

Multiple Risk Factors During Pregnancy in South Africa: The Need for a Horizontal Approach to Perinatal Care

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Abstract South African children's long-term health and well-being is jeopardized during their mothers' pregnancies by the intersecting epidemics of HIV, alcohol use, low birth weight (LBW; <2,500 g) related to poor nutrition, and depressed mood. This research examines these overlapping risk factors among 1,145 pregnant Xhosa women living in 24 township neighborhoods in Cape Town, South Africa. Results revealed that 66 % of pregnant women experienced at least one risk factor. In descending order of prevalence, 37 % reported depressed mood, 29 % were HIV+, 25 % used alcohol prior to knowing that they were pregnant, and 15 % had a previous childbirth with a LBW infant. Approximately 27 % of women had more than one risk factor: depressed mood was significantly associated with alcohol use and LBW, with a trend to significance with HIV+. In addition, alcohol use was significantly related to HIV+. These results suggest the importance of intervening across multiple risks to maternal and child health, and particularly with depression and alcohol use, to positively impact multiple maternal and infant outcomes.

Keywords Prenatal care delivery · Pregnancy risk · South Africa

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Introduction

There is an urgent need to develop and implement evidence-based, cost-effective health intervention packages that can be delivered on a wide scale including reaching the poorest families, in order to achieve key positive health outcomes. Integration of programs would contribute to improved maternal and child health and also promote more efficient and effective use of resources. Many donor agencies (e.g., PEPFAR, World Bank) fund programs to address problems generated by a single risk factor. For example, HIV funding cannot be spent for depressed women and alcohol funding cannot be spent for HIV. The result is vertical programs for single health issues. Vertical programs do not work as effectively or efficiently as more comprehensive approaches, particularly in countries that face multiple and concurrent health challenges.

South Africa faces the intersecting epidemics of HIV, alcohol misuse, under/malnutrition, and depression. South Africa has the highest number of persons living with HIV globally (UNAIDS 2010) and, in some parts of the country, the highest documented rate of fetal alcohol syndrome (FAS) (May et al. 2009). The annual cost of direct harm due to alcohol misuse in South Africa is about \$9 billion, around 1 % of the gross domestic product (World Health Organization 2002). Maternal depression rates are as high as 35 % in many communities (Cooper et al. 1999; Hartley et al. 2011). Equally devastating for child survival is the problem of poor nutrition or malnutrition. Low birth weight is associated with high mortality rates and substantial life-long impairments in neuro-cognitive and socio-emotional development (Hayes and Sharif 2009).

Given the high prevalence rates for HIV, alcohol misuse, low birth weight (LBW) related to poor nutrition, and maternal depression, it is important to identify the co-occurrence among risk factors to begin to understand the individual and

synergistic effects on child health and development. For example, in multiple studies, maternal depression during pregnancy has been found to be associated with long-term negative child outcomes (Grote et al. 2010; Orr et al. 2002). Regarding alcohol misuse, investigators report that mothers of children with FAS have a lower body mass index than those whose children were not exposed to alcohol prenatally, suggesting poor nutrition during pregnancy (May et al. 2008; Urban et al. 2008). Moreover, heavy episodic alcohol misuse is associated with unplanned pregnancies and a higher incidence of HIV (Kalichman et al. 2007). Finally, HIV has been demonstrated to be associated with inadequate prenatal care, alcohol use, and poor weight gain (Grote et al. 2010; Kelly et al. 2002). This co-occurrence of risk factors is ignored in vertical programming.

The South African government is currently promoting integrated care—a re-engineering of the primary health care system. To prepare for this policy shift, it is critical that we understand the clustering of possible risk factors associated with poor health outcomes, in order to prioritize a training agenda for generalist community health workers. Our goal is to examine the prevalence and co-occurrence of these risk factors among pregnant women in Cape Town townships of South Africa.

Methods

Sampling Frame

In three townships outside of Cape Town, we identified 24 non-contiguous neighborhoods with defined geographical boundaries. These neighborhoods were highly similar in the percentages of formal and informal housing, shebeens (alcohol bars), amount of time as a resident of Cape Town, and income (for a more thorough description see Rotheram-Borus et al. 2011).

Participants

The research was approved by the Health Research Ethics Committee of Stellenbosch University in the Western Cape, South Africa (N08-08-218) and the Social Behavioral Institutional Review Board at the University of California at Los Angeles (G07-02-033) in the USA.

All pregnant women in the 24 neighborhoods were eligible for recruitment. From May 2009 to December 2010, a recruiter identified all pregnant women in each neighborhood, visiting all houses repeatedly to ensure that no pregnant women were missed. Of the 1,195 Xhosa-speaking pregnant women identified, 96 % of women agreed to participate, resulting in a total sample size of 1,145. Following a standardized script, the recruiters informed the mothers

about the study. The mothers were assured that decision to participate would not affect services at any local clinic site. After the neighborhood recruiter obtained consent to contact and consent to be driven to the assessment site, a driver scheduled an appointment with the assessment team and drove the woman for a scheduled assessment interview at which voluntary informed consent was granted, or not.

Assessment Interviewer Training

Assessment interviewers were Xhosa-speaking women who did not live in the study neighborhoods. Interviewers had to be able to speak, read, and write in Xhosa and English and had to have good social skills. Assessment interviewers received training from South African researchers familiar with the mothers' culture and values. Training began with IRB certification and human subjects training, an item-by-item review of the assessment interviews, mock interviews, and certification based on observing assessors interviewing mothers not in the study neighborhoods.

Measures

A structured assessment questionnaire was developed for this study that included items that have been used among similar populations in South Africa (Kalichman et al. 2006). The 194-item questionnaire included: mothers' demographic characteristics (age, education level, marital status, language, ethnicity, employment status, and income), housing status (formal/informal housing, indoor water supply, electricity, and toilet facilities), and the number and health status of all household members and previous children. The interview was translated into Xhosa and then back translated following standard principles (Brislin 1970). Ninety-eight percent of pregnant women had been tested for HIV during the identified pregnancy and shared the results of their HIV tests. Mothers also reported the birth weight of previous children and identified if the child had been less than 2,500 g at birth (LBW).

Women reported alcohol use prior to knowing that they were pregnant using the Derived Alcohol Use Disorder Identification Test from the National Epidemiologic Survey on Alcohol and Related Conditions (Derived AUDIT-C (Dawson et al. 2005)). The Derived AUDIT-C is a three-item questionnaire based upon the original 10-item AUDIT (Saunders et al. 1993), which has been used extensively to assess alcohol use in both men and women in the Cape Town region of South Africa (Kalichman et al. 2008).

The Edinburgh Postnatal Depression Scale (EPDS; Cox et al. 1987) was used to assess depressive symptoms. The measure carries a significant level of sensitivity and specificity in identifying African women at risk of, or potentially suffering from, either prenatal or postpartum depression

(Chibanda et al. 2010; Lawrie et al. 1998; Rochat et al. 2006). The EPDS consists of 10 items, each response rated 0–3 based on severity, and summed to yield a total score (0–30). The scale has items related to depressive symptoms of anhedonia, anxiety, tearfulness, helplessness, and low motivation. A cutoff of >13 has been found to characterize minor to major depression in antenatal South African women (Rochat et al. 2009).

Data Analysis

Descriptive data on the total sample were first examined. Next, women were classified as HIV+ or HIV- (1, 0), drinking or not drinking alcohol prior to pregnancy recognition based upon a score of >0 on the Derived AUDIT-C (1, 0), as having a previous pregnancy with an infant birth weight of <2,500 or \geq 2,500 g (1, 0); and as having or not having depressed mood based upon an EPDS score more than 13 (1, 0). Prevalence rates (in percent) were calculated, and multiple combinations of risk factors were then estimated. Comparisons of women with certain risks were conducted using Chi-square tests. Analyses were performed using SAS version 9.2 (SAS Institute, Inc., Cary, North Carolina, USA).

Results

As shown in Table 1, mothers were an average age of 26.28 years old (SD=5.45); 87 % of women had attended some high school, with an average education level of 10.31 years (SD=1.83). The majority of women were married or living with a partner (56.77 %). Only 19.13 % were employed, with the majority of women having a household income of less than \$258 per month. Two thirds of the women lived in informal housing, with 51.27 % having indoor running water, electricity, and flush toilets. Most mothers had more than one child ($M=1.48$; $SD=0.92$ live births). Women averaged 3.56 lifetime sexual partners and 38.08 % had experienced partner violence in the past year. About 28 % had a sexually transmitted disease in their lifetime. Only 3.5 % of women smoked cigarettes. On average, women were at 8.19 weeks (SD=5.75) gestation when they learned they were pregnant and were interviewed at 25.90 weeks (SD=8.13) gestation.

Prevalence Rates of Risk Factors

Prevalence rates of risk factors are presented in Table 2 in descending order of frequency of co-occurrence. Of the total sample of 1,145 women, over a third (37 %) of women screened positive for depressed mood, when this was

Table 1 Sociodemographic characteristics of pregnant women ($N=1,145$)

Demographics		
Age (M , SD)	26.28	5.45
Highest education level (M , SD)	10.31	1.83
Marital status (n , %)		
Single	495	43.23
Married/living together	650	56.77
Language (n , %)		
Xhosa	1,066	93.10
Other	79	6.90
Employed (n , %)	219	19.13
Household income (n , %) ($N=1,105$)		
Less than \$258	595	53.85
\$258 or greater	510	46.15
Living conditions		
Lives in formal housing (n , %)	357	31.18
SUM indoor water, electricity, flush toilet (0–3) (M , SD)	1.97	1.12
0 (n , %)	110	9.61
1 (n , %)	404	35.28
2 (n , %)	44	3.84
3 (n , %)	587	51.27
Reproductive health		
Pregnancy planned (n , %) ($N=1,143$)	306	26.77
Previous pregnancy (M , SD)	2.70	0.96
Previous live births (M , SD)	1.48	0.92
Previous treatment for an STI (n , %)	318	27.77
Weeks pregnant at pregnancy recognition (M , SD)	8.19	5.75
Weeks pregnant at assessment (M , SD)	25.90	8.13
Substance use		
Tobacco (n , %)	40	3.49
Cannabis (n , %)	1	0.09
Sexual behavior and partner violence		
Lifetime partners (M , range)	3.56	1–28
Partners past year (M , range)	1.18	0–5
Any violence from partner(s) past year (n , %)	436	38.08

defined as scoring greater than 13 on the EPDS. Of the 98 % of women who were tested for HIV, 29 % were HIV-positive. Twenty-five percent of women reported drinking post conception and prior to pregnancy recognition on the Derived AUDIT-C. Of the 751 women in the sample who had a prior pregnancy, 15 % reported having a LBW newborn.

Overlapping Risk Factors

Table 2 presents the combinations of risk factors. Only 34 % of pregnant women had no risk factors, and 66 % reported one or more risk factors. About 39 % reported having only one risk factor: 15.5 % reported depressed mood only, 11.5 % were

Table 2 Risk factors in pregnant women ($N=1,145$)

Total prevalence of risk factors, in descending order of frequency		
Depression, defined as EPDS >13	37 %	(419/1,145)
HIV+, among women tested for HIV	29 %	(330/1,126)
Alcohol use prior to pregnancy recognition	25 %	(284/1,145)
LBW, among women with a previous pregnancy	15 %	(112/751)
Combinations of risk factors		
No risk factors	33.9 %	(388/1,145)
One or more risk factors	66.1 %	(757/1,145)
One risk factor		
Depression only	15.5 %	(178/1,145)
HIV only	11.5 %	(132/1,145)
Alcohol only	9.0 %	(103/1,145)
LBW only	3.1 %	(35/1,145)
Two or more risk factors		
HIV and depression	6.6 %	(75/1,145)
Alcohol and depression	6.0 %	(69/1,145)
HIV and alcohol	3.8 %	(43/1,145)
LBW and depression	2.6 %	(30/1,145)
HIV and LBW	1.1 %	(13/1,145)
Alcohol and LBW	0.3 %	(4/1,145)
HIV, alcohol, and depression	3.9 %	(45/1,145)
HIV, LBW, and depression	0.9 %	(10/1,145)
Alcohol, LBW, and depression	0.7 %	(8/1,145)
HIV, alcohol, and LBW	0.7 %	(8/1,145)
All four risk factors	0.3 %	(4/1,145)

HIV+ only, 9 % used alcohol prior to pregnancy recognition only, and 3.1 % had a previous LBW infant only. One in four (27 %) pregnant women had two or more risk factors: 6.6 % reported depressed mood and were HIV+, 6 % reported alcohol use and depressed mood, 3.8 % reported alcohol use and were HIV+, 2.6 % reported depressed mood and had a previous LBW infant, 1.1 % were HIV+ and had a previous LBW infant, and 0.3 % reported alcohol use and had a previous LBW infant. Combinations of three or more risk factors totaled 6.5 %.

Table 3 displays the comorbidity among risk factors and the significant associations between risk factors, based on Chi-square tests. Compared to the HIV- group, HIV+ women trended toward being more likely to display depressed mood using EPDS >13 (41 vs. 35 %, $p=0.072$) and were significantly more likely to use alcohol (30 vs. 22 %, $p=0.004$). Rates of prior LBW infants were similar across HIV serostatus at about 15 %. Compared to non-drinking pregnant women, women who used alcohol prior to pregnancy recognition were significantly more likely to be depressed (44 vs. 34 %, $p=0.002$) and HIV+ (36 vs. 27 %, $p=0.004$). Rates of prior LBW infants were the same across groups at about 15 %. Compared to women who never had a LBW infant, those with previous LBW infants were significantly

more likely to report depressed mood (46 vs. 36 %, $p=0.028$); rates of HIV+ and alcohol use were similar across groups. Lastly, compared to non-depressed pregnant women, those with depressed mood trended to being more likely to be HIV+ (33 vs. 27 %, $p=0.072$) and were significantly more likely to use alcohol (30 vs. 22 %, $p=0.002$) and to have a prior LBW infant (19 vs. 13 %, $p=0.028$).

Discussion

This study suggests that a focus on a horizontal intervention approach be adopted to concurrently screen and intervene on multiple outcomes to improve the health of pregnant women in South Africa. Over one third (39 %) of the women in our study experienced one risk factor, while one in four (27 %) experienced two or more. In addition, while the rates of HIV, alcohol use, low birth weight, and depressed mood are high (between 15 and 37 %), no one risk factor predominated in a way that might suggest a vertical disease targeted model of intervention. Traditionally, many health care initiatives are structured vertically (i.e., with one specific health issue or disease focus). Typically, these initiatives have been either biomedical or behavioral in orientation. The result is that many programs have had disappointing outcomes and have not been sustainable; this is particularly true of evidence-based HIV interventions (Gregson et al. 2007). In explaining these negative outcomes, reference is often made to various aspects of the social environment that prevent vulnerable groups from making use of the interventions. That is, the programs fail to resonate with the perceived needs and interests of their target populations (Campbell et al. 2009). Each of the risk behaviors requires shifts in daily household routines that impinge on the implementation of other health routines. As can be seen from these data, problems typically co-occur. Designing a program that addresses only one problem ignores the reality of the lives of these women. Categorical funding for HIV, alcohol misuse, child malnutrition, or maternal mental health alone does not reflect the reality of families' lives and will mean that children may die from an associated health risk if multiple risks are not addressed simultaneously. Addressing multiple risks simultaneously anticipates the need to design interventions that can feasibly be broadly implemented and sustained over time.

Our own work underway in Cape Town uses a community-based horizontal approach through the use of a mentor mother model. This model is a home-based maternal and child health intervention to support women through their pregnancies and the early development of their child by moving maternal and child health, nutrition, protection, and care beyond clinics and institutions into the community. Each

Table 3 Prevalence of risk factors within the specified risk subset in descending order of frequency, and pairwise significance testing

Risk factor	Risk subset, comparison group, and total						Chi-square <i>p</i> value
	HIV+ (<i>N</i> =330)		HIV- (<i>N</i> =796)		Total (<i>N</i> =1126)		
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	
EPDS >13	134	41	278	35	412	37	0.072
Alcohol	100	30	177	22	277	25	0.004
LBW ¹	35	14	76	15	111	15	0.734
	Alcohol (<i>N</i> =284)		No alcohol (<i>N</i> =861)		Total (<i>N</i> =1,145)		
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	
EPDS >13	126	44	293	34	419	37	0.002
HIV ²	100	36	230	27	330	29	0.004
LBW ¹	24	14	88	15	112	15	0.796
	Previous LBW (<i>N</i> =112)		No previous LBW (<i>N</i> =639)		Total (<i>N</i> =751)		
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	
EPDS >13	52	46	227	36	279	37	0.028
HIV ²	35	32	208	33	243	33	0.734
Alcohol	24	21	144	23	168	22	0.796
	EPDS >13 (<i>N</i> =419)		EPDS ≤13 (<i>N</i> =726)		Total (<i>N</i> =1,145)		
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	
HIV ²	134	33	196	27	330	29	0.072
Alcohol	126	30	158	22	284	25	0.002
LBW ¹	52	19	60	13	112	15	0.028

HIV+ subset and HIV- comparison group are among women who have tested for HIV (*N*=1,126). Previous LBW subset and no previous LBW comparison group are among women with a previous pregnancy (*N*=751). Pairwise testing of LBW and HIV is among women with a previous pregnancy who have also been tested for HIV (*N*=738)

^a Sample size restricted to mothers with a previous pregnancy: HIV+ (*n*=243), HIV- (*n*=495), total (*n*=738); alcohol (*n*=168), no alcohol (*n*=583), total (*n*=751); EPDS >13 (*n*=279), EPDS ≤13 (*n*=472), total (*n*=751)

^b Sample size restricted to mothers who have tested for HIV: alcohol (*n*=277), no alcohol (*n*=849), total (*n*=1,126); LBW (*n*=111), no LBW (*n*=627), total (*n*=738); EPDS >13 (*n*=412), EPDS ≤13 (*n*=714), total (*n*=1,126)

mentor mother addresses factors concerning maternal and child nutrition, birth preparation, antenatal care, the importance of TB testing, alcohol use during pregnancy, and the importance of testing for HIV and antiviral treatment for both the mother and child. The effectiveness of this approach is currently being tested through a randomized controlled research design but preliminary studies on the effectiveness of such an intervention on weight gain in underweight children yielded significant positive results (le Roux et al. 2011).

Limitations

The sample consisted of individuals from a fairly restricted geographic and culture specific group: township women in Cape Town, South Africa. Cape Town has perhaps the best level of primary health care and antenatal care in South Africa. Yet, the levels of risk were high. In addition, the use of self-report measures to assess HIV, alcohol consumption, LBW, and depression may have resulted in underreporting. However, the use of interviewers of the same cultural/ethnic backgrounds and the confidentiality

of mothers' responses suggest that women were truthful in their answers. Indeed, the high rate of consent suggests that women were interested in talking about their physical and mental health during pregnancy.

Conclusion

South African children's health and well-being is dependent on effectively intervening at the intersection of the HIV, alcohol misuse, LBW, and depression epidemics. Our study suggests that there is a need to provide comprehensive and accessible health care to pregnant women, particularly those living in low-income townships. The shift in policy in global health funding from vertical toward horizontal interventions, in accordance with the South African government's re-engineered primary health care approach, carries the promise of improving health care delivery in South Africa. Without an integrated approach to address multiple maternal risk factors, interventions are unlikely to meet women's needs nor to be sustained in the long term.

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