Background

Complications of pregnancy and childbirth remain the leading cause of death and disability for childbearing women in many low and middle income countries. A number of studies have associated the high maternal deaths in sub Saharan countries with many factors. Factors such as fertility rate (Hogan et al., 2010a; Muldoon et al., 2010) (a proxy for reproductive behaviour), educational attainment of the female population (Hogan et al., 2010b; McTavish, Moore, Harper, & Lynch, 2010), access to adequate maternal health facilities and personnel (e.g. skilled attendants) are all thought to be important determinants of maternal health (Adegoke, et al., 2012).

Although almost all cases of maternal deaths are avoidable, the severe socioeconomic deprivations that are prevalent in most countries are not conducive to prevent the causes of maternal deaths (Savadogo et al. 2014). For instance, Zambia's progress towards the MDG5 target of reducing maternal mortality has been insufficient as maternal mortality levels have remained high, from 729 per 100, 000 births in 2002 to 591 in 2007 and 483 maternal deaths per 100,000 live births in 2010 (CSO, 2012).

Given the insufficient decline of maternal mortality levels in Zambia, need for understanding what factors contributes to adverse maternal health outcomes is of critical importance for designing and refining future health interventions. Some studies have increasingly begun to include community level factors as determinants and employ multilevel models in their analyses. This development reflects a growing recognition of the importance of factors beyond the individual or household-level in understanding maternal health issues (Gabrysch & Oona M R Campbell 2009).

A number of studies from the developing world that employ multilevel models have found that community level variables are associated with variations in exposure to maternal mortality risks. Jat and colleagues, for instance, included community level factors in their analysis of the factors of skilled birth attendance use at delivery in Madhya Pradesh, India found that15% of variance in skilled birth attendance at delivery was accounted for by variation at community level (Jat, Ng, & San Sebastian, 2011). Also the study by Ononokpono and colleagues in Nigeria which included community level variables in the analysis of receipt of postpartum care found that significant variations in receiving postnatal care existed across communities (Ononokpono, et al, 2014). Specifically, Nigerian women's likelihood of receiving postnatal care was a function of where they resided. In this paper, we similarly employ a multilevel modeling strategy to analyze the role of community factors in exposure to maternal mortality risks in Zambia, advancing the literature further.

Methods

This study utilized secondary data from the weighted women recode of the 2007 Zambia Demographic and Health Survey (ZDHS). The survey data were downloaded from Measure DHS website after data use permission was guaranteed.

Study population

The population for this study was all women who were in the reproductive age group (15 to 49 years). The study subjects were women aged 15 to 49 years who gave at least one birth in the last 5 years preceding the 2007 Demographic and Health Survey.

Description of the variables

Dependent Variable

For this study fertility related high-risk pregnancy was measured through the reproductive status of the women. The outcome variable exposure to High Risky Pregnancy outcome (HRP) was developed by combining maternal age, parity and preceding birth interval. The three variables were chosen as composite descriptions of high risk pregnancy because research has found that pregnancy order are known to have a classic "J-shaped" relation with the maternal mortality ratio, with risks that are high for very young women, older women, women with no children, and those with many children, but are lower for women in between(McCarthy & Maine, 1992). Therefore, the outcome variable was defined as exposure to high risk pregnancy outcome if age was less than 19 years or older than 35 years of age or parity three or more and preceding birth interval less or equal to 24 months. The three variables are somehow interlinked as some studies have proved that certain reproductive characteristics like maternal age and number of previous births have all been previously shown to be associated with maternal mortality (Campbell & Graham, 2006; Laopaiboon et al., 2014; Ronsmans & Graham, 2006).

Explanatory variables

In order to study the influence of explanatory variables on fertility related high risk pregnancy, some predictor variables were selected based on previous studies that have indicated factors related to high risk pregnancy outcomes. Education and place of delivery (Fapohunda1, N, & Orobaton, 2014; Pfeiffer & Mwaipopo, 2013; Tunçalp et al., 2014) wealth status and place of residence (Prakash & Kumar, 2013) Distance (Gabrysch, et al., 2011; Ononokpono & Odimegwu, 2014) . The community was used to represent the primary sampling unit (PSU) of the data. Community impact on exposure to high risk pregnancy was assessed by considering the status of socioeconomic disadvantage of the community in which the participants were dwelling. The selected community level variables included region of residence, rural/urban residence, poverty levels, HIV risk assessment, community maternal level of education, maternal health awareness education, community use of health facility at delivery, and employment levels. PCA was applied to generate community socioeconomic disadvantage and subsequently classified into low, moderate and high. Communities with low socioeconomic disadvantage were the least deprived.

Data Analysis

STATA 12 software was used to analyze the data. Multilevel analysis was utilized to assess the independent effects of community factors and moderating effects on the association between individual variables and high risk pregnancy. A two-level multilevel logistic regression model was applied. Individuals (level 1) were nested within communities (level 2).

Preliminary Results

Figure 1 shows the percent distribution of inter class correlation and PCV in relation to exposure to high risk pregnancy. The ICC for model 1(null model) was 17%, model 2 (individual variables) was 14%, model 3 (community) was 13% and model 4(both interval and community) was 12%. Based on the variation partition coefficient (VPC) values, 17% of the total variance in exposure to high risk pregnancy was attributable to the differences across communities.

Figure 1: Percent Distribution of ICC and PCV

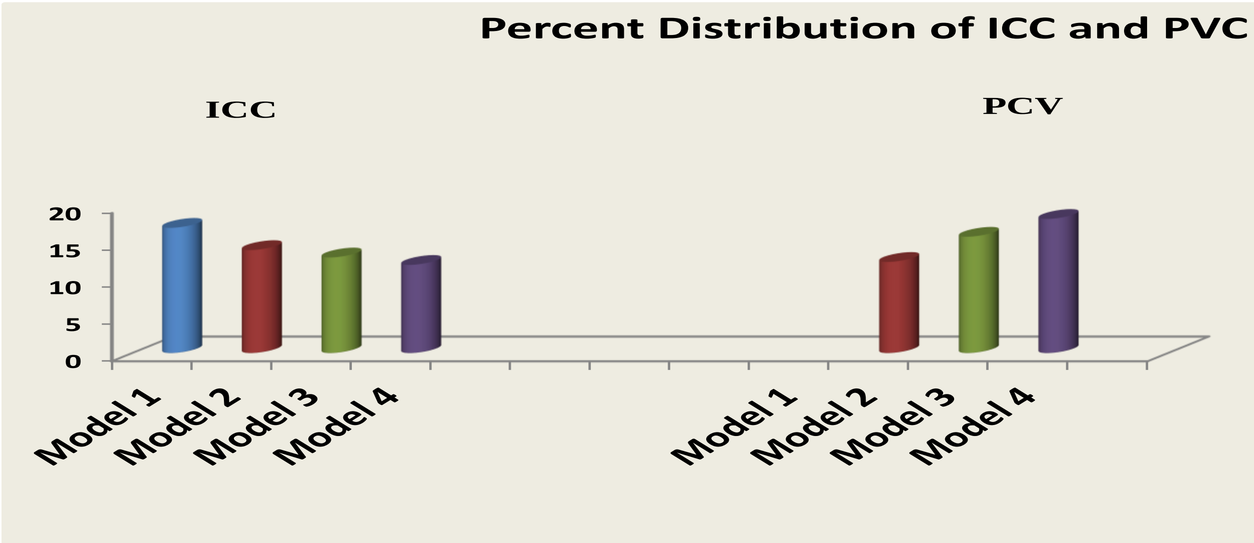

Figure 2 shows the plot of the estimated residuals for all 319 communities in the sample for the outcome variable. These residuals represent community departures from the overall average line predicted by the fixed parameters, this means that the majority of the communities do not differ significantly from the average line at the 5% level. However these communities whose residual shows the highest positive deviations have the largest effect on high risk pregnancy.

Figure 2: A Caterpillar Plot showing community variance (residual), standard error and ranking with 95% confidence interval for maternal mortality risks.