstetric complications.[22]

Webb et al.,[23] reported that health problems such as fatigue, headaches, backache, abdominal and vaginal pain at nine to 12 months postpartum were to be consistently and significantly related to functional health status. This larger study (n = 1323) reported increased functional limitation with increased severity of health problems among the women. The significance was found with a simple functional health status assessment based on three questions on the ability of the women to work, care for their children and perform general household chores.[23]

In contrast, a study conducted by Hunker et al.,[12] showed that the non-significant findings could be attributed to the small sample size. During the early postpartum period, women with adverse birth events (n = 57), such as assisted birth, caesarean section and prolonged labour, showed no significant relationship with functional status two weeks following childbirth.[12]

Another fact that leads to reduced functional ability could be related to preterm babies. In the present study, approximately 24% of women with severe maternal morbidity had preterm babies compared to 7.0% of women without severe maternal morbidity. Mothers of preterm babies were reported to have higher levels of fatigue in the morning at six weeks postpartum; the level of fatigue declined as time progressed.[24] The fatigue was likely the result of higher physical demands for caring for preterm babies and fragmented sleep because preterm babies wake more frequently compared to term babies. Therefore, in the present study, maternal concern about infant care and the realities of care for preterm babies explained the lower significant difference in functional ability for the infant care subdomain. This, in turn, affects the overall functional ability among women with severe maternal morbidity.

4.1. Limitations

This is a hospital-based study; the setting is unavoidable because the criteria for severe maternal morbidity would require certain accuracy for identification that is unlikely to be confirmed in the community setting. Likewise, women without severe maternal morbidity who were in the non-exposure group were also selected from hospitals to ensure that these women were clinically without severe maternal morbidity criteria. This study involved two tertiary centres that account for more than half of the total deliveries in Kelantan. Simple random sampling for the selection of women without severe maternal morbidity was applied to overcome the non-probability sampling limitations in this study, which adds to its external validity.

The IFSAC was designed to assess maternal functional status. It measures the readiness of the mother to assume an infant care role and to resume the roles she had prior to birth. However, it does not assess the mother's feelings about such roles. This is important to functioning because natural reprioritizing may occur in a mother's life and a return to full functional status, as measured by the IFSAC, may be difficult.[25]

A high proportion of non-response was observed during the six month follow-up period. The overall refusal rate was 33.5%, and the drop-out rate was 18.3%. This is perhaps not surprising, given the high rates of refusal of up to 50.1% and drop-out of up to 43.7% in studies involving prospective design, telephone-based postpartum women.[26,27] The high proportion of non-response was anticipated by oversampling the exposures and non-exposures in order to achieve an adequate sample size. The high non-response rate may reflect a widespread problem on the perceived demand placed on the women's time. However, the non-response bias analysis revealed that the sociodemographic characteristics of non-respondents were very similar to those of the respondents.

The women that participated in this study were primarily those that could be recruited by phone. All eligible women provided their contact phone number during recruitment, but some were not contactable during the follow-ups because of disconnected telephone services and thus, were regarded as non-respondents.

4.2. Strengths

The present study had several methodological strengths. This is the first study that assessed the relationship between maternal morbidity status and maternal health outcomes from childbirth until six months postpartum. It offers the trends and differences in the maternal functional ability over the period prospectively. The data were collected twice at one month and six months following childbirth to represent the short-term and long-term consequences of severe maternal morbidity.

Post hoc power analysis indicated that the available sample was adequate to support the findings in comparing the differences between maternal morbidity status and maternal health outcomes. In the analysis, social support, which may confound the relationship between severe maternal morbidity and maternal health outcomes was considered based on the published literature and was included in the repeated measure analysis of variance and analysis of covariance models. We also employed advance statistical technique in the data analyses.

The IFSAC scale was the only instrument designed explicitly to measure maternal functional status during the postpartum period.[25] It offers information on the current activity level and the changes in maternal postpartum function. It is able to identify women with an increased workload following childbirth or women experiencing difficulty with infant care. It also offers the opportunity to investigate the extent of involvement in social activities involved.[28]

4.3. Clinical implications

The association of severe morbid conditions and impaired maternal functional ability suggest that assessment of functional ability at an early stage is useful in postpartum health care management. Being a mother often requires multitasking, but women should not be burdened to resume all the roles because they need support from families and health care providers, particularly during the critical early postpartum period. Therefore, quality contact with midwives, during the postpartum period is necessary in order to encourage women to share their problems and concerns regarding their general well-being. Appropriate nursing assistance or frequent home visits and health problem identification for both the mother and baby may minimise the negative health outcomes and optimise health.

5. Conclusion

The findings showed a significantly lower maternal functional ability in women with severe maternal morbidity compared to women without severe maternal morbidity at one month postpartum.

Authors' contribution

NMN contributed to the conception and design, acquisition, analysis and interpretation of data and drafted the manuscript. NHNH, AAA revised the manuscript critically for important intellectual content. All authors read and approved the final manuscript.

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