Addressing the interaction between food insecurity, perinatal depression and informal work: findings of a cross-sectional survey among informal women workers with young children in South Africa.

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- working women, informal economy, perinatal depression, food insecurity, maternal health, child health, South Africa, Africa
Abstract
Background: There is a high burden of depression globally, including in South Africa. Maternal depression is associated with poverty, unstable income, food insecurity, and lack of partner support, and may lead to poor outcomes for mothers and children. In South Africa one-third of working women are in informal work, which is associated with socioeconomic vulnerability.

Methods: A cross-sectional survey explored work setting and conditions, food security and risk of depression among informal working women with young children (0-3 years). Depression risk was assessed using the Edinburgh Postnatal Depression Score (EPDS) and Whooley score. Food insecurity was evaluated using USAID Household Food Insecurity Access Scale (HIFAS). Data was analysed using SPSS and STATA.

Results: Interviews were conducted with 265 informal women workers. Types of work included domestic work, home-based work, informal employees and own account workers, most of whom were informal traders. Most participants (149/265; 56.2%) earned between US$70-200 per month, but some participants (79/265; 29.8%) earned less than US$70 per month, and few earned >US$200 per month (37/265; 14.0%). Many participants experienced mild (38/267; 14.3%), moderate (72/265; 27.2%) or severe (43/265; 16%) food insecurity. Severe food insecurity was significantly higher among participants with the lowest income compared to those with the highest income (p= 0.027). Women who received financial support from the baby’s father were less likely to be food insecure (p=0.03). Using EPDS scores, 22/265 (8.3%) women were designated as being at risk of depression. This was similar among postnatal women and women with older children. Household food insecurity was significantly associated with depression risk (p<0.001).

Conclusions: Informal women workers were shown to be vulnerable with low incomes and high rates of food insecurity, thus increasing the risk for poor maternal health, and child health and development outcomes. However, levels of depression risk were low compared to previous estimates in South Africa, suggesting that informal workers may have high levels of resilience. Interventions to improve social protection, access to health services, and support for safe childcare in the workplace could support these mothers care for their children.
Background
Depression represents a huge burden of disease globally, particularly among women in the perinatal period immediately before and after childbirth [1]. Perinatal depression is highly prevalent in low-income countries, especially in high poverty settings [2–4]. In South Africa (SA) estimated rates of depression in the antenatal period range from 22–47% [5, 6], and may be as high as 50% during the postnatal period [7]. Depression contributes heavily to the overall disease burden in SA [8].
Depression is associated with significant life challenges, including poverty, unstable income, food insecurity, lack of partner support, violence and poor health [9–14]. Maternal depression reduces quality of life and is a leading cause of disability and poor maternal health outcomes, especially in the context of HIV [15, 16]. Further, maternal depression has been associated with adverse effects on the quality of the mother-infant relationship and child development outcomes [4, 17], which can have implications for young children’s long-term psychosocial, cognitive, and economic well-being [13, 16]. Maternal mental health is therefore an important public health concern in SA, however it is frequently neglected and continues to be of low priority in health care practices [3, 18].
Food insecurity, defined as having uncertain or limited availability of nutritionally appropriate food or being unable to procure food in socially acceptable ways [19, 20], has been shown to be an important risk factor for depression [21]. Further, depression in mothers in low-income settings is a strong predictor of household food insecurity [22]. Household food insecurity is associated with poor health, development and behavioural outcomes among children [23, 24], and is common in SA, with around 25% of the population considered food insecure [25].
Informal work is frequently associated with vulnerability and poverty, particularly financial and food insecurity [26, 27]. Of the 6.8 million working women in SA, almost 2 million work informally, the largest groups being informal traders, agricultural workers and workers in private homes (domestic workers)[28]. By definition, informal workers do not have access to income protection including unemployment, sickness and maternity benefits. The perinatal period is a vulnerable time for all mothers since childcare and household responsibilities often fall disproportionately on women [29]. In SA female-headed households are common (43%)[30], and it may be especially difficult for mothers in
informal work, often already vulnerable due to their working conditions and reduced earning potential, to manage ongoing childcare and household responsibilities [29]. Several studies have shown how poverty and food insecurity interact in a vicious cycle among socially and economically deprived populations, leading to depression and poor health outcomes among women [9, 11]. Thus, factors associated with food insecurity and depression are likely experienced by women working in the informal economy. However, little focus has been given to the multiple risks of depression facing female informal workers and data is very sparse among this population group, especially in low- and middle-income settings [12]. Data from one Brazilian study suggests that informal work may increase the risk of psychological symptoms among women informal workers [30].

Women who work in the informal economy in SA are largely invisible in maternal and child health programmes and in efforts for equitable economic development. To address this gap, we conducted this study to explore the interaction between informal work, food insecurity and depression among women with young children working in the informal economy in urban and peri-urban areas of Durban, KwaZulu-Natal (KZN) Province, SA.

Methods
A cross sectional survey methodology was employed to explore the work setting and conditions, income, food security and risk of depression among informal working women with children under the age of three years.

Study setting
The study was conducted in three primary health care (PHC) clinics in three townships in Durban, South Africa. In these areas unemployment is high at around 20%, with high rates of poverty, and an average annual income of R29 400 (USD2000) [31]. In addition, there is poor access to basic services including water and sanitation and informal housing is common, but most households do have access to electricity [32]. A recent study in Durban found that women in the informal economy work long hours and many only earn <R1000 (USD70) per month [26]. Primary caregivers of children living in a low-income household are entitled to a SA government provided Child Support Grant (CSG) of R420 (USD30) per month for each child [33].
Health care for pregnant women and children is provided free of charge in PHC clinics, and there are high rates of antenatal clinic attendance (94%) and facility-based delivery (96%)[34]. HIV prevalence is high among young women in KZN, with 47% of pregnant women attending government antenatal clinics testing HIV positive in 2015 [35].

**Recruitment and sampling**

Eligible participants were informal workers, aged 18 years or older, with a child under the age of three years. Informal workers were either informally employed or own account (self-employed) workers. Informally employed women were defined by: 1) receiving money from an employer; 2) having no formal work contract; and 3) not contributing to SA’s mandatory Unemployment Insurance Fund (UIF). Own-account workers provided goods and services directly to customers but were not tax registered or paying tax. Women were excluded from the study if they worked fewer than three days per week or had been in informal work for less than six months.

A stratified sampling approach was employed to recruit equal numbers of eligible women with children aged less than one year (defined as the postnatal period) and mothers of children aged 12-35 months. Given the well-documented high risk of postnatal depression in SA, this approach was used to determine depression prevalence in the postnatal population compared to the wider population of informally working mothers.

A sample size of 192 women (96 with children aged < 1 year and 96 with children aged 1-<3 years) was required to detect a 20% difference in depression risk among postnatal women compared to the general population. This sample size calculation assumes a 35% rate of depression risk in women with children 1-<3 years of age with 95% probability and 80% power.

**Data collection**

Trained fieldworkers approached women in the clinic waiting area and explained the study. Eligibility was determined using a structured screening tool. All eligible women agreed to participate. Data were collected using a structured questionnaire administered in the local language (IsiZulu) and continued until the sample size was reached. Risk of depression was assessed using two tools validated for use in SA and translated into IsiZulu: the Edinburgh Postnatal Depression Score (EPDS) [5, 36] and the
Whooley score [37]. The USAID Household Food Insecurity Access Scale (HFIAS), adapted and translated to IsiZulu, was used to assess food insecurity. The HFIAS tool is designed to be easy to use and applicable to diverse sociocultural settings, and examines food security related to three domains: anxiety about food access; insufficient quality of food; and insufficient quantity of food [38].

A professional psychologist who was IsiZulu-speaking and had experience with both the EPDS and Whooley tools trained the fieldworkers to assess depression risk using the two tools. The psychologist also supervised data collection to ensure the correct administration of the tools in the field.

Data Analysis

Quantitative analysis was undertaken using SPSS version 24 and Stata V13. For the EPDS high risk of depression was determined by a score of ≥ 13. Two positive answers were considered a positive score for the Whooley questions. For both tools a positive answer to questions about suicidal ideation was considered high depression risk, regardless of the answers to the other questions.

Participants were retrospectively categorised according to the type of work they were doing. Firstly, all women who reported they worked from home were categorised as home-based workers. Women were categorised as domestic workers if they reported they worked in a private household undertaking domestic or childcare work. All other women were categorised either as employees if they reported receiving a wage from an employer, or as own account workers if they were self-employed. Sub-categories of own account workers included informal traders and a variety of other own account jobs.

For the multivariable analysis the food insecurity index was dichotomised into food secure (none or mild food insecurity) and food insecure (moderate or severe food insecurity), and the postnatal depression score was analysed on a continuous scale and means and standard deviations reported. The analysis was a two-step process. Initially a multi variable logistic model was used to identify factors associated with food insecurity. Due to the over dispersion of the PND score, a multi-variable negative binomial model including food insecurity was used to identify factors associated with PND score. In both cases only factors significant at p < 0.3 in bivariate analysis were included in the multivariable model. Adjusted and unadjusted odds ratios and 95% confidence limits are reported. Stata
V15 statistical software was used in the analysis

**Ethical considerations**

All participating women provided written informed consent. Screening, consent processes and data collection were conducted in a private area in the PHC clinics. Referral procedures were established with staff at each of the PHC clinics to offer additional clinical and social support to participants as required. All women identified as at risk of depression or with any thoughts of self-harm were immediately referred to clinic staff for further assessment. Follow up support from a study counsellor was offered to all women identified at risk of depression. Women identified as having moderate or severe food insecurity were referred to a clinic-based social worker.

**Results**

A total of 265 interviews were conducted with mothers in informal work between December 2018 and March 2019. Just over 50% of participants had completed secondary school and nearly half were in a relationship but not living with their partner. Close to 50% of participants reported themselves HIV positive. Characteristics of participating mothers are shown in Table 1.

Table 1: Characteristics of participating mothers
### Characteristics of participants

| Characteristics of participants                              | All participants N=265 (%) |
|-------------------------------------------------------------|----------------------------|
| Median age                                                  | 29 years (IQR 25-34 years) |
| Population group (Black / African)                         | 265 (100)                  |
| Education                                                   |                            |
| No schooling                                                | 2 (0.8%)                   |
| Primary school Grade 1-7                                    | 7 (2.6%)                   |
| Secondary school Grade 8-11                                 | 122 (46.0%)                |
| Completed school (Grade 12)                                 | 134 (50.6%)                |
| Relationship                                                |                            |
| Single                                                      | 52 (19.6%)                 |
| Married                                                     | 22 (8.3%)                  |
| Separated /divorced / Widowed                               | 4 (1.5%)                   |
| In a relationship, living with partner                       | 61 (23.0%)                 |
| In a relationship, not living with partner                   | 126 (47.5)                 |
| Has another child aged less than 3 years                    | 19 (7.2%)                  |
| HIV status                                                   |                            |
| Mothers reported having had an HIV test                     | 256 (96.6)                 |
| Mothers reported HIV positive                               | 131 (49.4%)                |

### Infant feeding and childcare

There were similar numbers of participants with children aged less than 12 months of age and with children aged between 12 and 39 months of age. Most mothers had breastfed their child, however, only 60% of infants less than 12 months of age were still breastfeeding. Most mothers (171/265; 64.5%) took time off work following childbirth and were financially supported during this time by the baby’s father (109/265; 41.1%), other family members (72/265; 27.2%), the SA CSG (71/265: 26.8%), and their own savings (21/265; 7.9%). The duration of leave taken at the time of childbirth was short, and over one-third of mothers did not take any time off work (Table 2).

Table 2. Characteristics of infant feeding and childcare
| Characteristics                                      | < 12 months | 12 - 36 months | All  |
|------------------------------------------------------|-------------|----------------|------|
|                                                      | n=132 (%)   | n=133 (%)      | n=265 (%) |
| Baby's age when stopped breastfeeding                |             |                |      |
| Never breastfed                                      | 18 (13.6)   | 27 (20.3%)     | 45 (17.0%) |
| Still breastfeeding                                  | 80 (60.6)   | 15 (11.3)      | 95 (35.8%) |
| 0 - < 3 months                                       | 15 (11.4)   | 15 (11.3)      | 30 (11.3) |
| 3 - < 6 months                                       | 11 (8.3)    | 14 (10.5)      | 25 (9.4)  |
| 6 - < 9 months                                       | 8 (6.1)     | 17 (12.8)      | 25 (9.4)  |
| 9 - < 12 months                                      |             | 7 (5.3)        | 7 (5.3)  |
| 12 - < 15 months                                     |             | 17 (12.8)      | 17 (12.8) |
| 15 - < 18 months                                     |             | 5 (3.8)        | 5 (3.8)  |
| 18 - < 24 months                                     |             | 9 (6.8)        | 9 (6.8)  |
| >24 months                                           |             | 7 (5.3)        | 7 (5.3)  |
| Baby's age when mother returned to work              |             |                |      |
| Did not take time off work                           | 40 (30.3)   | 54 (40.6)      | 94 (35.5) |
| < 3 months                                           | 43 (32.6)   | 22 (16.5)      | 65 (24.5) |
| 3 - < 6 months                                       | 29 (22.0)   | 36 (27.1)      | 65 (24.5) |
| 6 - < 9 months                                       | 4 (3.0)     | 15 (11.3)      | 19 (7.2)  |
| 9 - < 12 months                                      | 0           | 0              | 0      |
| 12 - < 15 months                                     | 1 (0.8)     | 1 (0.4)        | 1 (0.4)  |
| 15 - < 18 months                                     | 1 (0.8)     | 1 (0.4)        | 1 (0.4)  |
| 18 - < 24 months                                     | 0           | 0              | 0      |
| >24 months                                           | 2 (1.5)     | 2 (0.8)        | 2 (0.8)  |
| Not yet returned to work                             | 6 (4.5%)    | 2 (1.5)        | 11 (4.5) |
| Missing /mother unsure                               | 10 (7.6%)   | 2 (1.5)        |        |
| Took baby to work initially                          | 26 (19.7%)  | 28 (21.1)      | 54 (20.4%) |
| Person who usually cares for child while mother is working |         |                |      |
| Child's grandmother                                 | 31 (23.5)   | 21 (15.8)      | 52 (19.6%) |
| Child’s father                                       | 2 (1.5)     | 1 (0.8)        | 3 (1.1%)  |
| Child’s sibling                                      | 1 (0.8)     | 2 (1.5)        | 3 (1.1%)  |
| Other relative                                       | 28 (21.2)   | 18 (13.5)      | 46 (17.4%) |
| Non-relative                                         | 44 (33.3)   | 69 (51.9)      | 113 (42.6%) |
| Mother herself (takes child to work or works from home) | 26 (19.7)   | 18 (13.5)      | 44 (16.6%) |
| Childcare location                                   |             |                |      |
| Mother’s residence                                   | 76 (57.6)   | 47 (35.3)      | 123 (46.4%) |
| Carer’s home                                         | 22 (16.7)   | 20 (15.0)      | 42 (15.8%) |
| Current workplace                                    | 3 (2.3)     | 2 (1.5)        | 5 (1.9%)  |
| Crèche or school                                     | 29 (22.0)   | 62 (46.6)      | 91 (34.3%) |
| Other                                                | 2 (1.5)     | 2 (1.5)        | 4 (1.5)   |
Conditions of informal work

Over 40% of participants had been at the same job between one and three years, and close to half worked five to six days each week. Most women reported they worked regular hours, however over 60% did not benefit from a fixed income and were paid depending on the work done. An overview of informal working conditions reported by participants is shown in Table 3.

Table 3. Overview of informal work conditions of participants

| Conditions of informal work                  | All workers n=265 (%) |
|----------------------------------------------|-----------------------|
| Length of time in the same job               |                       |
| Less than a year                             | 93 (35.1%)            |
| 1-3 years                                    | 114 (43.0%)           |
| 4 or more years                              | 58 (21.9%)            |
| Number of days worked per week               |                       |
| 3-4 days                                     | 94 (35.5%)            |
| 5-6 days                                     | 119 (44.9%)           |
| 7 days                                       | 52 (19.6%)            |
| Works in same location every day             | 208 (78.5%)           |
| Regular hours of work                        | 201 (75.8%)           |
| Work setting                                 |                       |
| Mostly indoors                               | 220 (83.0%)           |
| Mostly outdoors with shelter                 | 22 (8.3%)             |
| Mostly outdoors without shelter              | 23 (8.7%)             |
| Wage is fixed or variable                    |                       |
| Receives a fixed wage                        | 101 (38.1%)           |
| Not fixed / depends on work done             | 164 (61.9%)           |
| How often receives wages                     |                       |
| Weekly                                       | 42 (15.8%)            |
| Monthly                                      | 176 (66.4%)           |
| Irregularly                                  | 40 (15.1%)            |
| Other                                        | 7 (2.6%)              |

Types of informal work

Just over 40% of participants reported they worked as employees in informal enterprises, including as cleaners (19), hairdressers (18), waiters (7), shop assistants (24), factory workers (12), office administrators (4), call centre workers (3), and security guards (3). Home based work included
hairdressing (23), and making and selling goods, such as crafts, sewing, and baking (9). Other participants were self-employed as informal traders and in a variety of other own account jobs such as crèche work, fashion design, catering, plumbing, welding, sewing and marketing (Table 4). A comparison of the characteristics of the different categories of informal work are shown in Table 4. Home-based workers were most likely to work seven days per week and not receive a fixed wage. Employed women and domestic workers benefited from more regular hours compared with other informal workers, however, many still could not rely on a fixed wage.

Table 4: Working conditions in different types of informal work

| Type of work                  | Conditions of work (N=265) |
|------------------------------|----------------------------|
|                              | Proportion in each category n (%) | Earning <R1000 monthly n (%) | Irregular working hours n (%) | Work 7 days per week n (%) | Paid monthly n (%) |
| Domestic workers             | 56 (21.1)                     | 12/56 (21.4)                  | 5/56 (8.9)                    | 1/56 (1.8)                  | 49/56 (87.5)      |
| Home based workers           | 49 (18.5%)                    | 25/49 (51.0)                  | 29/49 (59.2)                  | 28/49 (57.1)                | 19/49 (37.8)      |
| Employed in informal business| 116 (43.8)                    | 31/116 (26.7)                 | 20/116 (17.2)                 | 10/116 (8.6)                | 84/116 (72.4)     |

Sub-categories of own account workers:

| Sub-categories of own account workers | Conditions of work (N=265) |
|---------------------------------------|----------------------------|
| Informal traders                      | 29 (10.9)                  | 10/29 (34.5)                  | 6/29 (20.7)                   | 10/29 (34.5)               | 16/29 (55.2)      |
| Other own account workers             | 15 (5.7)                   | 1/15 (6.7)                    | 4/15 (26.6)                   | 3/15 (20.0)                 | 8/15 (53.3)       |

**Income among women informal workers**

Most participants (149/265; 56.2%) reported earning between R1 000- 3 000 (USD70- USD200) per month for their work. However, many women (79/265; 29.8%) earned less than R1 000 (USD70) per month, with the highest proportion being home-based workers. A minority of women earned more than R3000 (>200$) per month (37/265; 14.0%).
Most participants received additional income from the CSG (208/265; 78.5%), either for one (89; 33.6%), two (74; 27.9%), three (32; 12.1%), or more (13; 7.8%) children. In most cases participants reported that the father of their child was working (194/265; 73.2%) and had provided either money or material items for the baby in the past one month (181/265; 68.7%).

Most participants reported having a bank account (178/265; 67.2%). Despite being low paid, many mothers were saving money monthly (128/265; 48.3%), had a savings plan (123/265; 46.4%) and paid towards a funeral insurance policy (110/265; 41.5%).

**Financial responsibilities**

Participants were asked about current financial outgoings for themselves, their baby and the household. Most expenses for which the mother was responsible were shared with others (Table 5). Expenses related to the child were frequently shared with the child’s father. Many participants reported they did not contribute to household bills or that these costs were shared with other family members. However, most participants reported being responsible for their personal expenses such as their own clothing (122/265; 46.0%), toiletries and/or cosmetics (73/265; 27.5%) and paying for their cell phone or airtime (21/265; 7.9%). Some participants reported they regularly financially supported other family members (25/265; 9.4%) including their parents, siblings or other children not living with them.

Table 5: Financial responsibilities of participants

| Participants’ financial responsibilities | All n=265 (%) |
|----------------------------------------|--------------|
| **Household expenses**                 |              |
| *Responsible for paying water, electricity, rates, monthly costs* |              |
| Mother alone                           | 62 (23.4%)   |
| Shares the cost                        | 62 (23.4%)   |
| Do not pay / not applicable            | 141 (53.2%)  |
| Who cost is shared with (n=62)         |              |
| Father of the child                    | 27           |
| Other family members                   | 35           |
| *Responsible for paying for rent*      |              |
| Mother alone                           | 50 (18.9%)   |
| Shares the cost                        | 19 (7.2%)    |
|                              | Count   |
|------------------------------|---------|
| **Do not pay / not applicable** | 196 (74.0%) |
| **Who cost is shared with (n=19)** |         |
| Father of the child          | 12      |
| Other family members         | 7       |
| Non-family member            | 0       |
| **Responsible for paying for groceries** |      |
| Mother alone                 | 72 (27.2%) |
| Shares the cost              | 157 (59.2%) |
| Do not pay / not applicable  | 36 (13.6%) |
| **Who cost is shared with (n=157)** |       |
| Father of the child          | 61      |
| Other family members         | 95      |
| Non-family member            | 1       |
| **Responsible for transport costs** |       |
| Mother alone                 | 207 (78.1%) |
| Shares the cost              | 37 (14.0%) |
| Do not pay / not applicable  | 21 (7.9%)  |
| **Who cost is shared with (n=37)** |     |
| Father of the child          | 33      |
| Other family members         | 1       |
| Non-family member            | 3       |
| **Expenses for the child**   |         |
| **Responsible for paying for children’s clothes** |       |
| Mother alone                 | 66 (24.9%) |
| Shares the cost              | 181 (68.3%) |
| Do not pay / not applicable  | 18 (6.8%) |
| **Who cost is shared with (n=181)** |       |
| Father of the child          | 168     |
| Other family members         | 10      |
| Non-family member            | 2       |
| **Responsible for paying for child’s food or milk** |    |
| Mother alone                 | 56 (21.1%) |
| Shares the cost              | 154 (58.1%) |
| Do not pay / not applicable  | 55 (20.8%) |
| **Who cost is shared with (n=154)** |       |
| Father of the child          | 140     |
| Other family members         | 13      |
| Non-family member            | 1       |
| **Responsible for paying school fees** |     |
| Mother alone                 | 72 (27.2%) |
| Shares the cost              | 32 (12.1%) |


| Who cost is shared with (n=32) | 161 (60.8%) |
|-------------------------------|-------------|
| Father of the child           | 27          |
| Other family members          | 5           |
| Non-family member             | 0           |

| Responsible for paying childcare |  |
|----------------------------------|-----|
| Mother alone                     | 89  |
| Shares the cost                  | 41  |
| Do not pay / not applicable      | 135 |

| Who cost is shared with (n=41)  |         |
|---------------------------------|---------|
| Father of the child             | 40      |
| Other family members            | 1       |
| Non-family member               | 0       |

**Household food insecurity**

A household is considered to be food secure if household members can access sufficient, safe and nutritious foods of their choice without anxiety. Most women had experienced some form of household food insecurity in the last month, and less than half were designated as food secure (112/265; 42.3%). Some participants experienced mild food insecurity (38/267; 14.3%) where they could maintain the quantity of the household food, but the food was less diverse and not their preferred choice. Nearly 30% of participants had moderate food insecurity (72/265; 27.2%) where not only was the food was of lower quality, but sometimes the quantity of food had to be reduced by limiting either the number or the size of meals. Further, 16% (43/265) of participants had severe food insecurity where they often had to reduce the number or size of meals, or had run out of food, gone to bed hungry, or spent an entire day and night without food.

Severe household food insecurity decreased with increasing income: 19/79 (24.0%) participants with an income <R1 000 were severely food insecure, compared to 22/149 (14.8%) of participants with an income of R1 000-3 000 and 2/37 (5.4%) participants with an income over R3 000. There was a significant higher prevalence of severe food insecurity among the lowest paid compared to the highest (p= 0.027).

In multivariable analysis moderate or severe food insecurity was higher among mothers with an
income less than R1 000 per month, and among HIV positive mothers. Mothers who reported receiving financial support from the child’s father were less likely to be food insecure.

**Depression risk**

Among all participants, 8.3% (22/265) were identified at risk of depression using the EPDS score cut off ≥13. To provide estimates of depression risk in the postnatal period we considered depression risk among mothers with children less than 12 months of age (132/265). Of these mothers, 6.8% (9/132) were identified as being at risk of postnatal depression. Among 133 mothers with a child aged between 12 and 36 months, 13 mothers scored high on the EPDS (13/133; 9.8%). There was no significant difference between depression risk in the postnatal period compared to mothers with older children (p=0.38). Results were similar using the alternative Whooley Score, where a slightly higher percentage of mothers (40/265; 15.1%) were identified as at risk of depression. Again, rates were similar among mothers with children under 12 months (21/132; 15.9%) and mothers with older children (19/133; 14.3%).

A small number of participants expressed thoughts of self-harm. Using EPDS, 12 mothers (4.5%) reported they had thought of harming themselves in the past 7 days, as compared to Whooley where 10 mothers (3.8%) reported they had thoughts about self-harm in the past two weeks.

**Factors associated with high depression risk**

In order to determine the relationship between food insecurity and depression, we dichotomised the food insecurity variable as no or mild food insecurity versus moderate or severe food insecurity. Using the EPDS score as a continuous variable, Table 6 shows after adjusting for possible confounders there is a significantly higher risk of postnatal depression among mothers living in households where there is moderate or severe food insecurity. However, receiving financial support from the child’s father and working regular hours were associated with a lower average EPDS score. In our study there was no association between risk of depression and HIV status.

Table 6. Factors associated with postnatal depression with EPDS score as continuous variable

| n   | Mean postnatal depression score | Univariate | Multi variable |
|-----|---------------------------------|------------|---------------|
|     | mean | sd | p | OR | 95%ci | p |

15
| Mother's age        |          |          |          |          |          |          |
|---------------------|----------|----------|----------|----------|----------|----------|
| < 30 yrs            | 138      | 5.34     | 4.94     | ref      |          |          |
| 30-47               | 126      | 5.73     | 4.86     | 0.58     | 1.07     | (0.8-1.4) na |
| Mothers education   |          |          |          |          |          |          |
| < grade 12          | 131      | 6.16     | 5.39     | ref      |          |          |
| >= grade 12         | 134      | 4.88     | 4.28     | 0.07     | 0.79     | (0.6-1.0) 0. |
| Mother in a relationship with child’s father |          |          |          |          |          |          |
| No/na               | 57       | 6.65     | 4.96     | ref      |          |          |
| Yes                 | 208      | 5.20     | 4.84     | 0.11     | 0.78     | (0.6-1.1) 0. |
| Father gives money to support the child |          |          |          |          |          |          |
| No/na               | 84       | 7.30     | 5.09     | ref      |          |          |
| Yes                 | 181      | 4.69     | 4.58     | <0.001   | 0.64     | (0.5-0.83) 0. |
| Mothers receives Child Support Grant |          |          |          |          |          |          |
| No/na               | 57       | 5.84     | 5.01     | ref      |          |          |
| Yes                 | 208      | 5.42     | 4.87     | 0.63     | 0.93     | (0.7-1.30 na |
| Monthly earning     |          |          |          |          |          |          |
| < 1000              | 79       | 6.27     | 5.26     | ref      |          |          |
| 2-3000              | 149      | 5.34     | 4.75     | 0.26     | 0.85     | (0.6-1.1) 0. |
| > 3000              | 37       | 4.59     | 4.53     | 0.13     | 0.73     | (0.5-1.1) 0. |
| Salary              |          |          |          |          |          |          |
| Not fixed           | 164      | 5.52     | 5.03     | ref      | na       |
| Fixed               | 101      | 5.50     | 4.69     | 0.98     | 0.90     | (0.8-1.3) |
| Working hours       |          |          |          |          |          |          |
| Irregular           | 64       | 6.39     | 5.41     | ref      |          |          |
| Regular             | 201      | 5.23     | 4.70     | 0.17     | 0.82     | (0.6-1.1) 0. |
| Stable work         |          |          |          |          |          |          |
| < 4 yrs             | 207      | 5.57     | 4.72     | ref      |          |          |
| >= 4 yrs            | 58       | 5.29     | 5.52     | 0.74     | 0.95     | (0.7-1.3) na |
| HIV                 |          |          |          |          |          |          |
| Negative            | 117      | 4.91     | 4.59     | ref      |          |          |
| Positive            | 131      | 6.19     | 5.19     | 0.08     | 1.26     | (0.9-1.6) 0. |
| no answer/na        | 17       | 4.41     | 3.99     | na       |          |          |
| Household Food Insecurity Access Scale (HFIA) |          |          |          |          |          |          |
| Mild insecure       | 150      | 3.67     | 3.93     | ref      |          |          |
| Moderate/severe insecure | 115   | 7.91     | 5.00     | <0.001   | 2.15     | (1.7-2.8) 0. |
| HFIA score corr     | 0.50     |          |          |          |          |          |
Discussion
Despite the large number of women working informally in SA and throughout the Global South, very little is known about the interaction between informal work, food security and depression among mothers of young children working in the informal economy. This study sought to address this gap to inform the development of strategies to improve maternal and child health and enable more stable livelihoods for these women.

Our findings show that women in informal work were living in poverty, frequently on very low, unstable incomes despite being responsible for many household and personal expenses. Almost one third of women were earning less than R1 000 per month, well below the upper bound poverty line for SA, meaning that this amount is insufficient to supply all the individuals needs [39]. Types of work, employment conditions and places of work differed among these women, with employed women and domestic workers benefitting from a relatively stable income and work environment compared to self-employed workers, particularly informal market traders. Informal women workers reported high levels of moderate or severe household food insecurity, when compared with the SA average. The inability to adequately provide for the households’ food needs is a key indicator of poverty, and is a significant source of anxiety and determinant of poor mental health [21]. As a result, most women took very little or no time off work after childbirth, which was likely to affect their ability to breastfeed and care for their children.

The peri-partum period is a vulnerable time for many women as their incomes are reduced at the same time as they have the additional expense of providing for a new baby. Although some women who received the CSG experienced food insecurity, many women reported that the grant money they received for their older children helped support them during their maternity leave. This is supported by other studies, which have further shown that receipt of the CSG can reduce hunger, and improve child nutrition [40]. However, although the SA CSG is the largest cash transfer programme in Africa, reaching over 11 million children, the amount is insufficient to ensure adequate dietary diversity for
children or protect low-income families from financial shocks [41]. The CSG is a cornerstone of poverty alleviation in SA but access to the grant remains a challenge, particularly for mothers in extreme poverty, and more needs to be done to address this [42]. In addition, payments start several weeks after the baby is born. Therefore, extension of the CSG to cover the perinatal period would improve coverage and be very likely to improve mothers’ ability to take time off work to breastfeed and care for their new baby.

The depression risk among our population was lower than has been found in several other studies in SA [6, 7, 18], and was confirmed using two different validated screening tools for depression. This relatively low depression risk was found despite women living in contexts of social and economic adversity and food insecurity, that are known to be associated with high rates of depression [11]. The support that mothers received from their own family, both financial and practical, could be a factor in protecting women from depression. Another explanation for low rates of depression risk is that informal women workers may have built significant agency and resilience in response to the considerable adversities they have faced in the workplace. A person displays resilience when they are able to adjust well to significant risk [43]. Although our study did not measure women’s sense of agency or resilience, it appears that informal workers are resourceful and empowered women who may have learned to actively buffer their health from life stressors. Very few studies are available that explain resilience among women in SA, let alone women who work in the informal economy who face many risks. More research is needed to understand demonstrate and explain this resilience, as well as the role of social support, to inform more effective mental health interventions, particularly for marginalised women [43].

Most mothers relied extensively on practical and financial support from their family, especially after childbirth and before their return to work. In particular, we found that receiving financial support from a current partner was an important mitigating factor for both food insecurity and depression. This suggests that the intimate partner relationship is central to women’s well-being, supporting findings from other studies [6]. However, despite being in a relationship with the father of their child, most women were living with their own family. This is common in SA because of the custom for men to pay
a substantial bride price (known as “Lobolo”) before marriage. As a result, while the child’s father contributed to the child’s expenses, this support did not extend to cover household running costs or women’s personal expenses, leaving women to carry the burden of providing a home for themselves and their child. Thus, these women experienced the “‘double-burden’” of income earning work and managing childcare and household responsibilities. While this is common among women in many settings, it is likely that women working in the informal sector, with few labour protections, are particularly affected [29]. In addition, childcare is often considered to be the mother’s decision and her sole responsibility. Encouraging positive attitudes towards childcare in the community and in the workplace through increased awareness of the importance of early nutrition and nurturing care, could strengthen the role of society, including social and public services, in supporting and protecting childcare.

Lack of service support and policy frameworks for women working in the informal economy means public authorities, employers and decision-makers currently have no responsibilities to engage with these issues. While some organizations have been active in advocating for women’s rights and livelihoods [44], it will be important to further mobilise worker and women’s rights organisations and key decision-makers to acknowledge or advocate for the rights of informal working women and their children. This includes advocacy for maternity leave agreements, by-laws which support working pregnant women and mothers, the allocation of safer spaces for childcare facilities and the safeguarding of trading spaces when pregnant women and mothers are away due to childbirth, breastfeeding or caring for their children. Providing social protection to informal working women during the perinatal period, such as through a pregnancy grant, extended CSG or community saving schemes, could safeguard women’s employment when they are not working during late pregnancy or the early postnatal period. Thereby stabilizing incomes and supporting women’s and children’s health, in particular by delaying the time to return to work after childbirth.

The health system also has an important role to play in addressing the interaction between food insecurity, depression, poverty and informal work. First, health services, including mental health care, should be free, available and accessible to informal working mothers and their children. This would
require reorienting the health system so PHC opening hours and available services are organised to meet the needs of women working in the informal economy. For example, women start their trading or domestic work well before health facilities commonly open. As a result, women lose income if they attend a clinic, especially if it is a distance away. To enable more responsive, people-centred care, a solution could be to extend the role of community health workers (CHWs) from visiting homes to include visiting public spaces, which are also women’s workspaces.

Second, in addition to clinical services, women need the capacity, including personal and social efficacy, to sustain their livelihoods while ensuring infants are appropriately fed and cared for. Health providers have a critical role to play in providing life-skills training and mentoring support for women to enable them to problem-solve, plan, and make decisions about their lives and their child. In addition, to support early nutrition and nurturing care, infant feeding and responsive childcare training would enable mothers and caregivers to make and implement optimal, evidence-based caregiving choices for their infants and young children.

Lastly, service support and health workforce strengthening are critical. For example, health care providers must have the capacity to confidently and competently provide services to women working in the informal sector and their children and be supported by systems that invest in their professional development and well-being.

**Strengths And Limitations Of The Study**

One strength of this study was the use of two different tools to assess depression risk, which allowed for validation of data and strengthened the interpretation of the findings. Field workers were trained and supervised by a professional psychologist to ensure consistency and appropriate use of the tools. However, some limitations must be acknowledged. Although mothers’ risk of depression was identified using screening tools, we did not conduct a full depression assessment to confirm the depression diagnosis. In addition, although the tools used to assess depression and food insecurity had been validated in SA and were translated into isiZulu, it is possible that cultural and language differences may have led to different interpretations of the questions. All participants were aware that referral mechanisms were in place, and participants may have believed that over-reporting indicators
of poverty and depression would give them access to additional support. However, we provided a link to referral services and support that is available to all South Africans, including emergency food supplementation and referral to the South African Social Security agency (SASSA).

Conclusion
Our study provides unique and important insights into the association between food insecurity, depression, poverty and informal work among women in Durban, SA. The health and livelihoods of women working in the informal economy, and the health and well-being of their infants and young children are compromised by a vicious cycle of vulnerability. This presents a major public health concern, particularly as the high rate of food insecurity greatly increases the risk for poor maternal health and child health and development outcomes [6, 21]. Further research is needed to improve our understanding of these interactions, particularly the role of social support and resilience as a protective factor.

Abbreviations
CHWs
Community Health Workers
CSG
Child Support Grant
EPDS
Edinburgh Postnatal Depression Score
HFIAS
Household Food Insecurity Access Scale
KZN
KwaZulu-Natal
PHC
Primary Health Care
SA
South Africa
UIF
Unemployment Insurance Fund

Declarations
Ethics approval and consent to participate
Ethical approval for the study were received from the University of KwaZulu-Natal Humanities and Social Sciences Research Ethics Committee (HSSREC) (HSS/0319/018), KZN Department of Health (HRKM235/18) and the World Health Organization Ethics Review Committee (ERC 0003101). All the participants signed a consent form prior to participating in the study. To maintain anonymity, codes were used for each participant based on the study site.

**Consent for publication**

Not applicable

**Availability of data and material**

The data or material used in the study is available from the corresponding author upon reasonable request.

**Competing interest**

The authors declare that they have no competing interests.

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**Disclaimer**

The views expressed in the manuscript do not necessarily represent the policies or recommendations of the World Health Organization

**Authors’ contributions**

CH, LH, SL and NR conceptualized the study. SL supervised the data collection process and CC oversaw the analysis of the data. CH, LH, RH and CC interpreted the results. CH, LH and RH wrote the first drafts. All the authors reviewed and commented on the manuscript throughout the writing process. All authors approved the final manuscript.

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