BRICS: opportunities to improve road safety

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Abstract Brazil, the Russian Federation, India, China and South Africa – the countries known as BRICS – are currently undergoing a deep epidemiological transition that is mainly driven by rapid economic growth and technological change. The changes being observed in the distribution of the burden of diseases and injuries – such as recent increases in the incidence of road traffic injuries – are matters of concern. BRICS may need stronger institutional capacity to address such changes in a timely way. In this paper, we present data on road traffic injuries in BRICS and illustrate the enormous challenge that these countries currently face in reducing the incidence of such injuries. There is an urgent need to improve road safety indicators in every country constituting BRICS. It is imperative for BRICS to invest in system-wide road safety interventions and reduce the mortality and morbidity from road traffic injuries.

Abstracts in عربي, 中文, Français, Русский and Español at the end of each article.

Introduction

In recent years, five major emerging economies – Brazil, the Russian Federation, India, China and South Africa, which are known collectively as BRICS – have experienced not only considerable growth in their macroeconomic indicators but also substantial social and political changes. These rapid developments have modified the distributions of many health risk factors and, consequently, the burdens of many diseases and injuries.[1–3] For example, rapid urbanization, technological change and economic growth have led to substantial increases in vehicle densities and in the complexity of the traffic mix.[4,5] As infrastructural development and levels of law enforcement have struggled to keep pace with the increasing traffic densities, it is not surprising that the incidences of fatal and non-fatal road traffic injuries have increased substantially in BRICS in recent years.[6] These countries now need a comprehensive and cost-effective approach to road safety that addresses the recent changes in the risks of such injuries, at least in the short to medium term.

In terms of its road traffic injuries, the world could be facing a change similar to what economists have designated as the "Kuznets curve" – a phenomenon whereby middle-income countries, especially rapidly growing economies, face higher levels of mortality than low- or high-income countries.[7,8] BRICS already account for approximately 20% of the world's deaths from road traffic injuries and the associated economic losses –estimated at 1 to 3% of gross domestic products – are likely to increase unless investments to improve road safety are made.[1,2]

Any attempt by BRICS to address the increasing incidence of road traffic injury is likely to be hampered by budget and institutional constraints and by a paucity of accurate data on – and up-to-date monitoring of – the factors that determine road safety. In most middle-income countries, such factors are rarely investigated in systematic and rigorous observational studies designed to minimize the effects of reporting bias.[9] At the national level, data on road safety and road traffic injuries are often collected inconsistently and are seldom reported by independent agencies.[1,2] In this paper, we hope to contribute to the global health dialogue on BRICS by reviewing the relationship between economic growth and road traffic injuries, presenting evidence on the current status of road traffic injuries, and recommending improvement of road safety monitoring and evaluation.

Economic growth and motorization

Sustained economic growth is a leading factor in the increasing motorization in BRICS, mainly through two mechanisms: increasing per capita income and increasing urbanization. Dargay et al. predicted that by 2030, the number of working motor vehicles in the world will have grown – from the 800 million in existence in 2002 – to more than two billion, with China then possessing 20% of all the vehicles in the world.[10]

Per capita income appears to be the most important determinant of the ownership of a commercial or personal vehicle (Table 1).[11–13] However, urbanization – at least in its early stages, when there is increasing suburban sprawl but little public transport – is also a very strong determinant of the growth of a country's vehicle fleet.[11]

In areas with sustained economic growth, the growth of the vehicle fleet generally outpaces the growth of the institutions and resources needed to maintain road safety.[11] This is a particular problem in booming developing economies, where there is limited institutional capacity to generate smart and effective traffic regulations and the resources needed to provide a safe infrastructure for the incoming flow of new vehicles and to adjust both urban and suburban space to match the higher demand for motorization.[11,13,14]

Another factor that contributes to the complexity of the effect of economic growth on motorization is the heterogeneity in economic growth across urban and rural areas. At the national level, road networks and the demand for motorization generally expand at the same rate as the mean per capita income.[11] However, on a smaller scale, within urban areas, road networks often expand at lower rates than per capita income, while car ownership expands at higher rates than such income.[11]

Increased motorization is one of many challenges faced by BRICS as each country's national income and urban population grows. It appears to be an inevitable short-term consequence of economic success. Between the start of 2009 and the end of

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(*Submitted: 2 November 2013 – Revised version received: 19 February 2014 – Accepted: 10 March 2014*)

Table 1. **Gross national product per capita in 2010 and change in the number of vehicles per capita between 2007 and 2010, in 15 selected countries**

Country	GNP (US$ per capita)	Change in vehicles per capita (%)
Australia	46 200	+6.0
Bolivia	1 810	+2.2
Brazil	9 540	+7.8
China	4 240	+4.6
France	42 190	−9.1
India	1 260	+3.5
Italy	35 530	+15.6
Japan	42 050	−1.2
Mozambique	440	+0.5
Nigeria	1 170	+3.2
Paraguay	2 730	+5.5
Russian Federation	9 880	+3.2
South Africa	9 540	+0.7
United States of America	47 350	+2.4
Viet Nam	1 160	+11.7

GNP: gross national product; US$: United States dollars.
Sources: World Health Organization global status reports on road safety for 2009[2] and 2013.[1]

2010, Brazil's and China's vehicle fleets are estimated to have grown by 8% and 36%, respectively.[15] By the end of 2010, Brazil held half of all the vehicles in continental Latin America excluding Mexico; China had 36 million vehicles on its roads, and the Russian Federation had 34 million.[15] At the same time, India had only 13 million vehicles – although this represented a 10% increase since 2006 – and South Africa held 30% of all the vehicles, but only 5% of the people, in Africa.[15,16]

Risk factors for road traffic injuries

Important risk factors for road traffic injuries include failure to use seatbelts and child restraints in cars, speeding, failure to wear a helmet while travelling on a motorcycle, and driving while under the influence of alcohol. These so-called "five key risk factors" are the main focus of the global Decade of Action on Road Safety, which will end in 2020.[1,2] In the United States of America, failure to use a seat-belt, driving while under the influence of alcohol and all of the five key risk factors combined accounted, respectively, for 40%, 43% and 61% of the person–years lost by vehicle occupants because of road traffic injuries between 1982 and 2001.[17] The corresponding proportions in BRICS may be even higher because law enforcement in BRICS generally appears to be more lax than in the United States.

Investigation of the reported prevalences of the main risk factors for road traffic injuries in BRICS (Table 2) reveals two clear issues. First, a person living in one of the BRICS countries is at a relatively high risk of having a fatal road traffic injury because of one or more – often avoidable – risk factors.[18] Second, there is a paucity of nationally representative and systematically collected data on the risk factors for road traffic injuries in BRICS.[19] This gap in knowledge needs to be filled quickly.[20,21]

In BRICS, little improvement has been noted recently in the levels at which either existing road-safety rules are enforced or interventions for the improvement of road safety have been implemented.[1] When the World Health Organization scored levels of law enforcement for speeding on a scale of 1–10 – with 10 representing the highest level – Brazil and the Russian Federation scored 6, China scored 4 and India and South Africa only scored 3.[1] There is clearly room for improvement in the enforcement of traffic laws throughout BRICS. The often low levels of such enforcement indicate that many of people who live in BRICS are not recorded when they do break traffic laws and thus increase their risks of a road traffic injury.

Health outcomes and road traffic injuries

At the current stage of development, the BRICS countries are experiencing accelerated economic growth – leading to higher volumes of traffic – but have not had the time to build the institutional capacity to cope with such growth or to invest adequately in the systems needed to maintain or increase road safety. As a result, a recent and substantial increase in the numbers of both injuries and deaths from road traffic accidents has occurred. In general, the four middle-income countries among BRICS have higher traffic-related mortality (Fig. 1) and non-fatal injury (Fig. 2) rates than some low- and high-income countries.

Table 2. **Prevalence of key risk factors for road traffic injuries, Brazil, the Russian Federation, India, China and South Africa (BRICS), 2009**

Risk factor	Prevalence (%)				
	Brazil	Russian Federation	India	China	South Africa
Failure to use helmet[a]	12	ND	50	84	5
Failure to use seatbelt in cars and trucks	40	ND	73	50	50
Speeding by drivers	ND	3	ND	20	ND
Driving under the influence of alcohol[b]	11	ND	23	2	ND

ND: no data.
[a] Assessed among motorcyclists.
[b] Assessed among drivers who were stopped at checkpoints.
Sources: World Health Organization global status reports on road safety for 2009[2] and 2013.[1]

Table 3 shows the numbers of fatal and non-fatal road traffic injuries reported in 2009 and 2013 in each of the five countries. Only the Russian Federation showed a reduction in fatal road traffic injuries between 2009 and 2013 (Table 3) and a reduction in disability-adjusted life years lost from road traffic injuries between 1990 and 2010 (Table 4). Given that many non-fatal road traffic injuries go unreported, the numbers of such injuries that were reported in BRICS in 2009 are high. In general, road traffic injuries are now a much more severe problem in Brazil, China, India and South Africa than they were in 1990 (Table 4). The situation in the Russian Federation seems more encouraging and merits further exploration.

Conclusion

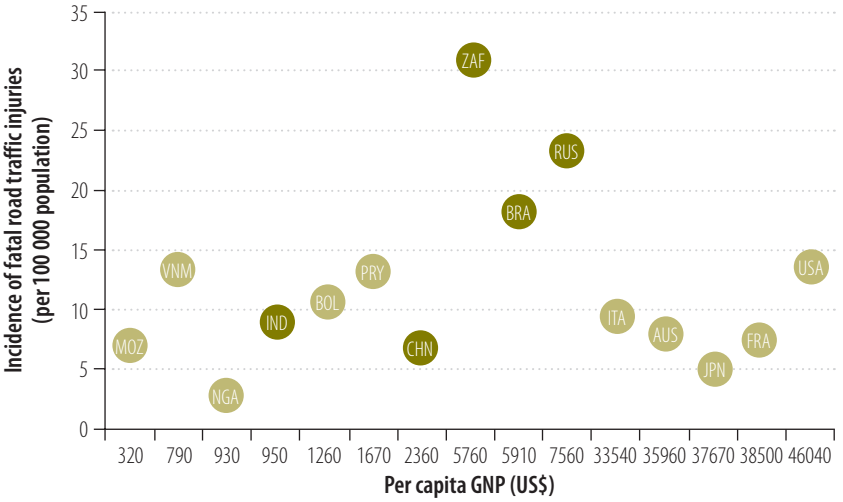
In this paper, we present data revealing the need for BRICS to reduce the burden posed by road traffic injuries – much of which can be associated with their recent, rapid economic growth. The increased number of vehicles, the increased complexity of the traffic mix and rapid urbanization appear to be key factors in the increasing incidence of traffic-related injuries. Road safety in BRICS needs to be improved through investment in interventions targeted at the key risk factors and collection of more reliable data to establish baseline values and track temporal changes in more detail.[22–25] There needs to be regular, large-scale systematic monitoring of the factors that influence road safety. This would then allow the cost–effectiveness of interventions for the improvement of road safety to be rigorously assessed and any temporal changes in road safety to be detected rapidly.[26]

The Russian Federation appears to have had some recent success in reducing the incidence of road traffic injuries. The monitoring and interventions implemented in the Russian Federation could perhaps be rolled out elsewhere. In a population-based survey, over 60% of adults who travel in motor vehicles in the Russian Federation claimed to wear seatbelts – either because they perceived such restraints to be potentially life-saving or because the law requires that they be worn.[19] Effective investment on reducing the prevalence of risk factors – via, for example, enforcement, social marketing or changes to roads and road layouts – can make a difference. However, if the road safety targets it has set itself are to be effectively translated into lives saved, the Russian Federation still has much work to do.[27]

The effective monitoring of road safety in BRICS will require increases in traffic law enforcement and related research capacity. The development of good and sustainable traffic research capacity will, in turn, require technical and financial investments by the BRICS countries and probably technical assistance from international organizations and donors.[28] The increasing incidence of road traffic injuries in these countries is a real challenge that is likely to impact economic development, especially in the long term. However, BRICS could tackle the problem soon, while it is still on the rise.

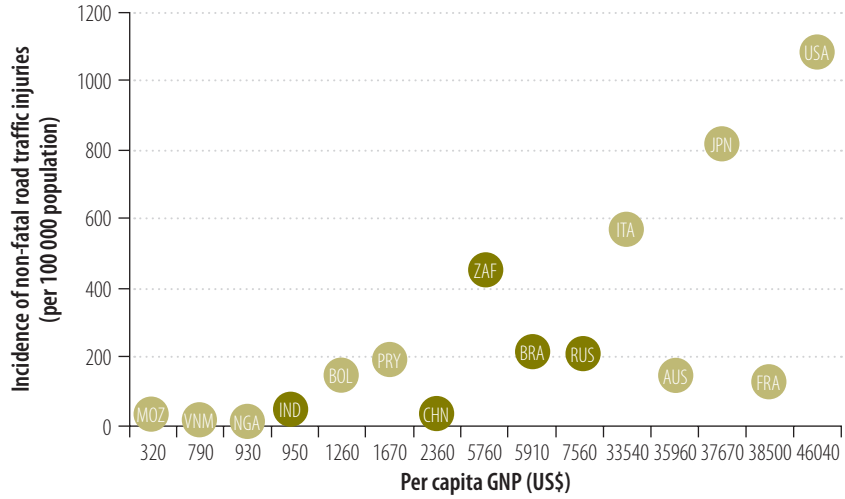
In the long term, BRICS must start considering and investing in systems of public transport that reduce individual car ownership. Public transport has its own risks and the vehicles and drivers used must meet minimum standards.

Fig. 1. **Fatal road traffic injuries and gross national product, 15 selected countries, 2009**



AUS: Australia; BOL: Bolivia; BRA: Brazil; CHN: China; FRA: France; GNP: gross national product; IND: India; ITA: Italy; JPN: Japan; MOZ: Mozambique; NGA: Nigeria; PRY: Paraguay; RUS: Russian Federation; USA: United States of America; US$: United States dollars; VNM: Viet Nam; ZAF: South Africa.
Sources: World Health Organization global status reports on road safety for 2009[2] and 2013.[1]

Fig. 2. **Non-fatal road traffic injuries and gross national product, 15 selected countries, 2009**



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Sources: World Health Organization global status reports on road safety for 2009[2] and 2013.[1]

Table 3. **Key demographics and numbers of road traffic injuries, Brazil, the Russian federation, India, China and South Africa (BRICS), 2009 and 2013**

Variable	Brazil	Russian Federation	India	China	South Africa
Population (thousands)					
2009	191 790	142 498	1 169 015	1 336 317	48 576
2013	194 946	142 958	1 224 614	1 348 932	50 132
Gross national product (US$ per capita)					
2009	5 910	7 560	950	2 360	5 760
2013	9 540	9 880	1 260	4 240	6 090
No. of fatal RTI (thousands)					
Reported for 2009	35	33	105	89	15
Reported for 2013	37	26	134	65	15
Estimated for 2009	35	36	196	220	16
Estimated for 2013	44	26	231	276	16
No. of non-fatal RTI (thousands)					
Reported for 2009	408	292	452	431	220

RTI: road traffic injury; US$: United States dollars.
Sources: Population sizes and estimated numbers of injuries come from the World Health Organization global status reports on road safety for 2009[2] and 2013.[1]
Reported numbers of injuries come from the unpublished records of the relevant Ministries of Health.

Table 4. **Global burden of disease attributable to road traffic injuries, Brazil, the Russian Federation, India, China and South Africa (BRICS), 2010**

Road traffic injuries	Brazil	Russian Federation	India	China	South Africa
Years of life lost	2 022 510	1 431 740	12 587 800	12 154 500	236 697
% of total life years lost	6.30	3.20	3.30	6.30	1.00
Years lived with disability	288 084	338 380	3 495 430	2 807 810	84 065
DALYs	2 310 590	1 770 120	15 093 100	14 962 300	320 762
Change in DALYs attributed to road injuries between 1990 and 2010 (%)	+30	–20	+60	+55	+80

DALY: disability-adjusted life year.
Source: The Global Burden of Disease: country profiles (2013).[18]

Investment in risk-reducing changes to the road infrastructure – such as the creation of separate lanes for private motorized vehicles, bicycles, pedestrians and perhaps buses – also need to be considered. The provision of efficient and affordable systems of mass transport and the separation of private motorized vehicles from all other forms of road traffic should reduce congestion and environmental degradation. Each of these issues is likely to become a mid- to long-term threat to the health and economic development of the BRICS countries. ■

Acknowledgements
This study was partly supported by the Global Road Safety Program of the Bloomberg Philanthropies.

Competing interests: None declared.

ملخص
تجمع "بريك" (BRICS): فرص تحسين السلامة على الطرق

تشهد البرازيل والاتحاد الروسي والهند والصين وجنوب أفريقيا – البلدان المعروفة بتجمع "بريك" (BRICS) – في الوقت الراهن تحولاً وبائياً عميقاً يقف خلفه بشكل رئيسي النمو الاقتصادي السريع والتغير التكنولوجي. وتمثل التغيرات التي يجرى ملاحظتها في توزيع عبء الأمراض والإصابات – مثل الزيادات الأخيرة في معدل الإصابات الناجمة عن حوادث المرور – مواضيع مثيرة للقلق. وقد يحتاج تجمع "بريك" إلى قدرة مؤسسية أقوى لمعالجة هذه التغيرات في حينها. ونقدم في هذه الورقة البيانات المتعلقة بالإصابات الناجمة عن حوادث المرور في تجمع "بريك" ونوضح التغير الهائل الذي تواجهه هذه البلدان في الوقت الراهن في تقليل معدل حدوث هذه الإصابات. وتوجد حاجة ملحة لتحسين مؤشرات السلامة على الطرق في كل بلد من البلدان التي تشكل تجمع "بريك". ويتحتم على تجمع "بريك" الاستثمار في تدخلات السلامة على الطرق على نطاق المنظومة وتقليل الوفيات والمراضة الناتجة عن الإصابات الناجمة عن حوادث المرور.

摘要

金砖国家：提高道路安全的机会

巴西、俄罗斯联邦、印度、中国和南非被称为金砖五国（BRICS），这些国家正在经历一场深刻的流行病学转变，这种转变主要由经济快速增长和技术变革驱动。目前紧要的问题是观察到的疾病和伤害负担分布的变化，比如最近道路交通伤害发生率的增加。金砖国家可能需要更强的机构能力来及时解决这些变化。在本文中，我们介绍金砖国家道路交通伤害的数据并说明这些国家目前在减少此类伤害发生率方面所面临的巨大挑战。每个金砖国家的道路安全指标都亟待提高。对于金砖国家来说，当务之急是在整个系统上加大对道路安全干预的投入，降低道路交通伤害死亡率和致残率。

Résumé

Groupe BRICS: possibilité d'amélioration de la sécurité routière

Le Brésil, la Fédération de Russie, l'Inde, la Chine et l'Afrique du Sud – les pays connus sous le nom de BRICS – connaissent actuellement une transition épidémiologique profonde qui s'explique principalement par la rapidité de la croissance économique et de l'évolution technologique. Les changements qui sont observés dans la distribution de la charge des maladies et des blessures, comme les hausses récentes de l'incidence des accidents de la route, suscitent des inquiétudes. Le groupe BRICS peut avoir besoin de capacités institutionnelles renforcées pour répondre rapidement à ces changements. Dans cet article, nous présentons les données sur les accidents de la route dans le groupe BRICS et nous illustrons l'énorme défi que doivent actuellement relever ces pays dans la diminution de l'incidence de ces accidents. Il est urgent d'améliorer les indicateurs de la sécurité routière dans chaque pays constituant le groupe BRICS. Il est impératif que le groupe BRICS investisse dans des interventions de sécurité routière dans l'ensemble du système et qu'il réduise la mortalité et la morbidité dues aux accidents de la route.

Резюме

Страны БРИКС: возможности для улучшения безопасности дорожного движения

Бразилия, Российская Федерация, Индия, Китай и Южная Африка — страны, известные как БРИКС, — в настоящее время переживают глубокое изменение эпидемиологической ситуации, вызванное в основном быстрым экономическим ростом и развитием технологий. Изменения, наблюдаемые в распределении бремени болезней и травм, как например, недавнее увеличение травматизма, связанного с дорожно-транспортными происшествиями, вызывают озабоченность. Странам БРИКС возможно понадобится больший институциональный потенциал для своевременного решения проблем, вызванных этими изменениями. В данной статье представлены данные по дорожно-транспортному травматизму в странах БРИКС и проиллюстрирована огромная проблема, связанная со снижением такого травматизма, которая стоит в настоящее время перед этими странами. Существует настоятельная необходимость в улучшении показателей безопасности дорожного движения в каждой из стран БРИКС. Крайне важно, чтобы страны БРИКС инвестировали в общесистемные мероприятия по безопасности дорожного движения и снижали уровень смертности и заболеваемости от дорожно-транспортного травматизма.

Resumen

BRICS: oportunidades para mejorar la seguridad vial

Brasil, la Federación de Rusia, India, China y Sudáfrica, los países conocidos como BRICS, se encuentran en la actualidad en una transición epidemiológica profunda impulsada principalmente por el rápido crecimiento económico y el cambio tecnológico. Los cambios que se observan en la distribución de la carga de enfermedades y lesiones, como los aumentos recientes de la incidencia de los accidentes de tráfico, son motivo de preocupación. Es posible que los BRICS necesiten una capacidad institucional más fuerte para hacer frente a esos cambios de manera oportuna. En el presente artículo, presentamos datos sobre lesiones en accidentes de tráfico de los BRICS e ilustramos el enorme desafío al que dichos países se enfrentan actualmente para reducir la incidencia de las mismas. Hay una necesidad urgente de mejorar los indicadores de seguridad vial en todos los países BRICS. Es imperativo que estos países inviertan en intervenciones de seguridad vial en todo el sistema y reduzcan la mortalidad y morbilidad por accidentes de tráfico.

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