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# Provincial Inequities in Institutional Maternal Mortality in South Africa: A Re-analysis of National Committee on Confidential Enquiries into Maternal Deaths Triennial Reports, 2008/10–2020/22

**Sam Thembelihle Ntuli**

sam.ntuli@smu.ac.za

Sefako Makgatho Health Sciences University

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## Abstract

# Background

South Africa has reduced institutional maternal mortality since the late 2000s, but national averages may conceal provincial inequities. This study examined provincial patterns in the institutional maternal mortality ratio (iMMR) across South Africa's nine provinces over five triennial periods.

# Methods

Aggregated provincial iMMR data from National Committee on Confidential Enquiries into Maternal Deaths triennial reports for 2008/10, 2011/13, 2014/16, 2017/19 and 2020/22. This was a secondary analysis of publicly available data; no individual-level data was used. Provincial estimates were classified as Low (< 100), Moderate (100–149), High (150–199) or Very High (≥ 200) deaths per 100,000 live births. National trends are described, provincial band transitions, convergence and the 2020/22 reversal. Descriptive analyses were conducted. Ethics approval was not required.

# Results

Nationally, iMMR declined from 176.2 in 2008/10 to 113.8 in 2017/19 (35.4% reduction), then rose to 126.0 in 2020/22 (10.7% increase). The provincial range narrowed from 84.9–289.1 in 2008/10 to 65.2–157.4 in 2017/19, then widened upward to 89.2–180.9 in 2020/22. The Western Cape was the only province consistently classified Low. By 2017/19 and 2020/22, seven provinces were Moderate, the Free State remained the only High-band province, and no province was Very High. Most provinces that left the High/Very High bands plateaued in the Moderate band.

# Conclusions

South Africa's national decline masks persistent provincial inequality. Clustering in the Moderate band suggests a plateau, while the 2020/22 reversal highlights fragility during shocks such as COVID-19. Provincial disaggregation, targeted interventions in lagging provinces and resilient maternal health systems are needed to sustain progress toward SDG 3.1.

## Introduction

Maternal mortality remains as a major global health challenge and a sensitive indicator of health system performance, how equitable care is distributed, and how accessible quality services are. Under Sustainable Development Goal (SDG) 3.1, the global community has committed to lowering the maternal mortality ratio (MMR) to below 70 deaths per 100,000 live births by 2030 (1). Although substantial gains have been recorded over the past three decades, many low- and middle-income countries remain distant

from this target, and progress has been uneven both across and within nations. The World Health Organization's *Strategies Toward Ending Preventable Maternal Mortality* (EPMM) framework emphasizes that eliminating preventable maternal deaths requires not only reductions in national aggregates but also the removal of inequities in maternal health outcomes across regions, income groups, and service delivery platforms (2).

South Africa presents a particularly instructive case. As an upper-middle-income country with a well-developed health infrastructure and a long-standing national maternal death surveillance system, it has achieved substantial reductions in maternal mortality since the late 2000s. The institutional maternal mortality ratio (iMMR), maternal deaths occurring in health facilities per 100,000 live births declined markedly from 176.2 in 2008/10 to 113.8 in 2017/19, a decline of 62.4 points (35.4%) over about ten years, reflecting the cumulative impact of interventions such as strengthened obstetric audits, expanded antiretroviral therapy, prevention of mother-to-child transmission (PMTCT), improved access to skilled birth attendants and enhanced emergency obstetric care (3, 4). However, this downward trajectory was interrupted in 2020/22, when the iMMR rose to 126.0, a 10.7% increase over the preceding period. This reversal aligns with international findings that the COVID-19 pandemic disrupted maternal health services (5, 6), diverted resources and personnel, lowered antenatal care attendance and contributed to a rise in indirect maternal deaths due to infection, delayed care and broader systemic strain (7, 8).

Crucially, national averages conceal substantial provincial variation. South Africa's nine provinces differ widely in socioeconomic conditions, health system capacity and historical investment in maternal health, and these differences are reflected in provincial iMMR estimates (9). Monitoring only the national ratio therefore risks overlooking persistent inequities and the uneven distribution of progress. To capture this variation, provincial iMMR estimates must be classified against meaningful thresholds that allow comparisons over time and across provinces. Drawing on data from the National Committee on Confidential Enquiries into Maternal Deaths (NCCEMD) triennial reports covering 2008/10 to 2020/22, this study analyzes provincial patterns in the institutional maternal mortality (iMMR) and evaluates whether the national decline has been distributed equitably across provinces. Specifically, it asks: (i) how did provincial iMMR classifications shift across the five reporting periods; (ii) which provinces consistently achieved low mortality, and which fell behind; and (iii) did the 2020/22 period interrupt the pattern of provincial convergence observed over the previous decade? By addressing these questions, the study aims to contribute evidence on the distributional dimensions of maternal mortality reduction in South Africa and to inform targeted provincial interventions needed to sustain and build on the gains achieved to date.

# Methods

### Study design and data source

This was a repeated cross-sectional analysis of aggregated provincial iMMR data drawn from the NCCEMD triennial reports for five reporting periods: 2008/10, 2011/13, 2014/16, 2017/19 and 2020/22.

The NCCEMD reports are the principal national source of maternal death surveillance data in South Africa and provide provincial estimates of maternal deaths occurring in health facilities per 100,000 live births. Data was extracted for all nine provinces (**Figure 1**): Eastern Cape (EC), Free State (FS), Gauteng (GP), KwaZulu-Natal (KZN), Limpopo (LP), Mpumalanga (MP), Northern Cape (NC), North West (NW) and Western Cape (WC).

### Measures and classification

The primary measure was the provincial iMMR, defined as institutional maternal deaths per 100,000 live births. Provincial iMMR estimates were classified into four bands adapted from the SDG 3.1 target, the EPMM framework and NCCEMD reporting conventions (1,2):

- **Low:** <100 deaths per 100,000 live births
- **Moderate:** 100–149 deaths per 100,000 live births
- **High:** 150–199 deaths per 100,000 live births
- **Very High:** ≥200 deaths per 100,000 live births

The SDG 3.1 target of fewer than 70 maternal deaths per 100,000 live births is a global benchmark. The "Low" threshold of <100 used here represents a slightly relaxed cut-off appropriate for South Africa's upper-middle-income context, where the <70 target remains aspirational in the near term and where a <100 threshold provides a more realistic and policy-relevant benchmark for distinguishing provinces that have achieved comparatively low institutional mortality from those that have not.

### Data Analysis

Descriptive analyses were conducted. National iMMR values were compared across periods using absolute and percentage change. Provincial iMMR estimates were classified into the four bands for each period, and band transitions were examined to identify provinces that consistently achieved low mortality, provinces that improved, and provinces that lagged. Provincial ranges were calculated for each period to illustrate the gap between the best- and worst-performing provinces. Because the analysis used aggregated published data, no inferential statistical testing or multivariable adjustment was undertaken. The analysis focused on patterns of convergence, plateau and reversal over time.

### Ethical considerations

This study used aggregated, publicly available provincial data from national maternal death surveillance reports (10-12). No individual-level patient data were accessed. Ethics approval was therefore not required.

## Results

### National trends in iMMR

**Table 1** presents the national iMMR for South Africa across the five reporting periods. The iMMR declined from 176.2 in 2008/10 to 154.1 in 2011/13 (−22.1; −12.5%), to 134.3 in 2014/16 (−19.8; −12.8%) and to 113.8 in 2017/19 (−20.5; −15.3%). Overall, the decline from 2008/10 to 2017/19 was 62.4 points, or 35.4%.

In 2020/22, the iMMR rose to 126.0, an increase of 12.2 points or 10.7% over the preceding period. This reversal is consistent with international evidence of COVID-19-related disruption to maternal health services and broader health system strain.

**Table 1:** Institutional Maternal Mortality Ratio (IMMR) for South Africa, 2008–2022

| Period | IMMR (per 100,000 live births) | Change from Previous Period | % Change |
|---|---|---|---|
| 2008–10 | 176.2 | | |
| 2011–13 | 154.1 | −22.1 | −12.5% |
| 2014–16 | 134.3 | −19.8 | −12.8% |
| 2017–19 | 113.8 | −20.5 | −15.3% |
| 2020–22 | 126.0 | +12.2 | +10.7% |

**Provincial distribution and band classifications**

**Figure 1** illustrates the spatial and temporal distribution of South Africa's iMMR from 2008/10 to 2020/22. The maps show a clear provincial decline from a peak range of 84.9–289.1 in 2008/10 to 65.2–157.4 in 2017/19, followed by a partial reversal to 89.2–180.9 in 2020/22. The darkest shading consistently concentrates in the central and northwestern interior provinces (FS, NW and NC), while the WC consistently records the lowest iMMR (below 100 per 100,000 live births) throughout.

**Table 2** classifies the nine provinces into the four iMMR bands across the five reporting periods. Several important patterns emerge.

**The Western Cape as a consistent low-mortality province**

The WC was the only province to remain in the Low band (<100 maternal deaths per 100,000 live births) throughout all five periods, indicating a sustained and comparatively well-resourced maternal health system. This persistently lower mortality is attributed to better-resourced health facilities, higher skilled birth attendance, stronger provincial governance, effective referral and emergency transport systems, lower HIV prevalence with high ART/PMTCT coverage, higher socioeconomic status and female education, greater urbanisation and geographic access to care, stronger implementation of national maternal health policies, lower teenage pregnancy rates and effective maternal death surveillance and response (3,10,13,14). These factors collectively reduce the three delays that contribute to maternal deaths. The WC therefore serves as a benchmark against which other provinces can be assessed.

**Sustained and widespread decline over the first decade**

Between 2008/10 and 2017/19, the number of provinces in the upper bands fell sharply. In 2008/10, seven provinces were classified as high or very high: EC, KZN, LP and MP in the high band; and FS, NW and NC in the very high band. By 2011/13, no province remained in the very high band, although seven provinces were in the high band. By 2014/16, only FS, LP and NW remained in the high band. By 2017/19, only FS remained in the high band, and no province fell into the Very High category. This confirms that the national decline in iMMR was driven by improvements across almost all provinces, not by a few outliers.

**Persistent clustering in the Moderate band**

By 2014/16, and increasingly by 2017/19 and 2020/22, most provinces had converted into the Moderate band (100–149). In 2014/16, five provinces were moderate: EC, GP, KZN, MP and NC. By 2017/19 and 2020/22, seven provinces were moderate: EC, GP, KZN, LP, MP, NW and NC. While this represents genuine progress relative to the High and Very High bands of 2008/10, it also reveals a plateau: most provinces improved to a similar level but did not progress further into the Low band.

**Widening inequality masked by national averages**

The gap between the best-performing province (WC, consistently Low) and the worst-performing province (FS, the only province remaining in the high band by 2020/22) illustrates that national iMMR figures conceal substantial provincial disparities. The national decline does not reflect uniform improvement. The provincial range narrowed between 2008/10 and 2017/19 but remained substantial, and the upper bound of the provincial range rose again in 2020/22.

**A partial reversal in 2020/22**

The 2020/22 period shows the moderate band comprising the same seven provinces as 2017/19, with FS remaining the only province in the high band and no province in the very high band. However, this apparent stability in classification should be interpreted with caution. The national iMMR rose by 10.7%, and the provincial maximum increased from 157.4 to 180.9. This may reflect changed reporting or data completeness during the COVID-19 pandemic as well as genuine deterioration in maternal health, consistent with the documented global increase in maternal deaths during this period. The 2020/22 period therefore interrupted the pattern of provincial convergence observed over the previous decade.

**Provincial trajectories and lagging provinces**

The provincial trajectories observed align with broader evidence that maternal mortality reduction in South Africa has been uneven, shaped by differential investment in health infrastructure, human resources and community-level determinants of maternal health (10, 15). Provinces that improved earlier, such as GP, KZN and MP, tend to have stronger referral systems, higher facility birth rates and more consistent implementation of maternal death surveillance and response (13,14). By contrast,

provinces that lagged, notably FS, are characterised by fragmentation of health services, health worker shortages, financial and cash-flow problems, dysfunctional communication technology, poor information management and weaker emergency obstetric transport, all of which sustain the delays that contribute to preventable maternal deaths (16). GP was classified as Moderate from 2008/10 onward, indicating earlier progress than most provinces. This early and sustained Moderate classification suggests that GP's maternal health system has performed relatively well but has not yet achieved the low mortality levels seen in the WC, implying that further targeted interventions are needed to close the remaining gap (3,12).

# Discussion

### Principal's findings

This study shows that South Africa's national iMMR declined substantially between 2008/10 and 2017/19 before rising in 2020/22. However, the national trajectory masks persistent provincial inequality. The WC remained the only consistent low-band province, while most other provinces plateaued in the moderate band. The FS lagged and remained the only high-band province by 2017/19 and 2020/22. The 2020/22 reversal interrupted the previous pattern of provincial convergence and underscored the fragility of maternal health gains during systemic shocks.

### Interpretation and comparison with existing evidence

The national decline in iMMR observed between 2008/10 and 2017/19 is consistent with the cumulative impact of a range of health system interventions implemented in South Africa over the past two decades. Strengthened obstetric audits, institutionalized through the NCCEMD's Saving Mothers reports, have enhanced the identification of avoidable factors and promoted accountability for maternal deaths at facility level (10, 13). The expansion of antiretroviral therapy and prevention of mother-to-child transmission (PMTCT) has substantially reduced HIV-related maternal mortality, which was a major contributor to deaths in the early 2000s (3,4). Improved access to skilled birth attendants, achieved through training and deployment initiatives, has increased the proportion of births attended by competent health professionals. Enhanced emergency obstetric care, including better referral systems and transport, has addressed delays in accessing definitive care for complications (2,14). These interventions collectively target the three delays, seeking, reaching and receiving care that underpin preventable maternal deaths. The South African experience therefore aligns with global evidence that multi-component health system strengthening can produce substantial reductions in maternal mortality, even in upper-middle-income settings with persistent inequities.

The 2020/22 increase in iMMR aligns with a growing body of international evidence documenting the indirect effects of the COVID-19 pandemic on maternal and perinatal health. Studies have reported disruptions to maternal health services, including reduced antenatal care attendance, fewer facility births in some settings, and diversion of health workers and resources to COVID-19 response efforts (5,6). These disruptions contributed to delayed care-seeking, increased indirect maternal deaths due to

infection and other complications, and broader systemic strain on already fragile health systems (7,8). In South Africa, the pandemic coincided with lockdowns, transport disruptions and reallocation of obstetric staff, which may have exacerbated existing provincial disparities. While some of the 2020/22 increase may reflect changes in reporting completeness or data quality during the pandemic, the consistency of the pattern with global evidence suggests that a genuine deterioration in maternal health outcomes occurred. This reversal interrupted the previous decade's pattern of provincial convergence and underscored the fragility of maternal health gains in the face of systemic shocks, reinforcing the need for resilient health systems capable of maintaining essential maternal services during emergencies.

The persistence of provincial disparities in iMMR is consistent with a growing body of evidence indicating that maternal mortality reduction in South Africa has been shaped by differential investment in health infrastructure, human resources, and community-level determinants of maternal health (9,15). Provinces that achieved earlier and more sustained reductions in iMMR such as the WC, GP, KZN, and MP share several health system characteristics that facilitate timely and effective care. These include stronger referral systems that ensure pregnant women with complications are promptly transferred to appropriate levels of care, higher facility birth rates that increase the likelihood of skilled attendance at delivery, and more consistent implementation of maternal death surveillance and response, which enables health systems to identify avoidable factors and implement corrective actions (13,14). The WC has demonstrated how sustained investment in emergency obstetric transport, well-resourced facilities, and strong provincial governance can produce and maintain low mortality levels over multiple reporting periods. These factors collectively reduce the delays in seeking, reaching, and receiving care that contribute to preventable maternal deaths, and they illustrate the importance of health system readiness beyond mere geographic access to facilities.

By contrast, provinces that have lagged, most notably the FS, which remained the only high-band province by 2017/19 and 2020/22, face a constellation of interconnected health system challenges that sustain the delays contributing to preventable maternal mortality. These challenges include fragmentation of health services across levels of care, persistent health worker shortages, financial and cash-flow problems that disrupt service delivery, dysfunctional communication technology, poor information management, and weaker emergency obstetric transport systems (16). Such constraints mean that even when pregnant women seek care, they may not receive timely or appropriate interventions, particularly in emergency situations requiring rapid referral and transport. The FS's persistent high-band classification, while other provinces improved, underscores that national-level interventions alone are insufficient to address locally embedded health system weaknesses. Addressing these disparities will require targeted, province-specific investments that strengthen referral pathways, improve human resource capacity, enhance information systems, and ensure reliable emergency transport interventions that directly address the structural determinants of maternal mortality inequity.

**Implications for policy and practice**

The findings have several implications. First, national-level reporting alone is insufficient to track equity in maternal health; provincial disaggregation is essential for identifying where progress has stalled and where resources should be concentrated. Second, the clustering of most provinces in the moderate band suggests a plateau in maternal mortality reduction, indicating that the interventions that successfully moved provinces out of the high and very high bands may be insufficient to achieve low-band performance. Third, the partial reversal observed in 2020/22 underscores the fragility of gains in maternal health and the need for resilient health systems capable of sustaining essential services during shocks such as the COVID-19 pandemic.

**Table 2:** Provincial Distribution of Institutional Maternal Mortality Ratio Categories in South Africa, 2008/10–2020/22

| Threshold | Classification | 2008/10 | 2011/13 | 2014/16 | 2017/19 | 2020/22 |
|---|---|---|---|---|---|---|
| **< 100** | **Low** | WC | WC | WC | WC | WC |
| **100–149** | **Moderate** | GP | GP | EC, GP, KZN, MP, **NC** | EC, GP, KZN, LP, MP, **NW, NC** | EC, GP, KZN, LP, MP, **NW, NC** |
| **150–199** | **High** | EC, KZN, LP, MP | EC, **FS**, KZN, LP, MP, **NW, NC** | **FS,** LP, **NW** | **FS** | **FS** |
| **≥ 200** | **Very High** | **FS, NW, NC** | | | | |

*Notes:* IMMR = institutional maternal mortality ratio, expressed as maternal deaths per 100,000 live births. Provinces are classified into four bands according to the following thresholds: Low (< 100), Moderate (100–149), High (150–199), and Very High (≥ 200). **Source:** Data are drawn from the National Committee on Confidential Enquiries into Maternal Deaths (NCCEMD) triennial reports, 2008/10–2020/22. Provincial abbreviations: EC = Eastern Cape; FS = Free State; GP = Gauteng; KZN = KwaZulu-Natal; LP = Limpopo; MP = Mpumalanga; NC = Northern Cape; NW = Northwest; WC = Western Cape.

Targeted provincial interventions should prioritise lagging provinces, particularly FS, and should address health system fragmentation, human resource shortages, emergency obstetric transport, information management and the quality of referral systems. Provinces in the moderate band may require a different set of interventions from those that remain in the high band, including efforts to improve quality of care, strengthen maternal death surveillance and response and address the social determinants of maternal health.

**Strengths and limitations**

This study has several strengths. It uses national maternal death surveillance data covering five triennial periods and all nine provinces, allowing a consistent comparison of provincial patterns over more than a decade. It applies to a policy-relevant classification framework and highlights the distributional

dimensions of maternal mortality reduction. The study also has limitations. The analysis relies on aggregated published data and does not permit individual-level adjustment for confounders or statistical estimation of uncertainty. The iMMR is facility-based and does not capture all maternal deaths, particularly those occurring outside health facilities. The classification thresholds, while adapted from SDG 3.1 and EPMM, involve a degree of judgement, and the relaxed low threshold of <100 may not reflect the ultimate SDG target of <70. Reporting completeness and data quality may have varied across provinces and periods, particularly during the COVID-19 pandemic, and some of the 2020/22 changes may reflect reporting differences rather than genuine changes in maternal mortality. Finally, the analysis is descriptive and cannot establish causal relationships between specific interventions and provincial trends.

# Conclusion

This study examined provincial trends in South Africa's iMMR from 2008/10 to 2020/22 using NCCEMD data. Nationally, the iMMR declined by 35.4% over the first decade, from 176.2 to 113.8 per 100,000 live births, before rising by 10.7% in 2020/22, likely due to COVID-19 disruptions. However, this national decline masks substantial provincial inequality. Using a four-band classification, the analysis shows that six of seven provinces moved out of the high/very high bands by 2017/19, but most plateaued in the moderate band. The WC was the only province to remain consistently low, while the FS lagged. The findings indicate that national averages conceal persistent inequities, that most provinces have stalled in the moderate band and that maternal health gains are fragile, underscoring the need for provincial disaggregation, targeted interventions in lagging provinces and resilient health systems to sustain progress.

# Declarations

### Ethics approval and consent to participate

This study used aggregated, publicly available provincial data from national maternal death surveillance reports published by the National Committee on Confidential Enquiries into Maternal Deaths (NCCEMD). No individual-level patient data were accessed. Ethics approval was therefore not required.

### Consent for publication

Not applicable. This manuscript does not contain any individual person's data in any form.

### Availability of data and materials

The data supporting the findings of this study are available from the National Committee on Confidential Enquiries into Maternal Deaths (NCCEMD) triennial reports, which are publicly available through the South African National Department of Health. The datasets analysed during the current study are available from the corresponding author on reasonable request.

### Competing interests

The authors declare that they have no competing interests.

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### Authors' contributions

Sam Ntuli is the sole author of this manuscript. He conceptualized the study, conducted the data extraction and analysis, interpreted the findings, drafted and revised the manuscript, and approved the final version for submission. As sole author, Sam Ntuli is responsible for all aspects of the work.

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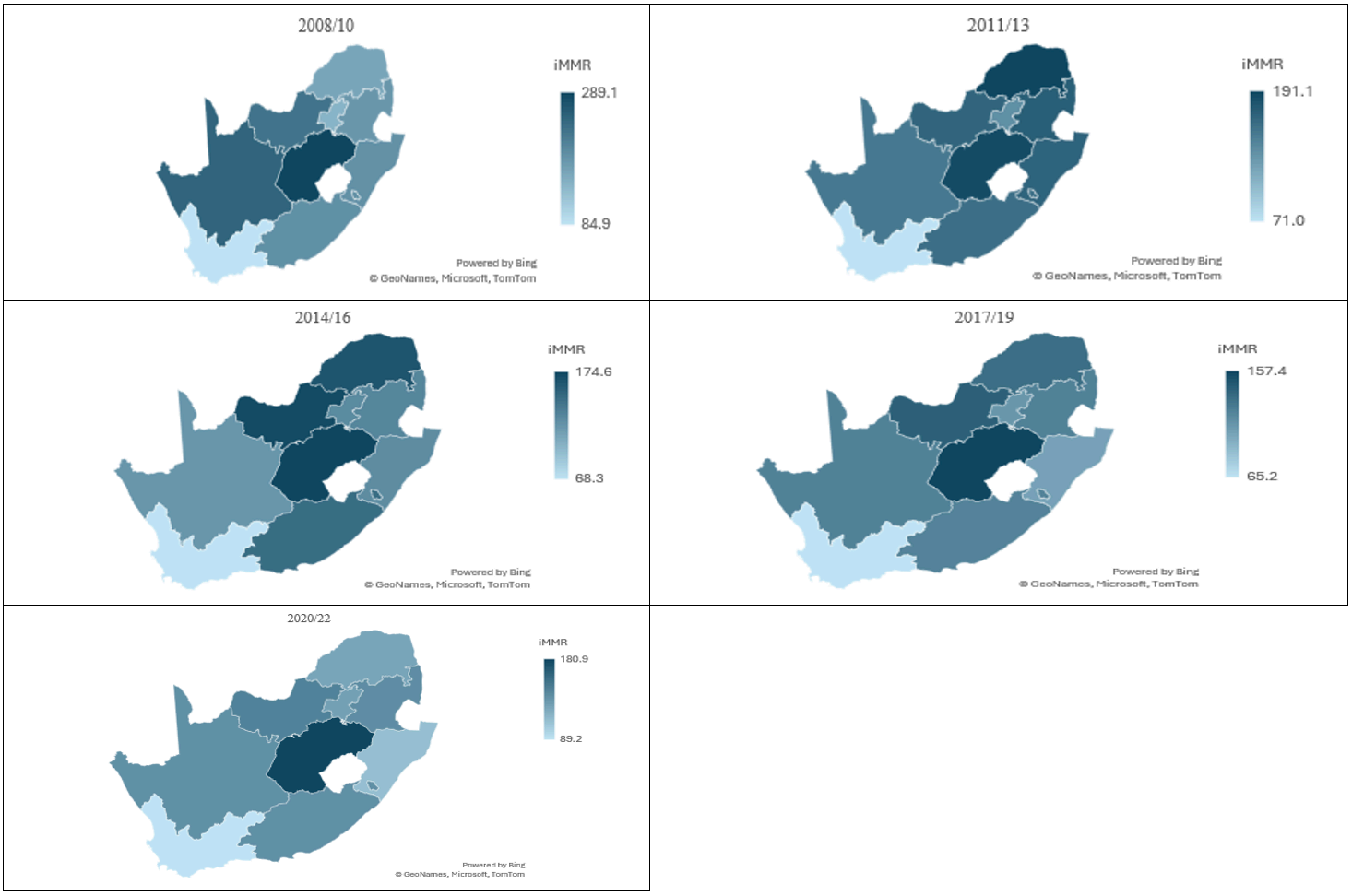
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# Figures




**Figure 1**

Map of South Africa highlighting study provinces (**Source**: XXXXXX)




## Figure 2

**Figure 1.** Spatial and temporal distribution of institutional maternal mortality ratio (iMMR) across South African provinces, 2008/10–2020/22. The figure displays provincial iMMR maps for 2008/10, 2011/13, 2014/16, 2017/19 and 2020/22, with darker shading indicating higher iMMR. The WC consistently shows the lowest iMMR, while the FS, NW and NC show persistently higher levels, particularly in earlier periods.