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Balancing the three-legged pot: Benchmarking road safety institutional frameworks across SADC member states

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ABSTRACT

Background: Road deaths and injuries constitute a major global burden of disease, with Africa the worst affected region. Two successive UN Global Decades of Action (2011–2020 and 2021–2030) have focused on pillars of action aimed at halving road deaths. Pillar 1, Road Safety Management, requires a road safety institutional framework (RSIF) containing three legs: i) a road safety lead agency, ii) road safety funding, and iii) a national road safety strategy with timebound death reduction targets.
Method: We used a regional benchmarking approach to examine RSIFs in the 16 member states of the Southern African Development Community (SADC), which make up 26% of Africa's population and a third of its land mass. Using data from the World Health Organization's 2018 Global Status Report on Road Safety, we computed an RSIF score for each state and visually depicted its RSIF as a three-legged pot with full, partial, or missing legs. We also performed correlational analyses to determine whether there were relationships between member states' RSIF scores and WHO-estimated death rates, GDP per capita, governance scores on the BertelsmanStiftung Transformation Index (BTI-g) and scores on the Human Development Index (HDI).
Results: In 2018, most SADC member states' RSIFs consisted of "wobbly three-legged pots". Leg i (road safety lead agency) was most present, being evident in 80% of the member states. Legs ii (funding) and iii (national road safety strategy) were each present in 73%; however, in most cases, they were deficient compared with global best practice. The only statistically significant correlation we found was between RSIF scores and BTI-g scores.
Discussion: The SADC lagged behind the continent as a whole with respect to lead agencies, with other researchers noting that >90% of African countries had such agencies. The two member states with the highest RSIF scores and lowest death rates (Mauritius and Seychelles) are amongst the wealthiest in the region and have extremely small populations. Overall, the SADC was skewed towards low RSIF scores (correlated with poor governance scores) and high death rates.
Conclusion: Almost all SADC member states require strengthening of all three RSIF legs to bring them into line with global best practice for Pillar 1, Road Safety Management. Collective regional improvement could be facilitated by longstanding intergovernmental cooperation (with high levels of cross-border traffic) and growing civil society involvement in road safety. If the SADC could become an exemplar on the continent this would boost the chances of halving African road deaths and substantially reducing global deaths by 2030.

1. Introduction

1.1. Background

The Decade of Action for Road Safety 2011–20 was launched jointly by the United Nations (UN) and World Health Organization (WHO) in 2010 when global road deaths were recognized as a pressing public health problem and a goal was set to halve them by 2020. To that end, road safety targets were integrated in the Sustainable Development Goals (SDGs), the complex interactions between people, motor vehicles and road infrastructure were recognized under the Safe System approach and five pillars of action were identified: 1, Road Safety Management; 2, Safer Roads and Mobility; 3, Safer Vehicles; 4, Safer Road Users; and 5, Post-Crash Care (World Health Organization, 2009a,

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2011; Academic Expert Group, 2020). Over the decade, absolute road deaths plateaued despite a 4% increase in global population and a 16% increase in motor vehicles; however, marked regional and inter-country differences were evident, with high-income countries (HICs) faring better than low- and middle-income countries (LMICs) which accounted for 93% of global traffic deaths in 2016 (Academic Expert Group, 2020; World Health Organization, 2015). From 2013 to 2016, the global average dropped from 18.3 deaths per 100,000 population to 18.2, whilst in the European region (with a predominance of HICs), the regional average dropped from 10.4 to 9.3/100,000 (World Health Organization, 2018). In 34 high- and middle-income countries, mostly in the OECD, deaths declined by 42% by mid-decade and by 68% by 2020, with a final range of 2–13.6/100,000 (OECD/ITF, 2015; OECD/ITF, 2020). By contrast, in the African region – predominantly consisting of LMICs and having the world's worst road trauma burden – the average death rate rose from 26.1/100,000 in 2013 to 26.6/100,000 in 2016 (World Health Organization, 2018).

Failure to achieve the target of halving global road deaths per annum by 2020 led to the declaration of a second Decade of Action for Road Safety 2021–30 in which the five pillars remain an essential component in reaching the aim of a 50% reduction in the 1.35 million road deaths per annum which were occurring at the start of the decade (Academic Expert Group, 2020; United Nations General Assembly, 2020; World Health Organization, 2021).

Achieving the SDGs requires increased engagement of all levels of civil society and, crucially, according to the World Report on the Prevention of Road Traffic Injuries,(Peden MM et al., 2004) a robust and effective road safety agency with committed leadership. Thus, this paper looks at Pillar 1, Road Safety Management, which rests on a road safety institutional framework which we termed the RSIF. According to the WHO's Global Status Reports on Road Safety (GSRRSs), in its full form, this contains three key components: i) a road safety lead agency, ii) inclusion of road safety funding in the national budget, and iii) a fully funded national road safety strategy with timebound death reduction targets (World Health Organization, 2013, 2015, 2018). Road safety lead agencies are "responsible for leading national efforts to achieve the national road safety goals," including developing and implementing national road safety strategies and bringing "all arms of government and society together to improve safety outcomes" (p6) (Mitullah et al., 2022) and funding is a critical enabler in this (Assum, 1998).

1.2. Road safety benchmarking

Benchmarking between countries is a well-established research method for understanding and responding to road safety challenges (Chen et al., 2017; Shen et al., 2015; Safarpour et al., 2020) and regional comparisons allow countries with shared characteristics to learn from each other's experiences, helping policymakers identify weaknesses, strengths, and priorities (Wegman and Oppe, 2010; OECD/ITF, 2017a). Although challenging to perform, they foster a fuller understanding by comparing risks and interventions (Shen et al., 2015) and can lead to the development of road safety theories and models (Wegman et al., 2008; Holló et al., 2010) as well as handbooks and manuals (European Road Safety Observatory, 2006a; European Commission, 2012; Gitelman et al., 2013; Wegman et al., 2005). Most benchmarking research to date has centered on the European Region, although some studies have taken place in Latin America(OECD/ITF, 2017b) and Southeast Asia (Chen et al., 2017). To date, little benchmarking has occurred in Africa, even with the launch of the African Road Safety Charter in 2016 (African Union, 2016) and African Road Safety Action Plan 2021–2030; (Lisinge RT, 2022) the paucity of African road safety literature reflects a broader dearth of LMIC literature (Staton et al., 2016). Some cross-country comparisons have been undertaken, including an examination of road safety initiatives in five African countries[1] by the Sub-Saharan Africa Transport Policy Program (SSATP)(Assum, 1998) and a study of road safety lead agencies in 16 African countries.[2] (Mitullah et al., 2022). The latter drew six conclusions, namely that road safety lead agencies need clear and legislated institutional mandates, must be results-focused (with national road safety strategies aligned to good practice), should coordinate stakeholders including government and non-state actors, require sustainable funding, need good electronic data systems to monitor and evaluate key risk factors, and must build capacity in terms of human resources, knowledge transfer, infrastructure, and technology.

1.3. Selection of the Southern African Development Community (SADC) as the study focus

No benchmarking research has been carried out in any of Africa's Regional Economic Communities (RECs) despite this offering manageability on a continent containing over 50 highly diverse countries with heterogeneous road traffic systems. For our research, we focused on the REC known as the Southern African Development Community (SADC)[3] due to its significant size and because its abutting member states share cross-border traffic. In 2018 the SADC's 16 member states[4] together comprised a third of Africa's land mass (see Fig. 1), and their combined population of 335 million constituted 26% of the continent's population of 1.3 billion (Worldometer). The SADC's purpose is to achieve equitable and sustainable development, peace, security, and economic growth in the region with a view to alleviating poverty, enhancing people's quality of life, and supporting the socially disadvantaged. The 1996 SADC Protocol on Transport, Communication and Meteorology (Southern African Development Community, 1996) recognized that member states' transport networks are interdependent and their combined transport resources represent a significant and strategic heritage. Intergovernmental cooperation on transport and road safety is now mirrored by growing civil society cooperation, with the launch of the SADC Alliance of NGOs for Road Safety in 2021; currently, this includes 18 NGOs from 11 member states.[5]

Despite the SADC's importance within Africa, road safety research within its member states has been scanty. Twelve (75%) of them belong to the 44-country Sub-Saharan Africa Transport Policy Program (SSATP)[6] but only four[7] were featured in SSATP's study on road safety lead agencies (Mitullah et al., 2022). Whilst four single-country road safety performance reviews have been conducted in Africa, (United Nations Economic Commission for Europe, 2018; United Nations Economic Commission for Africa and United Nations Economics Commission for Europe, 2018; United Nations Economic Commission for Africa and United Nations Economic Commission for Europe, 2020; United Nations Economic Commission for Africa and United Nations Economic Commission for Europe, 2021) only the most recent focused on a SADC member state (Zimbabwe).[8] Similarly, the Africa Status Report on Road Safety 2020 included only five (31%) of the SADC member states.[9](-Africa Road Safety Observatory, 2021) Finally, only one SADC member

[1] Benin, Cote d'Ivoire, Kenya, Tanzania, Zimbabwe.

[2] Cameroon, Chad, Côte d'Ivoire, DR Congo, Egypt, Ethiopia, Ghana, Kenya, Mali, Morocco, Mozambique, Namibia, Nigeria, South Africa, Tunisia, Uganda.

[3] https://www.sadc.int.

[4] Angola, Botswana, Comoros, the Democratic Republic of Congo (DRC), Eswatini (formerly Swaziland), Lesotho, Madagascar, Malawi, Mauritius, Mozambique, Namibia, Seychelles, South Africa, Tanzania, Zambia, Zimbabwe.

[5] Personal communication with Alliance secretary Horst Heimstädt (Namibia) in June 2023; see also sadcroadsafetyngo.org.

[6] Angola, Comoros, DRC, Eswatini, Lesotho, Madagascar, Malawi, Mozambique, Namibia, Tanzania, Zambia, Zimbabwe.

[7] SSATP members DRC, Mozambique and Namibia and non-member South Africa.

[8] The non-SADC countries reviewed were Cameroon, Uganda and Ethiopia.

[9] DRC, Madagascar, South Africa, Zambia, Zimbabwe.

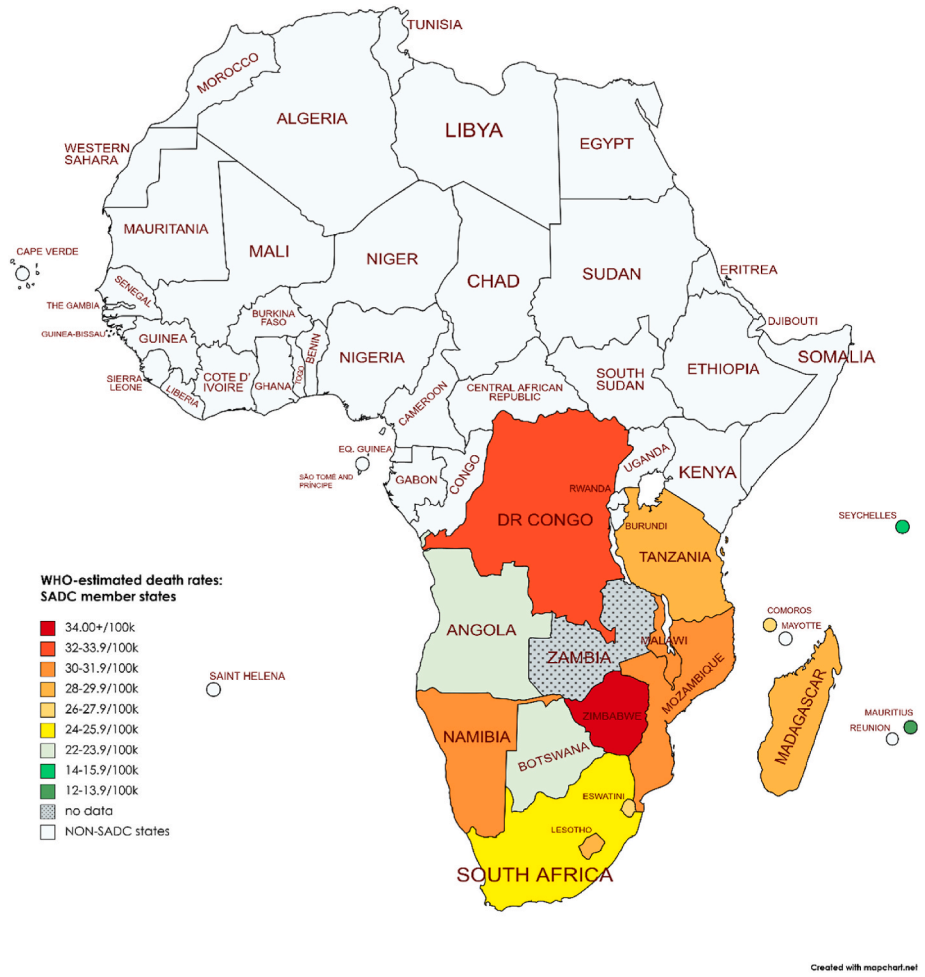

Fig. 1. Member states of the Southern African Development Community (SADC), colour-coded by their WHO-estimated road death rates as reflected in GSRRS-2018. (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article.)

state (South Africa) has featured in the annual road safety reports of the International Traffic Safety Data and Analysis Group (IRTAD) (OECD/ITF, 2020; ITF, 2021). This paper aims to contribute to the knowledge base of road safety research in Africa with the goal of providing guidance on steps to be taken to achieve a 50% reduction in road deaths by the end of the decade.

1.4. Study objectives

The primary objective of our study was to quantify the extent to which each SADC member state had a road safety institutional framework (RSIF) in place during the GSRRS-2018 reporting period[10]. Our secondary objective was to determine whether there were relationships between member states' RSIF scores and their WHO-estimated road death rates, Gross Domestic Product (GDP) per capita, broader governance levels and human development.

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2. Method

For the purposes of our study, we selected the World Health Organization's Global Status Report on Road Safety 2018 (henceforth abbreviated to GSRRS-2018) as our main data source. This was the most recent of four such reports released up until that date (World Health Organization, 2009b, 2013, 2015, 2018). We received an ethics waiver from the Human Research Ethics Committee (Medical) of the Faculty of Health Sciences, University of the Witwatersrand (Certificate W-CBP-220322-01).

We extracted data from GSRRS-2018 and entered it into a customized Excel spreadsheet containing a bespoke scoring matrix (see Table 1) to score the member states based on the presence/absence of the three RSIF components: Leg i (lead agency for road safety), Leg ii (road safety funding in the national budget) and Leg iii (national road safety strategy). Development of the scoring matrix was by consensus of the investigation team after a review of GSRRS-2018 revealed the particular elements of the RSIF captured in that report, and how they were quantified. Agreement was reached within the team as to how to interpret certain data – for instance, it was agreed that if death reduction targets in member states' national road safety strategies were at the level of $\geq$50% reduction over $\leq$10 years, they were deemed to match best practice. We assigned a total possible score of 1, to each of Legs i and ii. To Leg iii, we assigned a total possible score of 5 and converted all scores to a standard score out of 1, to equalize with Legs i and ii. We added the scores for Legs i, ii and iii together to compute an overall RSIF score for each member state.

For context, we captured data relating to population size and road deaths, with the latter including country-reported deaths, algorithm-derived WHO-estimated road deaths, (Papadimitriou et al., 2019)

[10] GSRRS-2018 incorporates data from the years 2016–2018: fatality estimates (2016), information on legislation, road standards and post-crash care (2017) and vehicle standards (2018) (p.xv).(5).

Table 1
Road Safety Institutional Framework (RSIF) scoring matrix.

Leg i: Road safety lead agency	Leg ii: National government funding for road safety	Leg iii: National road safety strategy
Present = 1 point Absent = 0 points	Present = 1 point Absent = 0 points	Existence of strategy: Present = 1 point Absent = 0 points Specific funding for strategy: Full funding = 2 points Partial funding = 1 point No funding = 0 points Target contained in strategy: Yes, aligned to global best practice[a] = 2 points Yes, but unaligned = 1 point No = 0 points
Total possible score = 1	Total possible score = 1	Total possible raw score = 5 Standard scores: 1/5 = 0.2 2/5 = 0.4 3/5 = 0.6 4/5 = 0.8 5/5 = 1.0
OVERALL RSIF SCORE = Leg i score + Leg ii score + Leg iii standard score		

[a] global best practice = ≥50% death reduction over ≤10-year period.

variances between these, and WHO-estimated road death rates (deaths per 100,000 population). For correlational purposes, we sourced additional data, namely 2018 GDP per capita in USD (World Bank, 2018) as well as scores on two international development indices: the BertelsmanStiftung Transformation Index (specifically, its governance domain which we named BTI-g) (BertelsmanStiftung Transformation Index, 2018) and the Human Development Index (HDI) (United Nations Development Program, 2018). BTI-g scores fall along a 10-point scale: very good (scores of 7–10), good (5.6 to <7), moderate (4.3 to <5.6), weak (3 to <4.3) and failed (<3). HDI scores denote four categories: low (scores <0.550), medium (0.550–0.699), high (0.700–0.799) and very high (≥0.800).

We anticipated utilizing regression modelling if the data lent themselves to this but ultimately, on the advice of a statistician, used non-parametric analysis. We tested for correlations between member states' RSIF scores and, respectively, their WHO-estimated road death rates, GDP per capita, BTI-g scores and HDI scores. For this, we selected Kendall's Tau as a suitable correlational coefficient to determine ordinal associations between two measured values; possible scores range from −1 (perfect negative correlation) to +1 (perfect positive correlation), with 0 denoting no relationship. We used R Statistical Software (v4.1.1; R Core Team, 2021) to identify correlations and determine whether these were significant.

3. Results

We found data for 15 (94%) of the 16 SADC member states. No data were available for Zambia.

With respect to the components of the RSIF we found as follows:

Leg i - Road safety lead agency: 12 (80%) of the member states had a lead agency in place; those which did not were Eswatini, Malawi and Zimbabwe.

Leg ii - National government funding **for road safety**: 11 (73%) of the member states made provision for road safety in their national budget; those which did not were Angola, Comoros, Tanzania and Zimbabwe.

Leg iii - National road safety strategy: 11 (73%) of the member states had a national road safety strategy; the four (27%) which did not were Comoros, Eswatini, Lesotho and Zimbabwe. Of those with a strategy, four (36%) had aligned targets (Botswana, Mauritius, Namibia, South Africa) whilst four (36%) had no death reduction targets (Angola, DRC, Mozambique, Seychelles) and the remaining three (27%) (Madagascar, Malawi, Tanzania) had targets which were not aligned with global best practice, ie. ≥50% reduction in deaths over ≤10 years. Where strategies existed, two (18%) were reported to be fully funded (Botswana, Mauritius) while nine (82%) were reported to be partially funded. The latter group included two of the four states with aligned targets, all four states which had no targets and the three states with unaligned targets.

Detailed results are shown in Table 2, with cells colour-coded from red (worst scores) to dark green (best scores).

A summary of all data is provided in Supplementary Table 1.

Analysing the data across legs showed the following: of the 12 states which had a lead agency, only nine (75%) had road safety funding in their national budget; this type of funding was also present in two states which lacked a lead agency. Ten (83%) of the states with lead agencies had a national road safety strategy, as did one state without a lead agency. Of the eight states which had a lead agency, road safety funding in their national budget *and* a national road safety strategy, only two (25%) had a strategy aligned to best practice – ie. fully funded and containing adequate timebound death reduction targets. Malawi was a standalone in having a national road safety strategy (albeit deficient) in the absence of a lead agency. Zimbabwe was a standalone in that it lacked a lead agency, road safety funding in its national budget and any sort of national road safety strategy.

As a visual device we developed an illustration of a three-legged pot (*potjie* in Afrikaans[11]) of the sort used in Africa for several centuries. For such a pot to perform optimally it requires three well-balanced legs so as not to tip and spill its contents. Based on their Leg i, ii and iii scores we depicted each member state's RSIF as a pot with fully present, partially present or absent legs, as applicable. This allowed us to categorise the states into four groups. To Group 1 we assigned two (13%) of the states which had maximum scores denoting three fully present legs (Botswana and Mauritius). Group 2 comprised seven (47%) of the states which each had two full legs and one partial or missing leg (Namibia, South Africa, Madagascar, DRC, Mozambique, Seychelles, Lesotho). Group 3 consisted of five (33%) of the states which had only one full leg, with three (50%) of these having one full leg, one partial leg and one missing leg (Tanzania, Malawi, Angola) and another three (50%) having one full leg and two absent legs (Eswatini, Comoros, Lesotho). Finally, one (7%) of the states fell into Group 4, with no legs at all (Zimbabwe). These results are graphically depicted in Fig. 2.

We noted a phenomenon of significant under-reporting of road deaths across the SADC, with a collective total of 27,003 country-reported deaths contrasted with a collective total of 93,747 deaths estimated by WHO.[12] Using the latter figure we calculated a collective SADC death rate (across the 15 countries examined, which excluded Zambia) of 28.6/100,000 population, above the rate of 26.6/100,000 for the whole African Region. By contrast, using country-reported deaths implied an implausible rate of only 8.5/100,000 population, well below the global average of 18.2/100,000 and even below the best-performing European Region with its 9.3/100,000. Only in five (33%) of the SADC states (Botswana, Mauritius, Namibia, Seychelles, South Africa) was the variance between country-reported deaths and WHO-estimated deaths ≤20%. In the remaining states it varied from approximately 78% in

[11] Afrikaans is one of South Africa's eleven official languages; '*potjie*' means 'little pot".

[12] WHO estimates road deaths per country using an algorithm to correct for different timeframes and definitions and converts the figures to a death rate (deaths per 100,000 population). For SADC member states, the variance between country-reported and WHO-estimated deaths ranged from 0% for Seychelles (with 15 deaths) to 6791% for the DRC (with 385 country-reported deaths compared to WHO's estimate of 26,529).

Table 2
Results of data analysis, including computed RSIF scores.

	RSIF score	LEG i	LEG ii	LEG iii			BTI-g*		HDI**	
		Lead agency	Funding in national budget	National road safety strategy	Specific funding for strategy	Targets contained in strategy	Score	Category	Score	Category
Angola	1.4						3.6		0.574	
Botswana	3.0						7.09		0.728	
Comoros	1.0				n/a	n/a	-	n/s	0.538	
DRC	2.4						2.47		0.459	
Eswatini	1.0				n/a	n/a	-	n/s	0.608	
Lesotho	2.0				n/a	n/a	3.59		0.518	
Madagascar	2.6						5.12		0.521	
Malawi	1.6						5.61		0.485	
Mauritius	3.0						6.64		0.796	
Mozambique	2.4						4.25		0.446	
Namibia	2.8						5.49		0.645	
Seychelles	2.4						-	n/s	0.801	
South Africa	2.8						5.96		0.705	
Tanzania	1.6						5.07		0.528	
Zimbabwe	0.0				n/a	n/a	2.37		0.563	

Colour keys:

LEG i: lead agency / LEG ii: funding in national budget	absent	present				
LEG iii: national road safety strategy	absent	present				
LEG iii: specific funding for strategy	absent	partially present	fully present	not applicable		
LEG iii: targets contained in strategy	absent	yes - unaligned	yes - aligned	not applicable		
* BertelsmannStiftung Index (governance) score(37)	failed	weak	moderate	good	very good	no score
Human Development Index score(38)	low	medium	high			

Eswatini to nearly 7000% (specifically, 6791%) in the DRC (see Supplementary Table 1).

With regards to contextual factors, we noted that World Bank GDP per capita figures for 2018 varied from a low of $503 (Mozambique) to a high of $15,995 (Seychelles), with a median of $4,341. Five (33%) of the member states were Low-Income (Mozambique, Madagascar, Malawi, DRC, Tanzania), five (33%) were Lower-Middle-Income (Lesotho, Zimbabwe, Comoros, Angola, Eswatini), four (27%) were Upper-Middle-Income (Namibia, South Africa, Botswana, Mauritius) and one (7%) was High-Income (Seychelles) (see Fig. 3).

Mapping of WHO-estimated death rates against RSIF scores and GDP per capita (Fig. 4) revealed that the single High-Income state (Seychelles) and four Upper Middle-Income states (Botswana, Mauritius, Namibia, South Africa) all had RSIF scores at or above the median of 2.4 and most (80%) had death rates below the median of 28.6. Three of them (Botswana, Mauritius, South Africa) fell firmly within the most optimal upper left quadrant whilst Seychelles fell on its border. With regards to the five Lower-Middle-Income states, three (60%) fell on or close to the median death rate and two (40%) fell on the median for RSIF scores; only Zimbabwe was firmly in the least optimal lower right quadrant with its zero RSIF score and above-median death rate. Of the five Low-Income states, Madagascar was on the border of the most optimal quadrant but the other four fell within or on the border of the least optimal quadrant. Four (80%) of the five Lower-Middle-Income states had lower RSIF scores than all the Low-Income states. The two member states with the highest RSIF scores and lowest death rates (Mauritius and Seychelles) had extremely small populations (<130,000) compared to the other member states, the populations of which ranged from approximately 796,000 to almost 79 million (see Supplementary Table 1).

With respect to governance, BTI-g scores were available for 12 (80%) of the member states, the missing ones being Comoros, Seychelles and Eswatini. Two (17%) of the scored member states were categorized as failed (DRC, Zimbabwe), three (25%) as weak (Angola, Lesotho, Mozambique), three (25%) as moderate (Madagascar, Namibia, Tanzania), three (25%) as good (Malawi, Mauritius, South Africa) and one (8%) as very good (Botswana).

In relation to human development, HDI scores were available for all 15 member states, with seven (47%) categorized as Low (Comoros, DRC, Lesotho, Madagascar, Malawi, Mozambique, Tanzania), four (27%) as Medium (Angola, Eswatini, Namibia, Zimbabwe) and four (27%) as High (Botswana, Mauritius, Seychelles, South Africa) (percentages rounded thus not adding precisely to 100%). None fell into the Very High category.

With regards to regression modelling, scatterplot diagrams indicated non-linear patterns/relationships and, given the small sample size and non-homogeneous variations, our statistical advisor recommended that we confine ourselves to looking for relationships using non-parametric techniques. The results of our correlational analyses showed a strong, positive correlation between RSIF scores and BTI-g scores, which was statistically significant ($\tau_b = 0.635$, 95% confidence interval [CI]: 0.247, 1.023; $P = 0.007$). A weak negative correlation was found between RSIF scores and WHO-estimated death rates ($\tau_b = -0.324$, 95% CI: −0.74, 0.093; $P = 0.11$) while weak positive correlations were found between

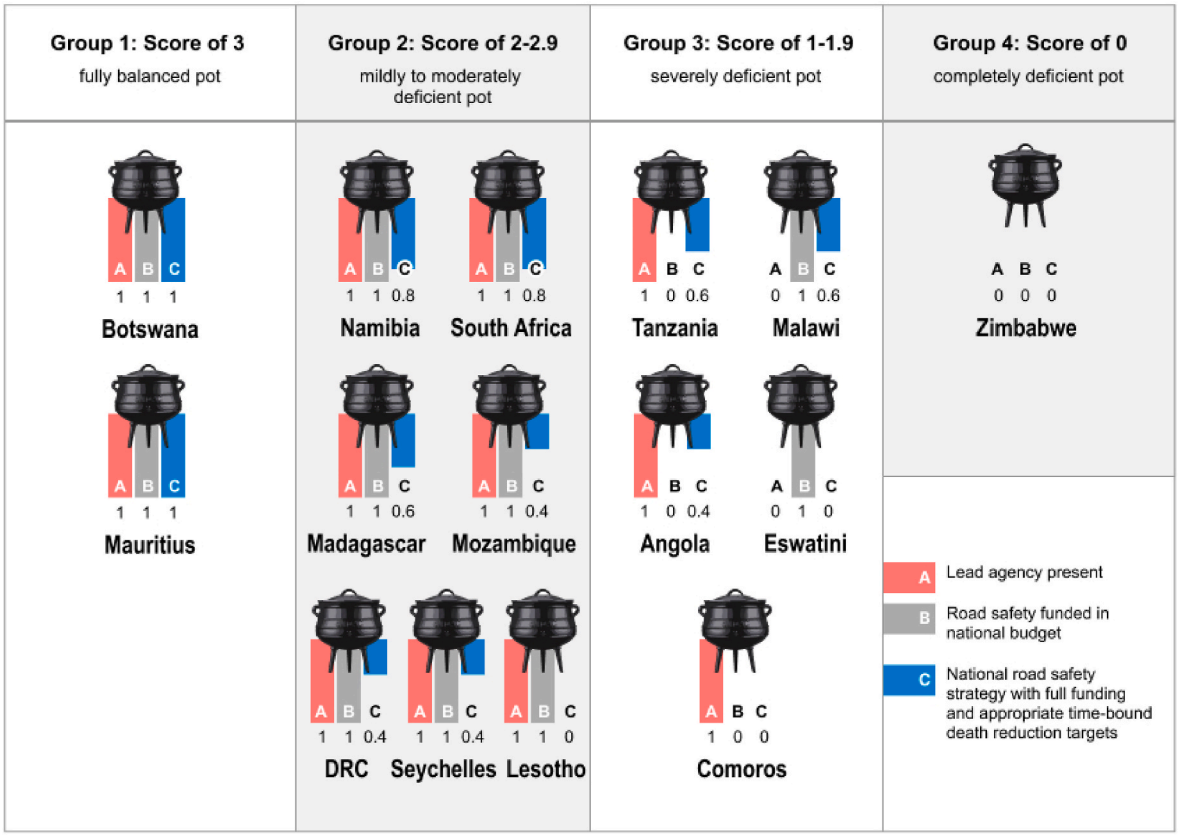

Fig. 2. Member states' road safety institutional frameworks (RSIFs) depicted as three-legged pots.

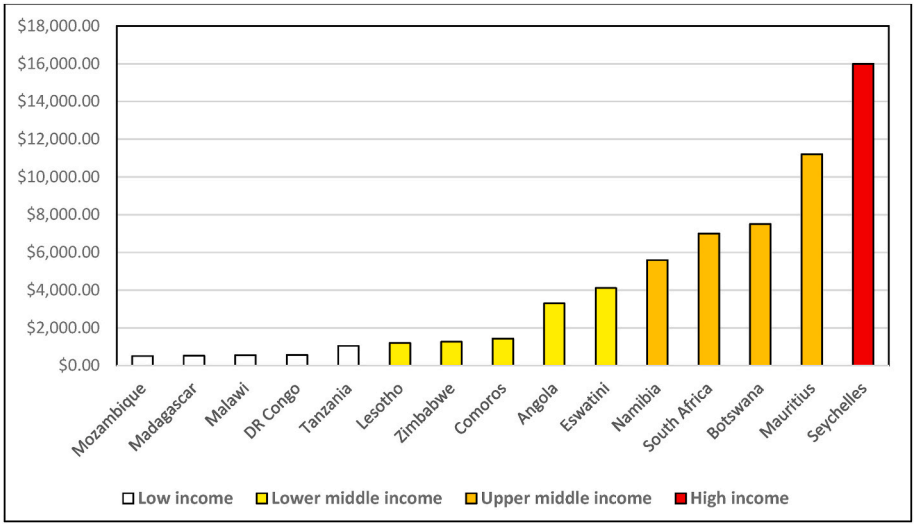

Fig. 3. 2018 GDP per capita in USD for the 15 SADC member states featured in GSRRS-2018.

RSIF scores and GDP per capita ($\tau_b = 0.265$, 95% CI: −0.139, 0.669; $P = 0.195$) and HDI scores ($\tau_b = 0.265$, 95% CI: −0.131, 0.661; $P = 0.195$).

4. Discussion

Our study provides a snapshot of RSIFs in SADC member states in the period 2016–2018, the reporting period for WHO's GSRRS-2018. Our novel benchmarking methodology was found to be robust and fulfilled the purpose of elucidating the critical elements of the RSIF at member state level as well as regionally.

We found high variability in RSIF scores, WHO-estimated road death rates, population size, GDP per capita and levels of governance and human development. There was only one factor strongly correlated with RSIF scores, that being governance as reflected in BTI-g scores. Visually depicting the states as three-legged pots, we found only two to be well balanced whilst the majority had mild to severe deficiencies and thus 'unbalanced pots'; the remaining one was completely deficient, with no legs at all.

The most prevalent RSIF component across the region was Leg i, a road safety lead agency. This was present in 80% of the states, falling

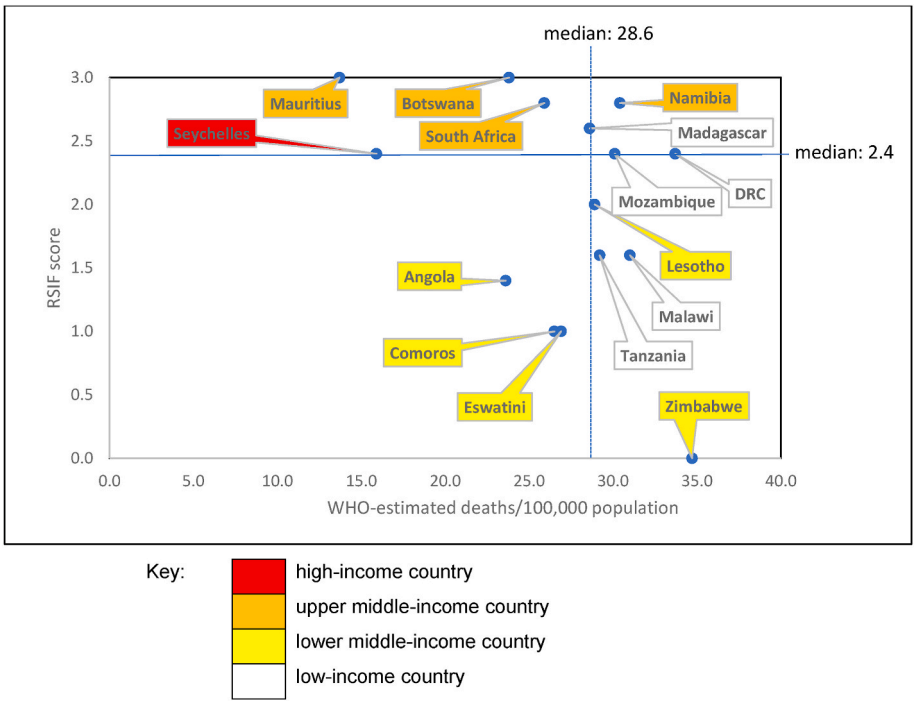

Fig. 4. Member states' Road Safety Institutional Framework (RSIF) scores mapped against their WHO-estimated death rates, with colour-coding by income category. (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article.)

beneath the 94% prevalence reported in a study of 50 African countries (Mitullah et al., 2022) and the overall 90% across the African Region noted by the World Bank (World Bank (Global Road Safety Facility), 2019). The proportion of SADC member states with lead agencies also fell well below the proportions reported for other regions: 95% in the Latin America/Caribbean Region, 90% in the Middle East/North African Region and 85% respectively in the South Asian Region, Asia/East Pacific Region and Europe/Central Asia Region (World Bank (Global Road Safety Facility), 2019).

We found Leg ii (road safety funding in the national budget) to be present at least to some extent in 73% of the SADC states, which exceeded the 40% reported elsewhere for both the African Region and the Middle East/North Africa Region as well as the 70% reported for the South Asia Region (World Bank (Global Road Safety Facility), 2019). However, the SADC compared poorly with other world regions, with full funding being reported by 90% of countries in the Asia/East Pacific Region, 85% in the Latin America/Caribbean Region and 80% in the Europe/Central Asia Region (World Bank (Global Road Safety Facility), 2019). Funding has been noted to be a critically important aspect of road safety management (Mitullah et al., 2022; Assum, 1998) and member states need to budget adequately for this.

Leg iii (a national road safety strategy) was present in 73% of the SADC states,[13] but we found most of the strategies across the region to be under-developed and/or under-resourced. Over a third (37%) were targetless and another 27% had targets which were not aligned to best practice; only 36% contained aligned targets. Other researchers have noted that most world regions dominated by LMICs are characterised by significant proportions of targetless strategies – namely, 40% in the Europe/Central Asia Region, 50% in the South Asia Region, and 60% in the African and the Middle East/North Africa Regions (World Bank (Global Road Safety Facility), 2019). The proportion of targetless strategies in regions which predominantly contain HICs is unknown.

As is evident from Fig. 2, there were anomalies in the results. For instance, two countries (Angola and Tanzania) reported lead agencies and partially funded national road safety strategies but lacked road safety funding in their national budgets; this may suggest a reliance on other sources of funding, such as private sector funding, for strategy implementation. One country (Malawi) reported national road safety funding and a strategy but had no lead agency and another (Eswatini) reported national road safety funding but had neither a lead agency nor a strategy.

The Pillar 1 deficiencies revealed by our analysis almost certainly make the SADC at risk of failing to halve road deaths by 2030, but the lack of a significant correlation between RSIF scores and WHO-estimated death rates was puzzling. An in-depth study of Road Safety Management (RSM) in the European Region found that better management strategies, overall, had a bearing on intermediate outcomes (operational conditions in the road traffic system, such as prevailing speeds and levels of speed enforcement) rather than on final outcomes (road deaths and injuries); however, they noted that the former influenced the latter (Gitelman and Doveh, 2016). That study found heterogeneity across countries and concluded that there was no single 'good practice' RSM model,(Gitelman and Doveh, 2016) echoing the findings of a scoping review (Wesson et al., 2016). A review of economic evaluations of road traffic injury prevention measures in LMICs noted that interventions must be targeted at evidence-based risk factors specific to individual countries(Wegman et al., 2015) while the setting of tailored targets was found to be effective in the high-income settings of Western Australia, Sweden, Switzerland and the Netherlands (Wegman et al., 2015). The importance of targets was also highlighted in the Latin American benchmarking study(OECD/ITF, 2017b) and the European Road Safety Observatory found them to be a key focus of road safety management (European Road Safety Observatory, 2006b). Moreover, a review of the literature on road safety management highlights the complexity thereof, with the presence of all three legs a necessary condition for improved safety outcomes, but not a sufficient one (Varhelyi, 2016). For example, the lead agency needs to have robust political support and commitment, the budget allocation has to allow for proper funding of road safety activity management and coordination, and

[13] We note that at the time of writing, Eswatini had recently released its first National Road Safety Strategy – see final-eswatini-national-road-safety-strategy-2023-2030.pdf (uneca.org).

national road safety strategies should include short-to-medium term goals and a medium-term strategy as well as a long-term vision (Varhelyi, 2016). Whilst our correlational work did not extend to examining relationships between death rates and individual RSIF components or subcomponents, such as targets, this warrants more detailed analysis which could identify the highest priorities for RSIF strengthening in resource-constrained countries.

Our benchmarking review is the first of its kind in the SADC, elucidating RSIF strengths and weaknesses in a prominent REC on the continent with the world's worst road trauma burden. It thus addresses a knowledge gap and contributes to the literature on road safety in Africa. We found the use of GSRRS-2018 as a common secondary source to be a feasible and affordable review mechanism, sidestepping challenges identified by other authors such as the costs of primary research and inability to harmonize primary data across countries (Shen et al., 2015; OECD/ITF, 2017b). Although we appreciate that road safety is a "system of systems" (p16), (McIlroy et al., 2019) by focusing on only one Pillar of Action we avoided the need for the complex numerical and qualitative procedures required to combine multiple road safety aspects into a single composite index (Gitelman and Doveh, 2016; Papadimitriou and Yannis, 2013; Gitelman et al., 2010). In addition we developed a visual device for grouping member states into categories, lending itself to dissemination of the findings to policymakers, researchers, academics and communities alike. By contrast, the Latin American benchmarking study utilizing complex primary data attempted but failed to group countries meaningfully (OECD/ITF, 2017b).

The most obvious – and unavoidable – limitation of our study was the omission of Zambia, due to its absence in GSRRS-2018. Reference to GSRRS-2015 (World Health Organization, 2015) revealed that in the previous reporting period Zambia would have achieved an RSIF score of 3, implying a fully balanced three-legged pot and placing it in our Group 1. Whether it retained that status by the GSRRS-2018 reporting period is unknown.

With respect to our finding of significant variance between country-reported deaths and WHO-estimated deaths, this was congruent with an acknowledged pattern of under-counting averaging 11% across HICs, 51% across Middle-Income countries and 84% across Low-Income Countries (World Bank (Global Road Safety Facility), 2019). A degree of variance is inevitable given that WHO utilises vital registration data (VRD) based on death certificates, whereas country counts typically draw on police and health sector records which may be incomplete or contradictory; in addition, not all countries adhere to the international definition, "deaths occurring within 30 days of the crash" (Papadimitriou et al., 2019). WHO categorizes countries by their quality of VRD, with Group 4 having the least reliable data and requiring statistical methods to be applied to derive the most accurate count possible. The striking variance we found probably relates to 12 (80%) of the reviewed member states falling into this category; another two (Mauritius, South Africa) fell into Group 1 (highest quality VRD) while one (Seychelles) fell into Group 3 (countries with very small populations).

Our results suggest several future research directions. Methodologically, our study design can be re-used for an updated SADC study once the next GSRRS is released and it could also be replicated for other regional benchmarking studies and inter-regional comparisons. It can be adapted for longitudinal research, documenting member states' trajectories over time in keeping with the ASEAN benchmarking study's recommendation that simple, easily applied frameworks be used to monitor road safety development in countries and regions (Chen et al., 2017). Pre- and post-Covid analyses could be of interest, given that the Covid-19 pandemic may have interrupted progress in terms of RSIF development due to the practical and economic effects of lockdowns and reprioritization of budgets, especially in resource-constrained settings. In addition, our study design could be applied to other country groupings or used to compare regions – for instance, the SADC RSIFs could be compared with those in the European Union, made up largely of HICs with aspirationally low road death rates. It could also assist with 'deeper dive' studies into sub-regional realities – for instance, we found it striking that the SADC's small island states of Comoros, Mauritius and the Seychelles (all with populations beneath 1 million) differed so significantly from one another in terms of their RSIF scores and their road death rates.

The research-to-policy implications of our findings are clear: given the generally high road death rates across the SADC, with catastrophically high rates in certain member states, there is an urgent need for policymakers to address Pillar 1: Road Safety Management. Improving RSIFs could improve the region's potential to meet the ambitious goal (halving road deaths) set for the second Decade of Action for Road Safety 2021–2030. With increasing urbanisation and motorisation, road safety management is of increasing importance in the SADC. Our findings can enhance policymakers' insights and inform priority-setting within and across the member states, feeding into existing intergovernmental initiatives and nascent civil society mobilisation around the pressing issue of road safety.

5. Conclusion

In the GSRRS-2018 reporting period most SADC member states were characterised by "wobbly three-legged pots" in relation to their RSIFs, and the regional road death rate exceeded the African Region average and was markedly above the global average. There was no single "best-in-class" SADC state but one standout "worst-in-class" also had the highest road death rate in the region. Four clear groupings emerged reflecting the differential levels of development of Pillar 1, Road Safety Management; RSIF scores were significantly correlated with states' general levels of governance. There is a need for lead agencies to be set up where none yet exist, for adequate road safety funding to be secured and for all member states to develop national road safety strategies which contain meaningful death reduction targets. These measures have the potential to make the SADC an exemplar on the continent, significantly improving the road safety situation in the African Region. Our benchmarking strategy is a key future methodology for comparison of RSIFs across different countries and in different time periods, generating attention around the critical public health problem of road safety.

Declarations of interest

none.

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CRediT authorship contribution statement

Lee Randall: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Resources, Validation, Visualization, Writing – original draft, Writing – review & editing. **Aliza Matusevich:** Resources, Project administration, Investigation, Formal analysis, Data curation, Conceptualization, Validation, Visualization, Writing – review & editing. **Susan Goldstein:** Writing – review & editing, Conceptualization, Formal analysis, Investigation, Supervision, Validation.

Data availability

Data will be made available on request.

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Appendix A. Supplementary data

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