Impact of Chronic Diseases on Labour Force Participation among South African Women: Further Analysis of Population-Based Data

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Abstract: The impact of chronic diseases on labour force participation is not frequently examined or considered as part of cost-of-illness studies. The aim of this study was to determine the impact of chronic diseases on labour force participation among South African women. This study included 6126 women from the 2016 South African Demographic and Health Survey. Labour force participation/employment was the outcome variable. Data were analyzed in percentage and multivariable binary logistic regression. Results showed that approximately 28.7% of women participated in the labour force and about 5.0% had diabetes. The prevalence of diabetes among women who are not in the labour force was 5.5%, whereas those in the labour force reported 3.8% prevalence of diabetes. The diabetic women had 35% reduction in labour force participation when compared with non-diabetic women (aOR = 0.65; 95% CI: 0.48 to 0.89). Geographical region was associated with labour force participation. Rural women and those currently in union/living with a man had 35% (aOR = 0.65; 95% CI: 0.56 to 0.76) and 27% (aOR = 0.73; 95% CI: 0.64 to 0.85) reduction in labour force participation, respectively, when compared with their urban and single counterparts. The findings of this study revealed that diabetes was significantly associated with reduction in labour force participation among women.

Keywords: diabetes; NCDs; cardiovascular diseases; health economics; women's empowerment; employment

1. Background

Maternal health condition is a major determinant in labour force participation as chronic diseases are contributory factors of illness-related labour market outcomes [1]. It is worthy of note that chronic diseases have gradually become the leading causes of morbidity and mortality globally. They encompass a number of illnesses such as cancers, diabetes, chronic respiratory diseases, cardiovascular disease, and musculoskeletal disorders [2].

Similarly, in sub-Saharan Africa (SSA), the problem of chronic diseases and their risk factors are also on the increase, with numerous causes which may emerge in individuals, such as hypertension [3], renal failure [4], obesity, lipiduria, and diabetes [5,6]. Diabetes and its complications cause significant economic costs for people with diabetes and their families [7]. This burden can be closely linked to societal healthcare costs involved in disease management, unintended costs that come with decreased productivity attributable to patient disability and early death, time wasted by family members supporting patients when seeking medical attention, and lost earnings.

Previous investigation revealed the connection between a variety of health-related indicators and workforce outcomes. Theoretically, health can be viewed as a human capital endowment that declines over time but is able to improve due to household production [8]. This implies that healthy workers earn higher wages and are more likely to be involved in the labour supply. Individual preferences for labour supply may be influenced by the relative utility of leisure and work as well as a reduction in the total amount of time available to earn money if they are in poor health. Furthermore, health entitles a person to income from welfare benefits if they are unable to work [9,10]. However, that is not to say that external conditions at work may contribute to physical or mental ill health in some cases, but in the case of chronic diseases, this type of bidirectional causality is unexpected.

Generally, participation in the labour force has a key role in women's lives. Besides social support, work provides income, which has positive effects on wellbeing and the quality of life [11]. Evidence-based studies show significant indirect effects of diabetes on labour force outcomes [12]. Furthermore, a large proportion of people with diabetic conditions have negative labour market supply [13]. Improved health leads to increased productivity as well as an enhanced potential to earn more money, which may contribute to greater health investment [8]. Health status, in general, has the potential to influence an individual's stock of human capital. Long periods of illness are likely to reduce work capacity and ability to participate in the labour force.

The prevalence of diabetes in African women has more than doubled, rising from 4.1% in 1980 to 8.9% in 2014 [14]. The International Diabetes Federation (IDF) has called for the establishment of national diabetes programs to better deliver prevention and control solutions in light of the rapid rise in diabetes [15], in accordance with the United Nations Sustainable Development Goal (SDG) 3.4, which aims to reduce premature mortality from noncommunicable diseases (NCDs) by one-third by 2030 [16]. Women are more affected by diabetes when compared to men, and they often take on unpaid caregiver responsibilities for affected relatives in addition to managing their own diabetes/self-care [17]. Furthermore, if a diabetic woman becomes pregnant, her foetus is at a higher risk of developing the disease in adulthood, accelerating the familial risk of diabetes [18].

There is an assertion that diabetes is attributed to long-term lifestyle factors of individuals, such as consumption of alcohol, poor diet, heredity, smoking, and physical inactivity. Furthermore, diabetes management requires patient knowledge of self-management [15]. Therefore, many countries have designed disease prevention and control programs to reduce incidence and aid patients in managing the illness [19,20]. Without proper medical attention, diabetes can result in critical medical conditions and hamper a person's ability to work and result in missed workdays (absenteeism) or lower productivity (presenteeism) [21].

Previous studies indicate that diabetes has a clear impact on economic costs [22,23], work capability, job performance, macroeconomic productivity, and socioeconomic impact [21–23]. However, most cost-of-illness studies estimate costs based on productivity losses from morbidity and mortality [24]. To understand the adverse effects of diabetes on workforce participation is painstaking. The approach to investigate the relationship between diabetes and labour force participation requires rigorous analysis of possible confounders, reverse causality between diabetes and labour force participation (endogeneity), and various stages of complications. The effects of diabetes on workforce outcomes have been reported for several high-income countries [23,25,26]. There is a need to learn about

the impact of chronic diseases on labour force participation. The research question for this study is: what impact do chronic diseases have on labour force participation among South African women?

2. Materials and Methods

2.1. Data Source

The 2016 South African Demographic and Health Survey (DHS) data was analyzed. This study included 6126 women as participants. DHS is conducted worldwide and designed to provide a wide range of health data, such as data for demographics, vaccine uptake, fertility, nutrition, family planning, sexually transmitted diseases, intimate partner violence, health behaviours, mortality amongst others as part of an important resource for monitoring population health, and vital statistics indicators. The data are used globally in public health research to determine trends, prevalence, associations, and inequalities. DHS uses a multi-stage stratified cluster random sampling approach to identify households in enumeration areas. In this study, data from the women's questionnaire was used. DHS datasets are available for researchers upon request at: http://dhsprogram.com/data/available-datasets.cfm (accessed on 9 December 2022).

2.2. Variable Selection and Measurement

2.2.1. Outcome Variable

Labour force participation was obtained from the variable "currently working". Women were asked about their current job status, to which they responded "yes" coded as 1 or "no" coded as 0. Individuals who reported "yes" were considered as participating in the labour force.

2.2.2. Exposure Variable

Respondents were asked if they were diagnosed with diabetes and other chronic diseases (high blood pressure, heart attack, cancer, stroke, high blood cholesterol, chronic bronchitis, and asthma) by a doctor/nurse, to which they responded "yes" or "no".

2.2.3. Covariates

- Age (years): 15–19/20–24/25–29/30–34/35–39/40–44/45–49/50+
- Region: Western Cape/Eastern Cape/Northern Cape/Free State/Kwazulu-Natal/North West/Gauteng/Mpumalanga/Limpopo
- Residential status: urban/rural
- Education: no formal education/primary/secondary/higher
- Sex of household head: male/female
- Household wealth quintiles: DHS calculated the household wealth index as a cumulative composite of household assets using principal component analysis (PCA) and placed them on a continuous relative wealth scale [27,28]. The z-scores and factor loadings of each household asset was calculated. The loadings were multiplied by the indicator values of each household asset and then added together to calculate the wealth index value. The overall standardized z-scores were grouped to the wealth quintiles poorest/poorer/middle/richer/richest.
- Marital status: single/currently in union or living with a man/formerly in union
- Respondent perception of own health: poor/average/good/excellent
- Covered by health insurance: no/yes

2.3. Ethical Considerations

For this research, the investigators utilized anonymized secondary datasets available in the public domain. The authors requested access and permission was granted to use the data by MEASURE DHS/ICF International. The DHS Program complies with the industry standards to protect women's privacy during the survey. ICF International guarantees that the survey follows the United States Department of Health and Human Services'

Human Subjects Protection Act. The study did not require any additional informed consent. More details about DHS data and ethical standards are available at http://goo.gl/ny8T6X (accessed on 9 December 2022).

2.4. Statistical Analysis

Due to the survey design involving stratification, clustering, and weighting, the stata survey module ('svy') was used in data analyses. In addition, variance inflation factor (VIF) was used to assess collinearity at a cut-off of 10 to detect significant concerns of interdependence of variables [29]. However, there was no collinearity found. Percentage was used for univariate analysis. To estimate the adjusted odds ratios, all statistically significant variables from the unadjusted logistic regression model were included in the multivariable logistic regression model using a 20% significance level. The statistical significance was determined in the adjusted model at $p < 0.05$. Stata version 14 (StataCorp., College Station, TX, USA) was used for data analyses.

3. Results

Table 1 shows the distribution of chronic diseases and women's characteristics. Approximately 5% of women have diabetes. In addition, high blood pressure, heart attack, cancer, stroke, high blood cholesterol, chronic bronchitis, and asthma reported 23.7%, 4.1%, 1.2%, 1.7%, 3.3%, 1.5%, and 4.0%, respectively. Women aged 50+ years accounted for 31.6% of the total sample. Women from Kwazulu-Natal, urban women, those with secondary education, female household head, those never in union, those not covered by health insurance, and those not currently working comprised 15.8%, 54.9%, 64.1%, 62.4%, 50.2%, 86.4% of the sample, respectively.

Table 1. Distribution of women's characteristics.

Variable	Number of Women	Percentage (%)
Diabetes		
No	5817	95.0
Yes	309	5.0
High blood pressure		
No	4676	76.3
Yes	1450	23.7
Heart attack		
No	5873	95.9
Yes	253	4.1
Cancer		
No	6054	98.8
Yes	72	1.2
Stroke		
No	6020	98.3
Yes	106	1.7
High blood cholesterol		
No	5924	96.7
Yes	202	3.3
Chronic bronchitis		
No	6034	98.5
Yes	92	1.5
Asthma		
No	5880	96.0
Yes	246	4.0
Age (in years)		
15–19	730	11.9
20–24	686	11.2

Table 1. *Cont.*

Variable	Number of Women	Percentage (%)
25–29	712	11.6
30–34	622	10.2
35–39	524	8.6
40–44	465	7.6
45–49	454	7.4
50+	1933	31.6
Region		
Western Cape	474	7.7
Eastern Cape	798	13.0
Northern Cape	529	8.6
Free State	647	10.6
Kwazulu-Natal	968	15.8
North West	581	9.5
Gauteng	561	9.2
Mpumalanga	705	11.5
Limpopo	863	14.1
Residential status		
Urban	3361	54.9
Rural	2765	45.1
Education		
No formal education	586	9.6
Primary	1048	17.1
Secondary	3927	64.1
Higher	565	9.2
Sex of household head		
Male	2304	37.6
Female	3822	62.4
Household wealth		
Poorest	1070	17.5
Poorer	1226	20.0
Middle	1340	21.9
Richer	1250	20.4
Richest	1240	20.2
Marital status		
Never in union	3076	50.2
Currently in union/living with a man	2053	33.5
Formerly in union	997	16.3
Respondent perception of own health		
Poor	792	12.9
Average	2046	33.4
Good	2493	40.7
Excellent	795	13.0
Covered by health insurance		
No	5295	86.4
Yes	831	13.6
Currently working		
No	4371	71.3
Yes	1755	28.7

Table 2 shows the prevalence of diabetes and selected chronic diseases by labour force participation status and across women's characteristics. Overall, the prevalence of diabetes among women who are out of and in labour force participation were 5.5% and 3.8%, respectively. The results showed higher prevalence of diabetes and selected chronic diseases among women who are out of labour force participation. In addition, the prevalence of diabetes and selected chronic diseases increased by women's advanced age. Among women who are out of labour force participation, there was a higher prevalence of diabetes and selected chronic diseases in the urban dwellers. Furthermore, the prevalence of diabetes was higher among women from the richest household wealth quintiles, those currently in union/living with a partner, those covered by health insurance, and those who had poor perception of their own health.

Table 2. Prevalence of diabetes and selected chronic diseases across women's characteristics by labour force participation status.

Variable	Currently Working								Not Currently Working							
	Diabetes (%)	Heart Attack (%)	Cancer (%)	Stroke (%)	High Blood Cholesterol (%)	High Blood Pressure (%)	Chronic Bronchitis (%)	Asthma (%)	Diabetes (%)	Heart Attack (%)	Cancer (%)	Stroke (%)	High Blood Cholesterol (%)	High Blood Pressure (%)	Chronic Bronchitis (%)	Asthma (%)
Age (in years)																
15–19	0.0	5.0	0.0	0.0	0.0	5.0	5.0	5.0	0.3	0.7	0.3	0.3	0.4	1.8	0.4	2.4
20–24	1.9	2.8	0.0	0.0	1.9	3.7	0.0	1.9	0.2	0.9	0.2	0.4	0.5	3.6	0.7	2.1
25–29	0.4	1.6	0.0	0.0	1.6	8.4	0.0	2.8	0.0	1.3	0.0	0.4	0.2	7.6	0.4	2.2
30–34	0.8	1.9	0.0	1.5	1.5	10.3	1.2	2.7	1.4	2.5	1.4	1.9	0.6	9.7	0.6	5.3
35–39	1.7	2.2	1.3	2.2	1.3	10.7	0.4	0.9	3.1	2.4	1.7	1.4	1.7	17.2	1.0	3.8
40–44	2.3	2.7	2.7	1.8	2.3	22.4	1.8	3.7	4.9	2.4	1.6	0.8	2.4	20.3	0.4	2.0
45–49	3.4	4.3	1.3	2.6	3.8	28.9	2.1	2.1	8.7	7.3	1.8	1.8	2.7	24.7	0.5	5.5
50+	10.5	6.1	1.9	1.9	7.7	45.3	2.6	5.6	12.9	9.2	2.1	3.7	7.7	53.4	3.4	6.9
Region																
Western Cape	6.5	2.2	3.8	2.7	8.2	27.7	3.3	3.3	9.0	5.2	2.1	3.1	12.4	32.8	5.2	10.0
Eastern Cape	7.5	3.8	2.4	0.9	2.4	27.2	1.4	2.8	7.4	5.3	1.4	2.4	3.9	29.1	1.0	8.2
Northern Cape	2.8	2.8	1.4	1.4	0.7	25.0	1.4	1.4	5.5	6.2	1.3	1.3	1.6	30.4	0.5	5.5
Free State	2.9	4.6	0.6	0.6	5.2	28.3	0.6	2.9	6.8	6.1	1.9	2.1	3.2	30.8	1.3	3.2
Kwazulu-Natal	1.8	1.8	0.4	3.5	3.1	14.5	0.0	2.6	6.8	1.6	0.4	1.2	3.0	17.3	1.6	3.2
North West	4.4	3.9	0.0	1.1	2.8	26.0	1.7	4.4	3.5	5.5	1.0	2.5	3.3	31.0	0.8	4.5
Gauteng	4.6	3.1	1.0	1.0	5.6	18.3	1.0	5.1	4.1	2.5	1.4	0.8	4.1	20.6	1.7	1.9
Mpumalanga	2.3	5.6	0.5	1.9	0.9	20.0	0.9	4.7	4.3	5.7	1.6	2.0	1.6	20.6	1.4	3.5
Limpopo	1.8	3.2	0.5	0.5	2.3	16.3	2.7	1.4	3.1	3.6	0.6	1.4	0.6	16.4	1.6	1.7
Residential status																
Urban	4.0	2.8	1.5	1.7	4.6	22.2	1.2	3.5	6.2	4.5	1.5	2.1	5.1	26.8	1.9	4.7
Rural	3.5	4.6	0.5	1.3	1.3	22.2	1.8	2.7	4.9	4.3	0.9	1.5	1.4	21.6	1.2	4.0
Education																
No formal education	4.8	6.0	1.2	0.0	2.4	42.9	0.0	1.2	10.0	7.2	1.2	4.2	4.6	45.0	2.0	5.0
Primary	5.6	6.0	0.9	3.2	3.7	27.8	0.9	5.6	8.8	8.3	1.3	2.8	3.7	39.1	1.9	5.7
Secondary	3.1	2.6	1.1	1.7	2.8	20.9	1.5	3.0	3.7	3.0	1.0	1.2	2.7	16.8	1.3	3.9
Higher	5.1	3.8	1.6	0.3	5.7	17.5	1.9	2.9	6.4	2.0	2.8	1.2	4.8	17.2	2.4	4.0
Sex of household head																
Male	3.5	3.3	1.7	1.5	3.9	21.7	1.5	3.3	5.7	4.5	1.5	2.0	4.1	22.5	1.8	4.3
Female	4.0	3.5	0.8	1.6	3.1	22.4	1.4	3.1	5.4	4.4	1.0	1.7	2.7	25.3	1.4	4.4

Table 2. *Cont.*

Variable	Currently Working								Not Currently Working							
	Diabetes (%)	Heart Attack (%)	Cancer (%)	Stroke (%)	High Blood Cholesterol (%)	High Blood Pressure (%)	Chronic Bronchitis (%)	Asthma (%)	Diabetes (%)	Heart Attack (%)	Cancer (%)	Stroke (%)	High Blood Cholesterol (%)	High Blood Pressure (%)	Chronic Bronchitis (%)	Asthma (%)
Household wealth																
Poorest	1.2	3.7	1.2	2.4	0.8	19.5	0.0	2.0	2.6	2.8	0.7	1.1	1.3	16.6	1.0	3.8
Poorer	1.4	1.7	1.0	1.0	2.0	20.6	0.3	1.7	3.2	5.3	0.7	2.3	1.6	26.3	1.0	5.4
Middle	4.9	3.4	0.6	1.7	2.9	24.4	1.4	2.3	6.5	4.4	0.9	1.8	2.8	22.9	1.0	3.3
Richer	6.0	5.0	1.5	1.5	4.5	23.3	2.5	4.5	7.5	5.5	1.7	2.2	4.0	26.9	2.1	4.4
Richest	4.1	3.0	1.3	1.3	5.2	21.9	1.9	4.3	8.1	3.9	2.2	1.6	7.0	28.8	2.8	5.0
1-17 Marital status																
Never in union	2.9	2.4	1.0	1.3	2.5	15.6	0.8	2.7	2.8	2.3	0.7	1.1	1.7	12.9	1.0	2.6
Currently in union/living with a man	3.9	3.5	1.5	1.6	4.2	24.9	1.6	3.5	7.4	5.9	1.8	2.1	4.8	29.7	2.1	5.1
Formerly in union	6.1	6.1	0.7	2.2	4.0	34.2	2.9	4.0	10.9	8.5	1.7	3.8	5.4	50.1	2.2	8.3
Respondent perception of own health																
Poor	9.4	12.6	1.3	6.9	5.0	39.6	2.5	7.6	12.2	12.3	2.4	5.5	4.7	47.2	3.0	9.3
Average	6.3	4.7	1.7	1.5	5.6	32.0	2.1	5.0	8.1	5.4	1.6	2.0	4.5	32.1	2.0	5.0
Good	2.2	1.7	1.1	1.0	2.2	16.1	1.1	1.7	2.2	1.7	0.6	0.5	2.3	14.5	0.9	2.9
Excellent	0.0	0.4	0.0	0.0	1.7	9.2	0.4	1.3	1.1	0.7	0.5	0.9	1.1	6.3	0.5	1.3
Covered by health insurance																
No	3.5	4.1	0.9	1.6	3.0	21.6	1.1	3.0	5.0	4.3	1.1	1.7	2.5	23.5	1.3	4.2
Yes	4.9	1.4	1.9	1.4	4.7	23.9	2.6	3.8	11.1	5.2	2.0	2.7	10.9	31.7	4.2	5.9
Total estimate	3.8	3.4	1.1	1.5	3.4	22.2	1.4	3.2	5.5	4.4	1.2	1.8	3.3	24.3	1.5	4.4

Table 3 shows the factors associated with labour force participation. The diabetic women had 35% reduction in labour force participation when compared with non-diabetic women (aOR = 0.65; 95% CI: 0.48 to 0.89). Furthermore, advance aged, education, those having good perception of their own health, and those covered by health insurance were more likely to be out of labour force participation when compared with women aged 15–19 years. Geographical region was associated with labour force participation. Rural women and those currently in union/living with a man had 35% and 27% reduction in labour force participation, respectively, when compared with their urban and single counterparts.

Table 3. Diabetes and covariates associated with labour force participation among women.

Variable	Unadjusted Odds Ratio	95% CI	Adjusted Odds Ratio	95% CI
Diabetes				
No	1.00		1.00	
Yes	0.68	0.57 to 0.81	0.65	0.48 to 0.89
High blood pressure				
No	1.00		1.00	
Yes	0.89	0.81 to 0.97	0.95	0.80 to 1.12
Heart attack				
No	1.00		1.00	
Yes	0.77	0.63 to 0.93	0.97	0.70 to 1.34
Cancer				
No	1.00			
Yes	0.96	0.68 to 1.34		
Stroke				
No	1.00			
Yes	0.84	0.64 to 1.13		
High blood cholesterol				
No	1.00			
Yes	1.05	0.86 to 1.29		
Chronic bronchitis				
No	1.00			
Yes	0.93	0.69 to 1.26		
Asthma				
No	1.00		1.00	
Yes	0.73	0.59 to 0.88	0.74	0.53 to 1.04
Age (in years)				
15–19	1.00		1.00	
20–24	6.63	4.81 to 9.14	6.62	4.03 to 10.86
25–29	19.33	14.21 to 26.29	20.17	12.50 to 32.54
30–34	25.66	18.85 to 34.95	30.42	18.76 to 49.33
35–39	28.42	20.18 to 38.82	32.94	20.20 to 53.72
40–44	31.60	23.09 to 43.26	40.16	24.46 to 65.94
45–49	38.09	27.81 to 52.17	52.94	32.13 to 87.22
50+	10.10	7.49 to 13.61	15.94	9.80 to 25.91
Region				
Western Cape	1.00		1.00	
Eastern Cape	0.57	0.49 to 0.67	0.91	0.69 to 1.21
Northern Cape	0.59	0.50 to 0.70	0.73	0.54 to 0.98
Free State	0.58	0.49 to 0.68	0.68	0.51 to 0.90
Kwazulu-Natal	0.48	0.41 to 0.56	0.72	0.55 to 0.95
North West	0.71	0.60 to 0.84	1.02	0.76 to 1.36
Gauteng	0.85	0.72 to 1.01	0.90	0.68 to 1.19
Mpumalanga	0.69	0.59 to 0.81	1.17	0.88 to 1.56
Limpopo	0.54	0.46 to 0.63	0.94	0.70 to 1.26
Residential status				
Urban	1.00		1.00	
Rural	0.58	0.54 to 0.63	0.65	0.56 to 0.76

Table 3. *Cont.*

Variable	Unadjusted Odds Ratio	95% CI	Adjusted Odds Ratio	95% CI
Education				
No formal education	1.00		1.00	
Primary	1.55	1.30 to 1.86	1.44	1.08 to 1.92
Secondary	2.44	2.09 to 2.86	2.02	1.54 to 2.66
Higher	7.53	6.25 to 9.07	3.87	2.76 to 5.42
Sex of household head				
Male	1.00			
Female	0.98	0.91 to 1.05		
Household wealth				
Poorest	1.00		1.00	
Poorer	1.07	0.94 to 1.21	1.00	0.81 to 1.24
Middle	1.18	1.04 to 1.33	1.05	0.85 to 1.30
Richer	1.57	1.39 to 1.77	1.17	0.95 to 1.45
Richest	2.01	1.78 to 2.27	1.21	0.97 to 1.53
Marital status				
Never in union	1.00		1.00	
Currently in union/living with a man	1.45	1.34 to 1.57	0.73	0.64 to 0.85
Formerly in union	1.12	1.05 to 1.24	1.00	0.82 to 1.22
Respondent perception of own health				
Poor	1.00		1.00	
Average	1.42	1.24 to 1.61	1.21	0.98 to 1.51
Good	1.95	1.72 to 2.22	1.55	1.24 to 1.93
Excellent	1.70	1.46 to 1.98	1.56	1.19 to 2.05
Covered by health insurance				
No	1.00		1.00	
Yes	3.16	2.86 to 3.48	2.07	1.72 to 2.50

CI, confidence interval.

4. Discussion

The evidence suggests that diabetes has a negative impact on labour force participation. This is consistent with previous research findings [30,31]. Diabetes has direct and indirect impact on socioeconomic costs in the society due in part to reductions in productivity and participation in labour force. Moreover, in a previous study, only diabetes with complications resulted in a complete labour force exit [32]. The findings from another study revealed that people with diabetes who have complications are more likely to be unemployed than people with diabetes who do not have complications [33]. According to the available evidence, people with diabetes are more likely to leave the labour force early, retire early, or receive a permanent disability pension.

The prevalence of diabetes is increasing not only in high-income countries but also in resource-constrained settings. To address the negative impact of diseases on labour force participation and economic development, several policies and programs have been designed. One of the primary goals of the current pension reforms is to maintain and possibly extend the ability to participate in workforce of older workers. This study, however, indicates that women with diabetes may be unable to maintain their employment status and, as a result, leave the labour market sooner [15]. A significant effort should be made to improve and extend the ability of diabetics to work. Additionally, particular emphasis should be placed on developing and improving the effectiveness of evidence-based prevention and management programs.

Furthermore, we found that labour force participation increased by increasing educational attainment. Other factors that were found to be significantly associated with

labour force participation include geographical region, residential status, age, marital status, women's perception of own health, and health insurance coverage. A previous study found that higher educational attainment increases a woman's likelihood of participating in the labour force [34]. Educational training is a medium where women acquire the knowledge and skill sets to be employed. It is generally assumed that the higher an individual grows in formal education, the better chance she has to gain employment. Hence, the findings of positive association between a woman's educational attainment and labour force participation corroborate with reports from previous studies.

Ultimately, the findings of this study should be improved by looking into the underlying dynamics and strengthening the evidence to practice. To begin, future cost studies on adverse effects of diabetes or its complications on workforce outcomes should account for the complete absence of unemployment or missed workdays. This will help to forestall a gross underestimation of the burden imposed by this condition on economic development. Furthermore, future studies should examine the male population and level of disease complications as well as examine reverse causality. These methods should be used for all outcomes, not just the presence or absence of labour force participation. It is possible that other factors may have been responsible for lack of labour force participation, and it is recommended that endogeneity should be examined in future studies. This will help to identify the underlying factors and processes, whether unobserved factors or through reverse causality. That could help to understand how a chronic lifestyle illness affects workforce outcomes.

Strengths and Limitations

This study provided evidence on the effect of diabetes on labour force participation, including absence of employment. The use of nationally representative data, which makes the findings generalizable, is the study's main strength. In this study, however, only association, not causality, can be established. Furthermore, other aspects of the disease, such as management efficiency, health literacy, and medication adherence, were not investigated. These should have been considered in the analysis in order to gain a better understanding of the underlying factors and to allow for the individualization of concrete starting points for practical intervention. Finally, this study relied on self-report of diabetes. More objective methods of determining diabetes and an understanding of which factors and dynamics actually lead to poor labour force outcomes using various modeling strategies for comorbidities and complications should be used in future research [35,36].

5. Conclusions

The findings of the study show some correlation between chronic diseases and labour force participation among South African women. We found diabetes to be associated with reduction in labour force participation. We recommend concerted efforts in improving chronic diseases modelling and the understanding of how the illnesses are linked to labour force participation and outcomes. This is important not only for calculating economic costs accurately, but it may also be useful in developing evidence-based prevention and disease management programmes.

Institutional Review Board Statement: Ethics approval was not required for this study because the authors used secondary data that was freely available in the public domain. As a result, IRB approval is not required for this study. More information about DHS data and ethical standards can be found at: http://dhsprogram.com/data/available-datasets.cfm (accessed on 9 December 2022).

Informed Consent Statement: The Demographic and Health Survey is an open-source dataset that has been de-identified. As a result, the consent for publication requirement is not applicable.

Data Availability Statement: Data for this study were obtained from the National Demographic and Health Surveys (DHS) of the studied African countries, which can be found at http://dhsprogram.com/data/available-datasets.cfm (accessed on 9 December 2022).

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Schofield, D.J.; Shrestha, R.N.; Passey, M.E.; Earnest, A.; Fletcher, S.L. Chronic disease and labour force participation among older Australians. *Med. J. Aust.* **2008**, *189*, 447–450. [CrossRef] [PubMed]
2. Chestnov, O. *Global Action Plan for the Prevention and Control of Noncommunicable Diseases*; World Health Organization: Geneva, Switzerland, 2013.
3. Akinlua, J.T.; Meakin, R.; Umar, A.M.; Freemantle, N. Current Prevalence Pattern of Hypertension in Nigeria: A Systematic Review. *PLoS ONE* **2015**, *10*, e0140021. [CrossRef]
4. Ekholuenetale, M.; Adeyoju, T.O.; Onuoha, H.; Barrow, A. Renal Failure among Women of Reproductive Age in Burundi: Estimating the Prevalence and Associated Factors Using Population-Based Data. *Int. J. Nephrol.* **2021**, *2021*, 6640495. [CrossRef] [PubMed]
5. Kassa, G.M.; Muche, A.A.; Berhe, A.K.; Fekadu, G.A. Prevalence and determinants of anemia among pregnant women in Ethiopia; a systematic review and meta-analysis. *BMC Hematol.* **2017**, *17*, 17. [CrossRef] [PubMed]
6. Amugsi, D.A.; Dimbuene, Z.T.; Mberu, B.; Muthuri, S.; Ezeh, A.C. Prevalence and time trends in overweight and obesity among urban women: An analysis of demographic and health surveys data from 24 African countries, 1991. *BMJ Open* **2017**, *7*, e017344. [CrossRef]
7. Kirigia, J.M.; Sambo, H.B.; Sambo, L.G.; Barry, S.P. Economic burden of diabetes mellitus in the WHO African region. *BMC Int. Health Hum. Rights* **2009**, *9*, 6. [CrossRef]
8. Currie, J.; Madrian, B.C. Health, Health Insurance and the Labor Market. In *Handbook of Labor Economics*; Elsevier: Amsterdam, The Netherlands, 1999; pp. 3309–3416.
9. Cai, L.; Kalb, G. Health status and labour force participation: Evidence from Australia. *Health Econ.* **2005**, *15*, 241–261. [CrossRef]
10. Mushtaq, A.; Mohsin, A.; Zaman, K. Effects of health on changing labor force participation in Pakistan. *SpringerPlus* **2013**, *2*, 610. [CrossRef]
11. Chorus, A.M.J.; Miedema, H.S.; Wevers, C.J.; van der Linden, S. Labour force participation among patients with rheumatoid arthritis. *Ann. Rheum. Dis.* **2000**, *59*, 549–554. [CrossRef]
12. Harris, A. Diabetes, Cardiovascular Disease and Labour Force Participation in Australia: An Endogenous Multivariate Probit Analysis of Clinical Prevalence Data. *Econ. Rec.* **2009**, *85*, 472–484. [CrossRef]
13. Schofield, D.J.; Cunich, M.; Shrestha, R.N.; Callander, E.J.; Passey, M.E.; Kelly, S.J.; Tanton, R.; Veerman, L. The Impact of Diabetes on the Labour Force Participation and Income Poverty of Workers Aged 45–64 Years in Australia. *PLoS ONE* **2014**, *9*, e89360. [CrossRef]
14. NCD Risk Factor Collaboration (NCD-RisC)—Africa Working Group. Trends in obesity and diabetes across Africa from 1980 to 2014: An analysis of pooled population-based studies. *Int. J. Epidemiol.* **2017**, *46*, 1421–1432. [CrossRef]
15. Atlas, D.; International Diabetes Federation. *IDF Diabetes Atlas*; International Diabetes Federation: Brussels, Belgium, 2015; Available online: https://diabetesatlas.org/ (accessed on 27 November 2021).
16. Rosa, W. (Ed.) Transforming Our World: The 2030 Agenda for Sustainable Development. In *A New Era in Global Health*; Springer Publishing Company: New York, NY, USA, 2017.
17. WHO. *Montevideo Roadmap 2018–2030 on NCDs as a Sustainable Development Priority*; WHO: Geneva, Switzerland, 2017.
18. Clausen, T.D.; Mathiesen, E.R.; Hansen, T.; Pedersen, O.; Jensen, D.M.; Lauenborg, J.; Damm, P. High prevalence of type 2 diabetes and pre-diabetes in adult offspring of women with gestational diabetes mellitus or type 1 diabetes: The role of intrauterine hyperglycemia. *Diabetes Care* **2008**, *31*, 340–346. [CrossRef]
19. Albright, A. The National Diabetes Prevention Program: From Research to Reality. *Diabetes Care Educ. Newsl.* **2012**, *33*, 4–7.
20. Fuchs, S.; Henschke, C.; Blümel, M.; Busse, R. Disease Management Programs for Type 2 Diabetes in Germany. *Dtsch. Ärzteblatt Int.* **2014**, *111*, 453–463. [CrossRef]
21. Breton, M.-C.; Guenette, L.; Amiche, M.A.; Kayibanda, J.-F.; Gregoire, J.-P.; Moisan, J. Burden of Diabetes on the Ability to Work: A systematic review. *Diabetes Care* **2013**, *36*, 740–749. [CrossRef]

22. Chaker, L.; Falla, A.; van der Lee, S.; Muka, T.; Imo, D.; Jaspers, L.; Colpani, V.; Mendis, S.; Chowdhury, R.; Bramer, W.; et al. The global impact of non-communicable diseases on macro-economic productivity: A systematic review. *Eur. J. Epidemiol.* **2015**, *30*, 357–395. [CrossRef]
23. Seuring, T.; Archangelidi, O.; Suhrcke, M. The Economic Costs of Type 2 Diabetes: A Global Systematic Review. *PharmacoEconomics* **2015**, *33*, 811–831. [CrossRef]
24. Ettaro, L.; Songer, T.J.; Zhang, P.; Engelgau, M.M. Cost-of-Illness Studies in Diabetes Mellitus. *PharmacoEconomics* **2004**, *22*, 149–164. [CrossRef]
25. Latif, E. The impact of diabetes on employment in Canada. *Health Econ.* **2009**, *18*, 577–589. [CrossRef]
26. Brown, H.S.; Pagán, J.A.; Bastida, E. The impact of diabetes on employment: Genetic IVs in a bivariate probit. *Health Econ.* **2005**, *14*, 537–544. [CrossRef] [PubMed]
27. Vyas, S.; Kumaranayake, L. Constructing socio-economic status indices: How to use principal components analysis. *Health Policy Plan.* **2006**, *21*, 459–468. [CrossRef] [PubMed]
28. Rutstein, S.O.; Staveteig, S. *Making the Demographic and Health Surveys Wealth Index Comparable*; DHS Methodological Reports No. 9; ICF International: Rockville, MA, USA, 2014.
29. Midi, H.; Sarkar, S.K.; Rana, S. Collinearity diagnostics of binary logistic regression model. *J. Interdiscip. Math.* **2010**, *13*, 253–267. [CrossRef]
30. Pedron, S.; Emmert-Fees, K.; Laxy, M.; Schwettmann, L. The impact of diabetes on labour market participation: A systematic review of results and methods. *BMC Public Health* **2019**, *19*, 25. [CrossRef]
31. Schofield, D.; Cunich, M.; Kelly, S.; Passey, M.E.; Shrestha, R.; Callander, E.; Tanton, R.; Veerman, L. The Impact of Diabetes on the Labour Force Participation, Savings and Retirement Income of Workers Aged 45–64 Years in Australia. *PLoS ONE* **2015**, *10*, e0116860. [CrossRef]
32. Kraut, A.; Walld, R.; Tate, R.; Mustard, C. Impact of diabetes on employment and income in Manitoba, Canada. *Diabetes Care* **2001**, *24*, 64–68. [CrossRef]
33. Ng, Y.C.; Jacobs, P.; Johnson, J.A. Productivity losses associated with diabetes in the US. *Diabetes Care* **2001**, *24*, 257–261. [CrossRef]
34. Hosney, S.H. *Factors Influencing Female Labor Force Participationin Egypt and Germany: A Comparative Study*; SOEPpapers on Multidisciplinary Panel Data Research, No. 826; Deutsches Institut für Wirtschaftsforschung (DIW): Berlin, Germany, 2016; p. 74.
35. Davis-Ajami, M.L.; Nahata, M.C.; Reardon, G.; Seiber, E.E.; Balkrishnan, R. Associations between Joblessness and Oral Anti-diabetic Medication Adherence in US Diabetic Working-age Adults. *Health Outcomes Res. Med.* **2012**, *3*, e139–e151. [CrossRef]
36. Rak, E.C. Employment Outcomes in Persons With Diabetes: The Role of Health Literacy and Diabetes Management Self-Efficacy. *Rehabil. Couns. Bull.* **2014**, *57*, 159–169. [CrossRef]