



# Epidemiology and trends of caesarean section births in the medical schemes' population, 2015 – 2018

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## Abstract

**Background:** Caesarean deliveries in the population covered by medical schemes is significantly higher than the South Africa public health sector average, and international experience. The high frequency of caesarean deliveries in the private sector may be indicative of inefficient use of healthcare resources, supplier induced demand, lack of coordinated maternal care and poor choices by members of medical schemes. Caesarean deliveries attract higher healthcare costs for hospital, specialists, pharmaceuticals and other healthcare services compared to normal vaginal deliveries.

**Objectives:** The objective of the study was to evaluate trends in the utilisation and expenditure on caesarean deliveries in the population covered by medical schemes between 2015 and 2018.

**Methods:** This cross-sectional analytical study included all benefit options registered between 2015 and 2018 financial years. The study population included births ranging from 116 063 in 2015 to 105 485 in 2018. Chi-square tests were used to identify significant associations between caesarean delivery and identified risk factors for which data is available. In addition, a multiple logistic regression was used to model the odds of caesarean delivery by risk factors to determine the existence of associations.

**Results:** The 2018 rate of caesarean deliveries of 76.9% in the population covered by medical is among the highest in the world. Our analysis showed an annualised increase of 0.6% for caesarean deliveries, a trend which is expected to continue in the absence of appropriate interventions. A significant finding of our study is the impact of EDO options on the reduction of caesarean deliveries. As expected, maternal age was a risk factor for caesarean deliveries. Benefit design did not show a strong association with caesarean deliveries, though odds of a caesarean delivery were significantly low in comprehensive plans compared to hospital plans. The study showed that the average cost of caesarean deliveries (R37 596.19 ± R548.11) was at least 75% higher than that of normal deliveries (R21 545.37 ± R311.18).

**Conclusions:** Urgent steps must be taken to reduce what is likely to be high levels of medically unnecessary caesarean delivery rates in the medical schemes population. Future studies must investigate the health outcomes of associated with caesarean deliveries in the medical schemes' population. Factors for investigation may include but not be limited to gestational age at the time of caesarean delivery, post-delivery hospital admission of baby or mother, birth weight and maternal clinical comorbidities.

## INTRODUCTION

The Council for Medical Schemes (CMS) is the regulatory authority responsible for the supervision of medical schemes in terms of the Medical Schemes Act (Republic of South Africa, 1998). Section 7 of the Act mandates the CMS to perform functions that amongst others include protecting the interests of medical scheme beneficiaries.

The regulatory framework contained in the Act includes a system of mandatory minimum benefits known as Prescribed Minimum Benefits (PMBs). PMBs are made up of a list of 270 diagnosis and treatment pairs that were introduced from 1 January 2000 and 25 defined chronic conditions introduced from 1 January 2004. Schemes are legally obliged to offer and pay for these benefits in full for all benefit options.

PMBs cover birth admissions and delivery of a baby. Antenatal care is covered only when hospitalisation of the pregnant woman is required before she gives birth. However, most medical schemes cover routine antenatal care in terms of their registered rules (Council for Medical Schemes, 2011).

Normal vaginal deliveries (NVD) are a prevailing standard of care and medical schemes, in terms of PMB legislation, are obliged to pay for them in full. A caesarean birth is considered a PMB only in situations where it is deemed clinically appropriate. Medical schemes may decline to fund elective caesarean section (CS) deliveries (Council for Medical Schemes, 2011). The rate of caesarean births, most of which are likely to be elective, has remained intractably high in the population covered by medical schemes, even though they are not a PMB condition (Willie, 2012).

CS births continue to increase despite the known associated adverse health outcomes. These include increased risk of infection, surgical and anaesthetic complications, reduced likelihood of breastfeeding, and risks for the baby. A CS can be a life-saving procedure when certain conditions such as life-threatening maternal or perinatal complications are present (Meng, Zou, Ding et al., 2019). It is only under these conditions that CS may be eligible to be funded as PMB level of care. It follows, therefore that healthcare providers and funders should aim for a CS rate that is associated with the lowest possible adverse health outcomes for mothers and neonates.

According to the WHO, there is no clinical "justification for any region to have a CS rate higher than 10 – 15 %" (Betran, Torloni, Zhang et al., 2015). Delivery by CS in the population covered by medical schemes averaged between 59% and 70% in the last 10 years (Council for Medical Schemes, 2018). Massyn,

Peer, Padarath et al. (2016) reported CS rates of 26.2% in the South African public sector for the 2015/2016 financial year. The CS rate for the African region was 7.3% in 2014 (Betran, Torloni, Zhang et al., 2016).

If clinically indicated, the high levels of CS rates may suggest a crisis in maternal health of in the population covered by medical schemes. It is unlikely that maternal health status of women covered by medical schemes is worse than that of the general population. On the contrary, women with medical scheme cover are more likely to have better socio-economic profile and enjoy extensive access to health services that is not available to the general population not covered by medical schemes.

The dominant fee-for-service payment mechanism used by medical schemes for paying for hospital and specialists services may be one of the factors responsible for the high rates of CS. It is possible that providers are incentivised by the fee-for-service system to perform more CS because of the higher reimbursement rate compared to vaginal births (Meng et al., 2019). Furthermore, physicians working independently, as opposed to working in patient-centred team-based models that are designed for better coordination of care, are likely to opt for CS in the delivery of the baby.

It has been reported in the media that specialists who deliver babies by CS are likely to be doing so because of fear of litigation and high cost of medical malpractice insurance (Hlatshaneni, 2018, Wasserman, 2019). The convenience of being able to schedule births admissions is also an incentive for specialists to perform CS. Beneficiary factors include pregnant mothers choosing caesarean birth believing that it is less painful and more convenient than NVD. Medical scheme membership makes this preference affordable.

## **Rationale**

CS births in the population covered by medical schemes is significantly above the South Africa public sector hospitals average, and international experience. The high frequency of CS births in the private sector may also be indicative of inefficient use of healthcare resources, supplier induced demand, lack of coordinated maternal care and poor choices by members of medical schemes. Birth by CS attract higher healthcare cost for hospital, specialists, pharmaceuticals and other healthcare services compared to NVD. Elective CS contribute to the wasteful utilisation of scarce healthcare resources.

## Objectives

The objective of the study is to use recently collected data with improved case definitions to evaluate trends in the utilisation and expenditure on CS births in the population covered by medical schemes between 2015 and 2018. In addition, the study aims to make recommendations on the strategies that medical schemes can employ in reducing clinically unnecessary CS births.

## Contribution to field

The study provides insights on the epidemiological factors that impact on the high level of caesarean section rates in the private health sector. The study further highlights some of the interventions such benefit design and care-coordination that could be employed to curb the increasing CS rates.

## Ethical considerations

Aggregated, anonymised data on the frequency and expenditure on CS and NVD by age of the mother, scheme and benefit option type, hospital type were submitted by medical schemes to the Council for Medical Schemes via a secure portal as part of the Healthcare Utilisation Annual Statutory Returns. The CMS does not have access to individual patients' clinical or claims records. The data was analysed at a consolidated level to ensure privacy and confidentiality and poses no ethical issues.

## METHODS

### Data and study population

The study analysed data from the Healthcare Utilisation Annual Statutory returns covering the period 2015 to 2018. The study population included births ranging from 116 063 in 2015 to 105 485 in 2018. The case definitions for CS and NVD are based on the methodology described in the CMS's Healthcare Utilisation Annual Statutory Returns Technical Guidelines as adapted from the case type definitions in a study by Lorenzoni and Roubal (2016). Their investigation looked at price levels for private hospital services in South Africa compared with hospital services in the public and private sector in a selection of OECD countries. The data was extracted from SQL Server into Microsoft Excel formats and imported to a SAS statistical software package for cleaning and analysis. The output was then transcribed to Excel for tabulating summary statistics and constructing graphical representations of the results.

## Study design

This cross-sectional analytical study included all registered medical schemes registered between 2015 and 2018 financial years. All female beneficiaries registered and admitted for a birth event during this period were included in the analysis. Births records with the male gender or female beneficiaries aged outside the 10 to 55 years were removed from the analysis. The analyses were stratified by scheme type (open or restricted), size (small, medium, large), benefit design (hospital, partial cover and comprehensive plans) and hospital types (private or public). Medical schemes may register with the CMS as open or restricted schemes. Open schemes are prohibited from refusing to accept anyone who applies for membership. Individuals and groups may become members of open schemes. Certain criteria must be met for restricted scheme membership. These include being formerly or currently employed in a trade, profession or industry. Small medical schemes were defined as schemes with less than six thousand members and less than 15 thousand beneficiaries. Medium scheme covered at least six thousand members and less 30 thousand beneficiaries. Schemes that covered more than 30 thousand beneficiaries were classified as large schemes. Medical scheme benefit options that did not submit data or submitted unreliable data on birth events were excluded in the analysis. Hospitals will be classified as either "public" or "private" according to the Practice Numbering Code System (PCNS).

## Statistical analysis

The study analysed the data using SAS 9.4 software. Chi-square tests were used to identify significant associations between the outcome, CS delivery, and identified risk factors for which data is available. A multiple logistic regression was employed to model the odds of CS delivery by risk factors to determine the existence of associations. The study also used independent samples of two-tailed test to compare average expenditure between CS and NVD. A p-value of 0.05 or less was considered significant.

## RESULTS

A total of 105 485 birth admissions from all schemes that submitted data for the 2018 Healthcare Utilisation Annual Statutory Returns were included in the analysis. Births admissions were reported in the ages ranging from 10 to 54 years among a total of 3 273 285 female beneficiaries.

Table 1 provides descriptive statistics for female lives covered by medical schemes and CS births for the 2018 financial year. Most births, 69 915 or 66.28%, were in the 25 to 34 years' age group. The median CS rate, increased with maternal age, 70.35%, 76.02% and 84.38% in the 10 to 24 years, 25 to 34 years and 35 to 54 years' age groups, respectively. Private hospitals accounted for 99.46% of all birth admissions. The median CS rate for private hospitals was 78.57% compared to 44.10% for public hospitals. There was a 46%:54% split in the proportion of women covered by open and restricted medical schemes. The number of births were disproportionally higher in women covered by open schemes (62.11%) compared to restricted schemes (37.89%). The median prevalence of CS rates was higher in open schemes (80.00%) compared to restricted schemes (75.00%). Large medical schemes recorded a median CS rate of 77.81% compared to 76.28% and 76.47% for medium and small schemes, respectively. The median CS rate for beneficiaries covered by efficiency discounted options (EDO) was 75.00% compared to 77.91% for non-EDO options. Comprehensive plans recorded the lowest CS rate of 77.33% among the benefit design types. The median CS rate was 78.15% and 81.05% for hospital plans and partial cover plans, respectively. The overall CS rate for the medical schemes industry was 77.40 % with an interquartile range of 65.18% to 91.30%.

**Table 1: Summary statistics for female beneficiaries and caesarean section births in 2018**

	Female beneficiaries <sup>1</sup>	Total births		Caesarean section births		
		n <sup>2</sup>	%	Q1 <sup>3</sup> (%)	Median (%)	Q3 <sup>4</sup> (%)
<b>Maternal age</b>						
10 to 24 years	890 931	13 125	12.44%	53.85	70.35	85.71
25 to 34 years	738 807	69 915	66.28%	67.31	76.02	85.97
35 to- 59 years	1 643 547	22 445	21.28%	73.68	84.38	100.00
<b>Admitting hospital type</b>						
Public hospital	-	571	0.54%	0.00	44.10	100.00
Private hospital	-	104 914	99.46%	69.23	78.57	90.91
<b>Scheme type</b>						
Restricted schemes	1 500 640	39 966	37.89%	58.82	75.00	88.89
Open schemes	1 772 645	65 519	62.11%	69.64	80.00	94.90
<b>Scheme size<sup>5</sup></b>						
Small schemes	79 732	1 991	1.89%	57.14	76.47	90.00
Medium schemes	133 147	3 954	3.75%	54.55	76.28	100.00
Large schemes	3 060 406	99 540	94.36%	66.67	77.81	90.91
<b>EDO<sup>6</sup> status</b>						
Non-EDO	2 952 755	90 728	86.01%	66.67	77.91	90.91
EDO	320 530	14 757	13.99%	60.00	75.00	94.12
<b>Benefit design type</b>						
Hospital plans	944 939	38 522	36.52%	66.67	78.15	87.87
Partial cover plans	1 375 466	32 650	30.95%	69.21	81.05	100.00
Comprehensive plans	952 880	34 313	32.53%	56.41	73.77	85.71
<b>All schemes</b>	<b>3 273 285</b>	<b>105 485</b>	<b>100%</b>	<b>65.18</b>	<b>77.40</b>	<b>91.30</b>

<sup>1</sup> Female beneficiaries in the age group spanning 10 to 59 years

<sup>2</sup> Sample size

<sup>3</sup> First quartile (p25), <sup>4</sup> Third quartile (p75)

<sup>6</sup> "small": < 6 000 members; "medium": ≥ 6 000 members but < 30 000 beneficiaries; "large" ≥ 30 000 beneficiaries

<sup>7</sup> Efficiency discounted options

Figure 1 show trends in CS and NVD rates by age groups. CS rates increase steadily from 55% in the 10 to 14 years' age group to 100% in the 50 to 54 years' age group, with the NVD going in the opposite direction. The number of birth admissions reduce markedly for women aged from 40 years and above.

Figure 2 shows a sustained increase in the rate of CS and a drop in the absolute number of births between 2015 and 2016, 74.4% (116 062 birth admissions) to 76.9% (105 484 birth admissions), respectively. There was a small difference in the CS rate for open and restricted schemes. The divergence in the CS preference between open and restricted schemes became apparent from 2016.

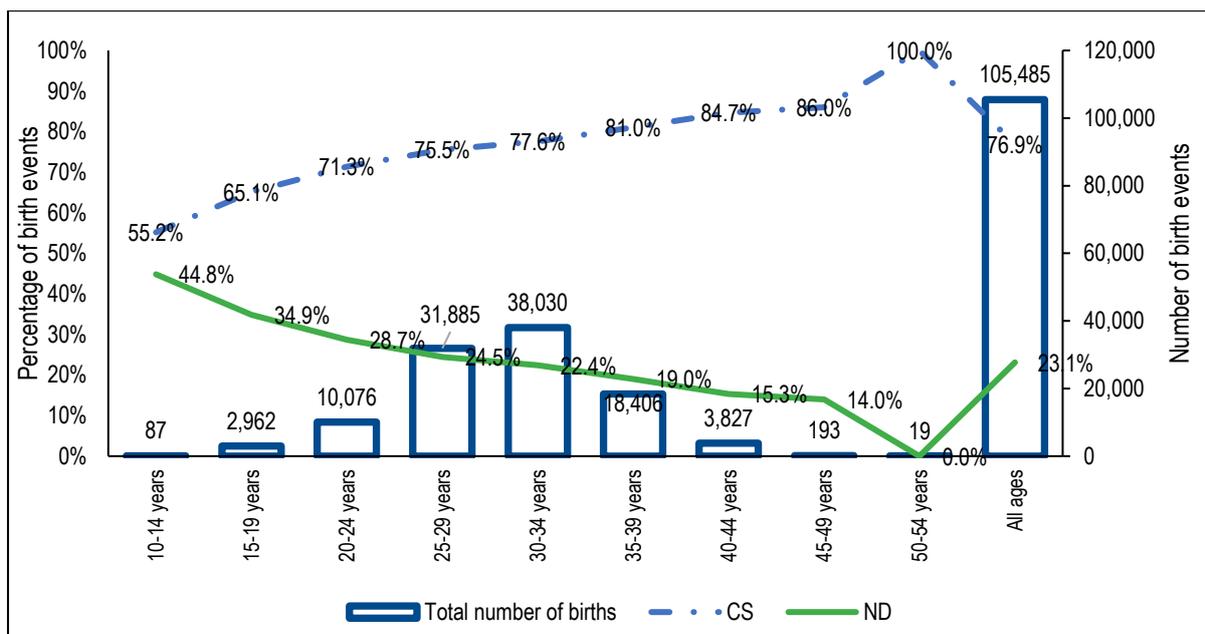


Figure 1: Consolidated birth events by age group

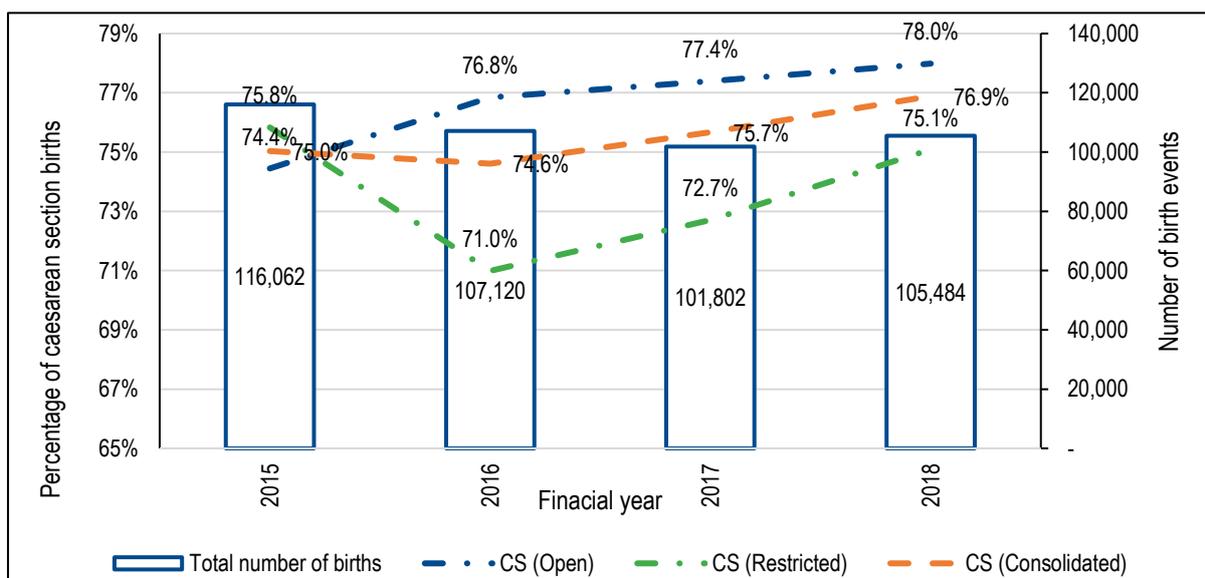


Figure 2: Trends in birth events by scheme type

The summary statistics and results of the two-independent samples t-test for the cost drivers of CS hospital admission are shown in Table 2 and Table 3, respectively. The median hospital expenditure by medical schemes for NVD and CS was R16 290.69 and R27 086.14, respectively. The average hospital costs were significantly higher (67.36%) for CS compared to NVD (R26 068.87 ± R306.95 vs R15 576.62 ± R199.04, p = <0.0001). Expenditure on hospital-based specialists and other professionals' fees was the second largest cost driver for birth admissions. The median specialists' costs for NVD was R4 898.58 (IQR: R2 676.38 to R6 073.59) compared to R9 404.74 (IQR: R4 640.14 to R10 999.11) for CS deliveries. Medical schemes spent 89.75% more for specialist consultations CS compared to NVD (R9 565.46 ±

R260.00 vs R5 041.02 ± R136.45),  $p = <0.0001$ ). The expenditure on pathology, radiology and medicines was significantly higher for CS compared to NVD. Overall, CS (R37 596.19 ± R548.11) was 74.50% more expensive than NVD (R21 545.37 ± R311.18),  $p <0.0001$ .

**Table 2: Summary statistics for the cost of normal delivery and CS per admission in 2018**

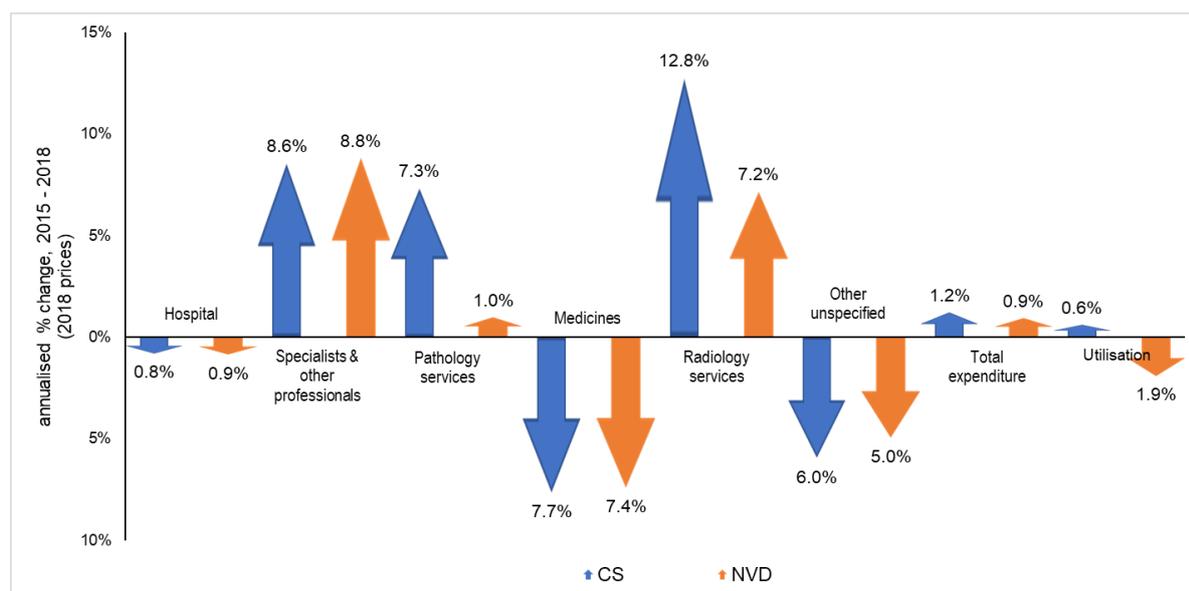
Payment category	Normal vaginal deliveries			Caesarean section		
	Lower quartile	Median	Upper quartile	Lower quartile	Median	Upper quartile
Hospital	R12 999.24	R16 290.69	R18 753.36	R23 707.21	R27 086.14	R30 135.42
Specialists & other professionals	R2 676.38	R4 898.58	R6 073.59	R4 640.14	R9 404.74	R10 999.11
Pathology services	R13.70	R288.90	R509.64	R27.60	R690.44	R971.65
Radiology services	R0.00	R0.00	R75.70	R0.00	R0.00	R313.95
Medicines	R0.00	R0.00	R10.99	R0.00	R19.91	R127.36
Other unspecified	R0.00	R109.10	R513.20	R0.00	R304.55	R581.02
<b>Total expenditure</b>	<b>R16 874.68</b>	<b>R22 656.17</b>	<b>R25 409.23</b>	<b>R31 002.98</b>	<b>R38 192.49</b>	<b>R42 440.77</b>

**Table 3: Average medical scheme expenditure for CS and normal delivery per admission in 2018**

Cost driver	Normal vaginal deliveries (± SE <sup>1</sup> )	CS deliveries (± SE)	% difference	p-value
Hospital	R15 576.62 ± R199.04	R26 068.87 ± R306.95	67.36%	<0.0001
Specialists & other professionals	R5 041.02 ± R136.45	R9 565.46 ± R260.00	89.75%	<0.0001
Pathology services	R365.78 ± R13.24	R803.41 ± R22.77	119.64%	<0.0001
Radiology services	R97.20 ± R13.33	R160.58 ± R22.21	65.20%	<0.0001
Medicines	R33.58 ± R2.73	R122.77 ± R6.36	265.57%	<0.0001
Other unspecified	R431.16 ± R33.24	R875.11 ± R64.69	102.97%	<0.0001
<b>Total expenditure</b>	<b>R21 545.37 ± R311.18</b>	<b>R37 596.19 ± R548.11</b>	<b>74.50%</b>	<b>&lt;0.0001</b>

<sup>1</sup> Standard error

Figure 3 depicts inflation adjusted (2018 prices) annualised changes in the cost drivers for birth admissions between 2015 and 2018. Inflation adjusted hospital expenditure for CS and NVD decreased by 0.8% and 0.9% during the period under review. Increases in hospital-based specialists and other professionals' fees were 8.6% and 8.8% for CS and NVD, respectively. Expenditure for pathology services increased by 7.3% for CS and 1.0% for NVD. Medicines recorded a decrease of 7.7% for CS and 7.4% for NVD. Higher radiology services expenditure increases were recorded for CS (12.8%) compared to NVD (7.2%). The total average increases on birth admissions was 1.2% and 0.9% for CS and NVD, respectively. CS deliveries increased at an annualised rate of 0.6%, while NVD decreased annually by an average of 1.9% between 2015 and 2018.



**Figure 3: Annualised cost driver percentage changes per admission, 2015 – 2018 (2018 prices)**

We analysed beneficiary age and medical scheme characteristics to determine their effect on CS deliveries as shown in Table 4. Age was analysed as both continuous and categorical variable. The risk of CS delivery was found to increase with age (Odds ratio [OR] 1.04, CI: 1.03 to 1.04). Women in the 25 to 34 years' age group had a OR of 1.42 (CI: 1.36 to 1.48) of CS delivery compared women in the 10 to 24 years, while the odds ratio for CS delivery for women in the 35 - 54 years was 1.93 (CI: 1.84, 2.03). Women admitted to a private hospital for a birth event had an OR of 3.74 (CI: 3.17, to 4.41) compared to women admitted in public hospitals. The odds of delivery by CS was higher in open schemes (OR: 1.18, CI: 1.14 to 1.21) compared to restricted schemes. The odds of a CS delivery for a woman who is a member of a medium scheme (OR: 1.00, CI: 0.88, 1.13) was not different from those of a woman who is a member of a small scheme. There was a marginal increase in the odds of a CS in women covered by large medical schemes (OR: 1.18, CI: 1.08 to 1.31). Women in the efficiency discounted options (EDO) had a 24% reduction in the risk of a CS delivery (OR: 0.76, CI: 0.74 to 0.80) compared to women covered by non-EDOs. Analysis of benefit design showed that partial cover plans had no effect on the risk of CS delivery compared to hospital plans (OR: 1.01, CI 0.97 to 1.04). Comprehensive plans reduced the odds of a CS delivery by 24% (OR: 0.76, CI: 0.73 to 0.79) compared to hospital plans.

**Table 4: Crude odds ratios for caesarean section births by maternal age and medical scheme characteristics**

	Caesarean section births		Crude odds ratio (95% CI)
	n <sup>1</sup>	%	
<b>Age</b>			
Maternal age in years	81 103	76.89	1.04 (1.03, 1.04)
<b>Maternal age by category</b>			
10 to 24 years (Ref)	9 163	69.81	1.00
25 – 34 years	53 604	76.67	1.42 (1.36, 1.48)
35 - 54 years	18 336	81.69	1.93 (1.84, 2.03)
<b>Admitting hospital type</b>			
Public hospital (Ref)	270	47.29	1.00
Private hospital	80 833	77.5	3.74 (3.17, 4.41)
<b>Scheme type</b>			
Restricted schemes (Ref)	30 008	75.08	1.00
Open schemes	51 095	77.99	1.18 (1.14, 1.21)
<b>Scheme size</b>			
Small schemes (Ref)	29 782	73.98	1.00
Medium schemes	4 540	73.98	1.00 (0.88, 1.13)
Large schemes	46 781	77.06	1.18 (1.08, 1.31)
<b>EDO status</b>			
Non-EDO (Ref)	70 393	77.59	1.00
EDO	10 710	72.58	0.76 (0.74, 0.80)
<b>Benefit design type</b>			
Hospital plans (Ref)	30 236	78.49	1.00
Partial cover plans	25 652	78.57	1.01 (0.97, 1.04)
Comprehensive plans	32 650	73.49	0.76 (0.73, 0.79)

<sup>1</sup> Number of caesarean births

Adjusted odds ratios for CS births by maternal age and medical scheme characteristics are shown in Table 5. The association between maternal age and risk of CS delivery remained significant in adjusted analysis (adjusted odds ratio [AOR]: 1.04, CI: 1.03 to 1.04). A birth admission to a private hospital remained significantly associated with a CS delivery (AOR: 3.28, CI: 2.77 to 3.87). The risk of delivery by CS remained higher in open schemes (OR: 1.25, CI: 1.20 to 1.29) compared to restricted schemes. Women in the efficiency discounted options (EDO) had a 31% reduction in the risk of a CS delivery (AOR: 0.69, CI: 0.66 to 0.72) compared to woman covered by non-EDOs. Partial cover plans showed a marginal increase in the odds of a CS delivery compared to hospital plans (AOR: 1.04, CI 1.00 to 1.09), while comprehensive plans reduced the risk of CS deliveries by 21% (AOR: 0.76, CI: 0.76 to 0.82) compared to hospital plans in adjusted analysis. Scheme size was not statistically significant in adjusted analysis.

**Table 5: Adjusted odds ratios for caesarean section births by maternal age and medical scheme characteristics**

<b>Attribute</b>	<b>Adjusted odds ratio (95% CI)</b>
<b>Maternal age</b>	1.04 (1.03, 1.04)
<b>Admitting hospital type</b>	
Public hospital (Ref)	1.00
Private hospital	3.28 (2.77, 3.87)
<b>Scheme type</b>	
Restricted schemes (Ref)	1.00
Open schemes	1.25 (1.20, 1.29)
<b>EDO status</b>	
Non-EDO (Ref)	1.00
EDO	0.69 (0.66, 0.72)
<b>Benefit design type</b>	
Hospital plans (Ref)	1.00
Partial cover plans	1.04 (1.00, 1.09)
Comprehensive plans	0.79 (0.76, 0.82)

## DISCUSSION

A CS can be a life-saving procedure when certain conditions such as life-threatening maternal or perinatal complications are present (Meng et al., 2019). On the other hand, elective CS predisposes women to avoidable risks of infection, surgical and anaesthetic complications, reduced likelihood of breastfeeding, and risks for the baby. The rising rates of CS in the private sectors has been a concern during the past few years (Hlatshaneni, 2018, Wasserman, 2019). The World Health Organisation estimates that CS in any region of the world should not be greater than higher than 10 to 15 % in clinically indicated cases (Betran et al., 2015). It is estimated that nearly 15% of pregnant women will experience obstetric complications during their pregnancy and CS delivery will be a lifesaving intervention for between 3.6% and 6.5% of cases (Ravit, Audibert, Ridde et al., 2018). The current rate of CS deliveries of 76.9% in the population covered by medical is among the highest in the world. The analysis showed an annualised increase of 0.6% for CS, a trend which is expected to continue in the absence of appropriate interventions. The national rate of CS delivery in the South African public sector was 26.2% in the 2015/2016 financial year (Massyn et al., 2016). The sub-Saharan region has one of the lowest rates of CS in the world, partly because of poor access to obstetric care (Ravit et al., 2018, Storeng, Baggaley, Ganaba et al., 2008). According the Organization for Economic Co-operation and Development (OECD) data, among European countries Italy, Poland, and Hungary have the highest CS rate (35.7%), whereas Scandinavian nations have the lowest (Finland 15.8%; Norway 16.6%; and Sweden 17.0%) (Cantone, Lombardi, Assunto et al., 2018).

The results showed that maternal age was a risk factor for CS. This is consistent with studies that have identified maternal age as one of the factors for complicated obstetric experience. Age, income, and education are other patient related factors that are known to be associated with the preference of CS delivery. CS delivery rates were high for both open and restricted schemes. The results of the study showed that the adjusted odds of a CS delivery were higher in open schemes compared to restricted schemes. This observation is consistent with the finding of the exploratory study on CS rate in large medical schemes by Willie (2012).

A significant finding of our study is the impact of EDO options on the reduction of CS deliveries. Though the rate CS in EDO is still high by any standards, membership to this type of option reduces the odds of a CS by 31%, after adjusting for other risk factors. EDOs options have not fully implemented the principles of strategic purchasing, they still rely on fee-for-service arrangement like other traditional plans (Govuzela, Willie and Leboho, 2019). Strategic purchasing involves “active, evidence-based identification of the best ways to maximize the efficiency of a health system by deciding the service-mix and volume and selecting the provider-mix in order to maximize societal objectives” (World Health Organization, n.d.). Medical schemes seem to be passive purchasers of healthcare services, including maternal health services.

Benefit design did not show a strong association with CS events. The odds of a CS delivery were reduced in comprehensive plans compared to hospital plans, even when the proportion of births is high across all plan types. The observed reduction in comprehensive plans may be explained by member profile and specialists serving this population. The contributions paid to comprehensive plans are on average higher than the contributions members make to other plans. Membership to these plans is associated with higher socioeconomic status, higher income levels, higher prevalence of chronic diseases and higher than average age. Therefore, members in comprehensive plans may have better information about the benefits, positive or negative, of a CS delivery. Alternatively, the demand for birth admissions is lower in this population due to the older age profile.

The cost of CS births is high compared to NVD. The burden is also high for the private healthcare system, considering the annual above inflation increases in contribution. Substantial reductions in the rates of caesarean birth will go a long way in reducing the cost of maternal health and the health system in general. The high reimbursement rates for CS compared to the NVD is likely to be a contributing factor to the high levels CS deliveries. Our study showed that the average cost of CS births ( $R37\,596.19 \pm R548.11$ ) was at least 75% higher than that of NVD ( $R21\,545.37 \pm R311.18$ ). Twenty-five percent of

beneficiaries paid at least R42 440.77 for a CS delivery in the private sector. Fees charged by specialists assisting with both CS and NVD have been increasing at above inflation annual rate of 8.6% and 8.8%, respectively. Due to involvement of a greater number of specialists in the CS delivery, the average cost of specialists for a CS delivery (R9 565.46 ± R260.00) were found to be significantly higher than the costs associated with NVD (R5 041.02 ± R136.45). Professional fees for CS accounted for 25.4% of the total average birth admission cost compared to 23.4% for NVD.

## **Limitations of study**

The study did not consider any clinical factors associated with CS births. There is also no data on the proportion of CS births that were elective or medically indicated. These data are not routinely collected by the Office of the Registrar. The analysis did not include maternal health outcomes data to assess whether CS improves quality as opposed to NVD. Provider perspective and beneficiary perspective were also not assessed, thus a qualitative study in this regard could also enhance and give more insights on other attributes.

## **Recommendations**

### **Beneficiary factors**

A factor that is likely to be driving the CS rates upward is the preference of pregnant women for this type of delivery. Part of maternal managed care services must include informing pregnant women about complications associated with CS and benefits of NVD.

### **Healthcare provider factors**

Reporting of maternal outcomes must be made mandatory. Reporting of maternal outcomes by specialists and hospitals involved in the delivery of babies and hospitals will provide a basis for peer evaluation and external review.

### **Malpractice reform**

The fear for litigation has been implicated as one of the factors associated with the increases rates of CS births. (Stafford, 1990). Possibility of reforms in the medical malpractice regime must be investigated.

## **Coordination of maternal care**

Patient-centred team-based models that are designed for better coordination of care in maternal health must be encouraged. Medical schemes must consider the value of contracting with providers whose practices are part of professional teams that promote value-based care.

## **Value based contracting for maternal services**

The effectiveness of EDO arrangements, coupled with a move away from a fee-for-service reimbursement mechanism, in the control of prices for health services should be investigated. Alternatives such as episode based bundled payments may prove useful in the control of expenditure for CS deliveries and incentives for both providers and patients.

## **Reimbursement reform**

Alternative mechanism to finance maternity care in the population covered by medical schemes in order to drive appropriate incentives must be investigated. A high reimbursement rate for CS deliveries is a likely driver for the very high prevalence of CS in the medical schemes population (Meng et al., 2019).

## **Future studies**

Future studies must investigate the health outcomes of associated with NVD and CS in the South African medical schemes' population. Factors for investigation may include, but not be limited to gestational age at the time of CS, post-delivery hospital admission of baby or mother, birth weight and maternal clinical comorbidities. Beneficiary and provider factors associated with the choice of birth procedure must be investigated.

## **CONCLUSION**

Caesarean section births are very high in the South African medical schemes' population. The study has not collected and analysed clinical data, however, the high levels of CS cannot be explained by clinical profiles of pregnant women covered by medical schemes. Healthcare provider influence, funder accountability and beneficiary choices for a birth procedure have serious financial implications for the National Health Insurance and the health outcomes of both the child and mother. Urgent steps must be taken to reduce high levels of medically unnecessary CS rates in the medical schemes population.

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