A critical analysis of adult platelet product utilisation in South Africa, 2014 - 2021

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Background. Platelet products are usually prescribed for the prevention and treatment of bleeding in patients with reduced platelet counts, or those with dysfunctional platelets. Between 2008 and 2017, platelet use across 12 multinational transfusion centres increased by 10.2%, and a further increase of 3.9% is predicted by 2032. The National Health Insurance (NHI) Bill has been signed into South African (SA) law, starting the transition from a two-tiered healthcare system to universal access to healthcare. Healthcare sector-specific platelet recipient and utilisation profiles for SA are largely unknown. Quantifying differences in utilisation patterns between the SA healthcare sectors is essential for long-term planning, and to provide valuable insights to inform policy.

Objectives. To critically analyse platelet utilisation patterns at the South African National Blood Service (SANBS) according to SA healthcare sector.

Methods. The SANBS provides blood products to eight out of the nine provinces in SA. We conducted a descriptive, cross-sectional, retrospective analysis of all platelet requisitions processed by the SANBS between 1 January 2014 and 31 December 2021. Healthcare sector-specific demographic and utilisation patterns were determined, and per capita utilisation calculated.

Results. Of the 445 803 platelet units issued in the specified time period, 200 856 (45.1%) were issued to the public sector, compared with 244 922 (54.9%) to the private sector. The public sector recipients were mostly female (55.7%), with a median (interquartile range (IQR)) age of 29 (15 - 42) years, and in the private sector, mostly male (53.1%), with a median (IQR) age of 53 (36 - 65) years. The private sector issued more units of platelets per 1 000 population on average than the public sector, with 3.89 units per 1 000 private sector population v. 0.59 units per 1 000 public sector population.

Conclusion. Platelet utilisation between SA's healthcare sectors is distinctly different. The drivers underpinning these patterns are interdependent, including population and demographic characteristics, disease patterns, transfusion practices and healthcare demands. A greater understanding of socioeconomic and disease drivers is required to provide policy-relevant insights to predict utilisation and assist transfusion services with planning in light of the NHI rollout.

Keywords: adult platelets, blood product utilisation, healthcare systems, healthcare policy, universal healthcare, National Health Insurance

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Globally, 118.5 million units of blood are collected annually.[1] The blood transfusions made possible by these donations form a critical part of patient care across medical specialties,[2] from organ transplantation to cancer treatment.[3] Depending on the needs of the patient, particular blood components, such as platelets, may be required.[4] Platelet products are generally indicated to either prevent (prophylactic transfusions) or stop bleeding (therapeutic transfusions) in patients with platelet counts below normal, or with atypically functioning[2] platelets. Compared with red-cell products, which can be stored for up to 42 days at 1 - 6°C, platelet units have a much-reduced shelf-life, as they require storage at room temperature, which is conducive to bacterial growth.[2,4,5] The complexities in collecting, processing and storing platelet products, especially single-donor apheresis platelets, are significant cost drivers to the pricing of platelet products in South Africa (SA).[6,7]

Platelet products can either be derived from multiple donors (pooled platelets from whole blood donations) or from a single donor (through platelet apheresis), with overlap in indications for use and risk profiles.[2,5] Both products have similar therapeutic outcomes.[8] Single-donor platelet products are indicated in patients requiring long-term platelet transfusion support, those who are immunocompromised or those who are seriously ill.[2] Pooled platelet products are mostly used in acute settings in adverse patients who need short-term platelet therapy.[2] Both products have similar risks, but with a dose-dependent greater immune response following pooled platelet transfusion.[9] Between 2008 and 2017, a multinational study reported platelet use to have increased by 10.2%.[10] Global Market Insights[11] predicts a further increase of 3.9% by 2032, based on the increasing prevalence of chronic and blood-related disorders, alongside the adoption of platelets for effective haemostatic support of these diseases.

The SA health services are delivered through a two-tiered system. The public healthcare sector services 84% of the population,[12] mostly to those who face both social and economic

challenges and who are more likely to experience poor health.[13] The public sector is resource-constrained and funded from taxes, and care is generally free or provided at a reduced price. Nonetheless, those who utilise these services often delay seeking care and are less likely to use inpatient care.[13] The remaining 16% of the population access the better-resourced private healthcare sector, typically funded through private medical insurance.[14,15]

Social inequality, poverty, unemployment and a heavy burden of disease continue to affect SA. Aiming to provide all SA citizens with universal access to healthcare in line with the World Health Organization (WHO)'s Sustainable Development Goal 3 by 2030, the President of SA, Cyril Ramaphosa, signed the National Health Insurance (NIH) Bill into law in May 2024.[16]

Understanding the current demand and utilisation patterns of blood products, including platelets, is essential for long-term planning, including for NHI implementation. In earlier work, differences in red-cell utilisation patterns were observed between the public and private healthcare sectors, each with distinct patient profiles.[17,18] In contrast, the healthcare sector-specific platelet recipient and utilisation profile in SA is unknown. As the indications for platelets differ from those for red-cell products, the utilisation patterns may differ. By analysing the patient and clinical discipline profiles of platelet product recipients and quantifying the differences in utilisation patterns between the public and private healthcare sectors in SA, this study aims to address this knowledge gap and provide valuable insights to inform policy decisions.

Methods

Study setting

The SA National Blood Service (SANBS) provides blood product support to 88% of the SA population across all provinces except the Western Cape.[12] SANBS collects, tests and processes blood from voluntary, non-remunerated donors, and distributes it equitably to both the public and private healthcare sectors through more than 80 blood banks. Clinicians order blood products and services from the blood banks by completing a requisition form containing patient details, blood products required, blood grouping and compatibility tests and relevant instructions, where needed.

Data collection and extraction

SANBS blood bank technicians capture operational data from the requisitions in real time onto the electronic blood establishment computer system, MEDITECH. These data include patient demographics, such as age and sex, patient registration type (public or private), clinical and hospital information. In addition, product information is collected, including the type of product(s) requested, the number of units ordered and issued and the number of units cancelled, with the cancellation reason.

The data for this study were extracted from the SANBS MEDITECH data warehouse. A list of the different adult platelet products is provided as appendix 1: http://coding.samedical.org/file/2338. Each requisition has a unique identifier representing a unique transfusion event for which more than one product type may be ordered.

Study design

We performed a retrospective, descriptive, cross-sectional study of the operational SANBS data per healthcare sector. We included all adult platelet product requests processed for the period 1 January 2014 to 31 December 2021, where adult platelets are defined as a platelet yield of $\geq 2.4 \times 10^{10}$.[11]

Data considerations

This study was an extension of previous analyses of red blood-cell products issued by SANBS. The data considerations outlined in those analyses are also applicable here.[17] The present study included an extended dataset and utilised previously described imputation methods[17] for approximation of the missing issued counts, i.e. the number of platelet units issued by the SANBS that were not available within the dataset. Specifically, imputation was required for 63, 86 and 61 missing issued counts in 2019, 2020 and 2021, respectively, which on average accounted for 0.0136% of all issued counts. The manual capturing of data is subject to human error; however, the sample size in conjunction with the legal requirement (which is subject to regular internal and external audit) for donor and recipient traceability should minimise the impact of such errors. Overall, age was generally well captured, but in cases where age was not available or erroneously captured, age was specified as 'not available'. The age variable was expressed in years, and the recipient's age was considered to not have increased until the next year increment.

The General Household Surveys for 2020 and 2021, used to generate SA healthcare sector population estimates, were affected by COVID-19. Since in-person data collection ceased, the dwelling frame sample[19] could not be used. The transition was made to telephonic interviews using contact numbers collected during previous household visits. This resulted in significantly reduced sample size of 50% of previous surveys. Due to the limited sample size, aggregation by province, sex, age and medical aid resulted in high levels of variance (private communication: N Roux, Statistics SA, 17 November 2022). To address the issue, weighted estimates were provided by Statistics SA and used in this analysis.

Data analysis

The data were analysed using RStudio version 2022.12.0+353 Elsbeth Geranium Release with R statistical software version 4.1.0. Demographic trends in age and sex were determined across transfusion events, and utilisation trends per age category. Per capita product use per 1 000 sector population was determined as follows:

$$\frac{\text{Number of units of platelet product issued over period}}{\text{Healthcare sector population over period}} \times 1\,000$$

SA healthcare sector population estimates (excluding the Western Cape Province) were generated from provincial estimates reported by Statistics SA and stratified by year, 5-year age bands and sex.[19,20-26]

Ethical considerations and data sharing

Ethical approval for the study was obtained from the human research ethics committees (HRECs) of SANBS (ref. no. 2017/7) and Stellenbosch University (ref. no. N18/10/128_RECIP_SANBS_2017/7). Anonymised data may be shared subject to the approval of the data request and/or study protocol by SANBS and the SANBS HREC. Upon conclusion of a non-disclosure agreement between the SANBS and any requesting individual or organisation, the data fields, data dictionary and analysis code will be made available as per approved request.

Results

Demographic trends in transfusion events

From 2014 to 2021, the overall adult platelet transfusion events accounted for 9.5% (365 518/3 849 064) of all transfusion events (Table 1). Among the 365 518 adult platelet transfusion events, 178 810 (48.9%) were in the public sector and 186 708 (51.1%) in the private sector. Platelet transfusion events involving only apheresis products were higher (48.4%) in the private than in the public sector

(38.6%), while those involving pooled products only were higher in the public (57.2%) than in the private sector (46.5%). The proportion of transfusion events associated with both platelet product types was higher in the private (5.2%) than in the public sector (4.2%). Public sector platelet recipients were younger, with a higher proportion of females than those in the private sector (Figs 1 and 2).

Trends in adult platelet product units issued per transfusion event

Across both healthcare sectors, most transfusion events involved the issue of a single unit of adult platelets (non-product specific). However, ≥2 units of platelets were issued more often in the private sector (27.1% v. 20.3% in the public sector) (Fig. 3).

Table 1. Demographic and utilisation characteristics of the 365 518 public and private sector adult platelet product transfusion events, 2014 - 2021

Characteristic	Public sector, *n* (%)*	Private sector, *n* (%)*	Total, *n* (%)*
Transfusion events	178 810 (48.9)	186 708 (51.1)	365 518 (9.5)
Platelet type			
Pooled	102 350 (57.2)	86 735 (46.5)	189 085 (51.7)
Apheresis	68 936 (38.6)	90 295 (48.4)	159 231 (43.6)
Both	7 524 (4.2)	9 678 (5.2)	17 202 (4.7)
Age (years), median (IQR)	29 (15 - 42)	53 (36 - 65)	
Gender			
Male	78 832 (44.1)	99 08 (53.1)	177 919 (48.7)
Female	99 568 (55.7)	87 411 (46.8)	186 979 (51.2)
Unknown	410 (0.2)	210 (0.1)	620 (0.2)

IQR = interquartile range.
*Unless otherwise indicated.

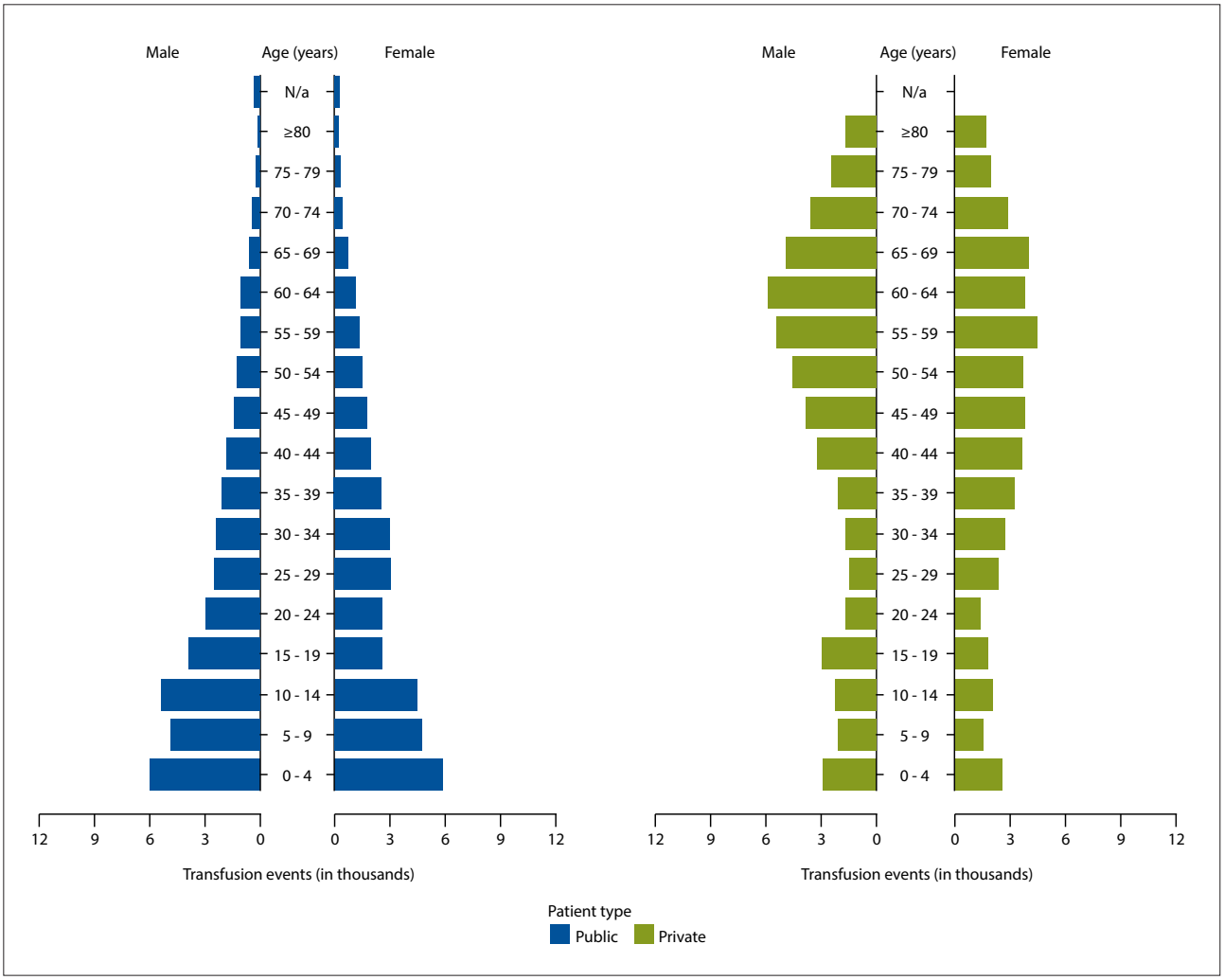

Fig. 1. Apheresis platelet transfusion events between 1 January 2014 and 31 December 2021, by sex and age in the South African public (n=*178 810) and private* (n= *186 708) sectors. (N/a = not available.)*

Trends in public and private healthcare platelet use, 2014 - 2021

Of the 445 803 platelet products issued during the study period, 200 856 (45.1%) were issued to the public sector, compared with 244 922 (54.9 %) in the private sector. On average, the public healthcare sector issued 0.59 units of platelets per 1 000 population, compared with the private healthcare sector, at 3.89 units per 1 000 population (Table 2). Per capita platelet utilisation in the public sector increased from 0.62 to 0.65 units per 1 000 population from 2014 to 2016. A sharp decline was observed thereafter, reaching the minimum over the 8-year period in 2021 of 0.49 units per 1 000 population. In contrast, the per capita platelet utilisation in the private sector decreased marginally from 2014 to 2017, followed by a sharp increase to a maximum of 4.40 per 1 000 population in 2020.

The focal point of age distribution in the public healthcare sector is the 20 - 39-year age group, accounting for 40.5% of total platelet use. Comparatively, the age distribution use in the private healthcare sector centered in the 40 - 69-year age group, accounting for 55.2% of utilisation. Furthermore, 22.2% of adult platelet products were issued to recipients <15 years of age in the public sector, compared with 6.5% in the private sector (Fig. 4).

Discussion

Our data confirmed distinctly different platelet product utilisation patterns between the public and private healthcare sectors in SA. To quantify these differences, we identified notable contrasts in recipient demographics and utilisation trends over an 8-year period. Specifically, the demographics of adult platelet product use between SA's healthcare sectors reveal distinct age and sex distributions driving the use of platelet products.

The private sector used significantly more platelets than the public sector when normalised for population size. More explicitly, platelet utilisation per 1 000 individuals serviced in the public sector decreased over time, while it increased in the private sector. Patients in the public sector were predominantly younger females, compared with older males in the private sector.

The observed public sector age and sex profile aligns with those of other resource-constrained countries. For example, platelet use in resource-limited Zimbabwe is driven mostly by females of child-bearing age, and paediatric patients.[27] Conversely, the demographic profile in the private sector may be related to the high rates of lifestyle and age-related disease among men in the private healthcare sector, many of whom require platelet products as part of their treatment. For example, a study assessing the incidence of

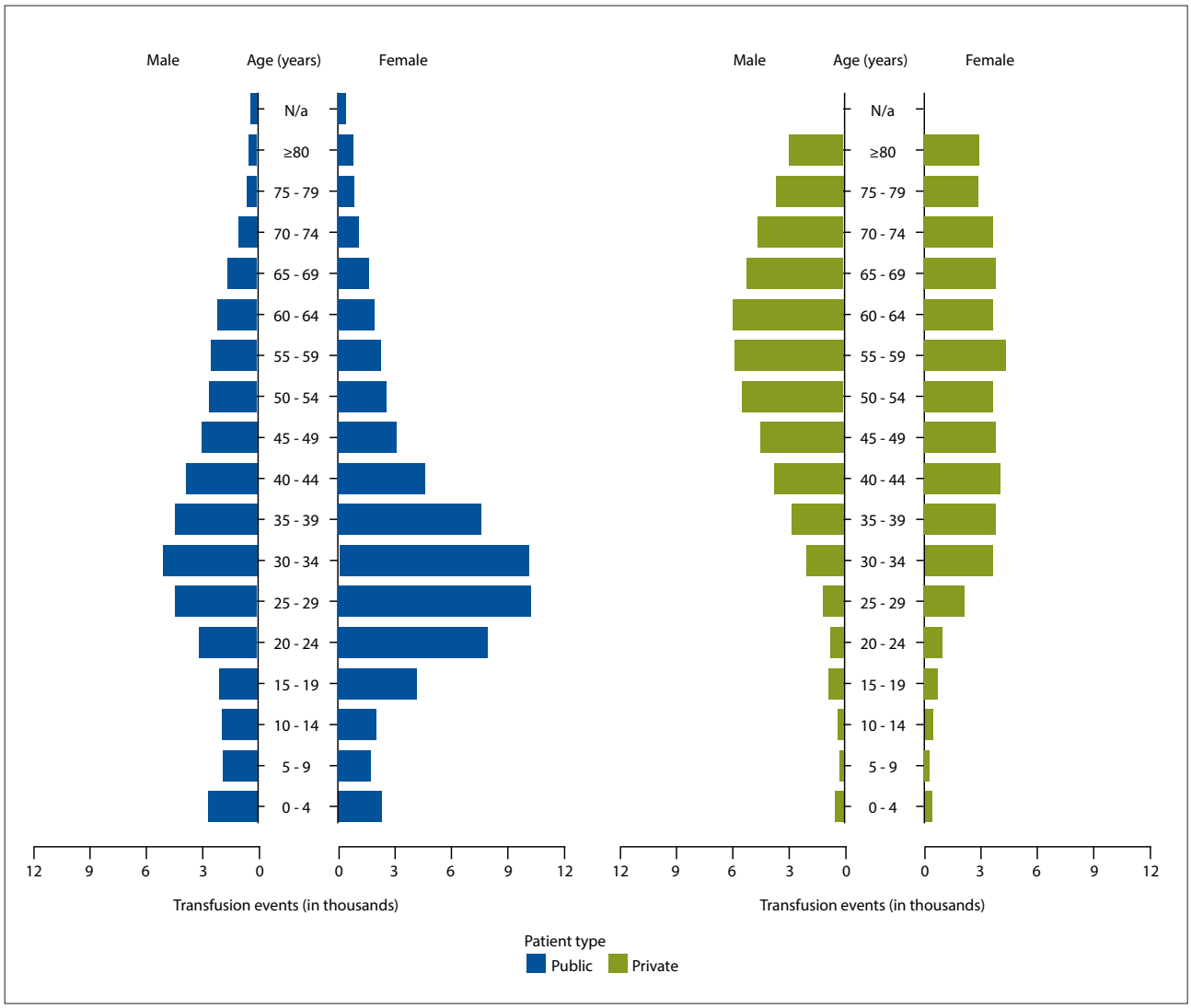

Fig. 2. Pooled platelet transfusion events between 1 January 2014 and 31 December 2021, by sex and age in the South African public (n=*178 810) and private* (n=*186 708) sectors. (N/a = ages not available.)*

cancer between 2008 and 2019 noted a 30% greater incidence among males aged 60 - 79 years compared with their female counterparts.[28] Although medical aid members in 2019 were mostly female, males ≥50 years and between 40 and 69 years had a higher prevalence of heart failure and hypertension, respectively, per 1 000 beneficiaries when compared with their female counterparts.[29]

In addition, public sector patients face greater economic insecurity and carry a greater likelihood of poor health outcomes.[13] Aspects such as care costs (either direct or indirect, such as transportation costs or loss of daily wage, and delays at healthcare facilities) factor into the decision to seek healthcare – regularly delaying the needed care.[13,30,31] Timely access to healthcare could increase the likelihood of early detection and successful treatment of major medical conditions such as hypertension and cervical cancer, and is thus associated with a longer life expectancy.[32] Patients in the private sector often seek healthcare and start treatment early,[13,31] resulting in increased survival and prolonged need for care, hence a higher utilisation of platelet products.

Public sector facilities face significant resource challenges that may lead to or exacerbate the differing transfusion practices between the two healthcare sectors. Resource limitations such as staff shortages and logistical challenges impede the full implementation of best practice operational guidelines, which in turn impede the use of evidence-based blood product utilisation protocols. These factors are worsened by a growing influx of economically disadvantaged patients as unemployment rates in the country continue to increase.[13,26,31]

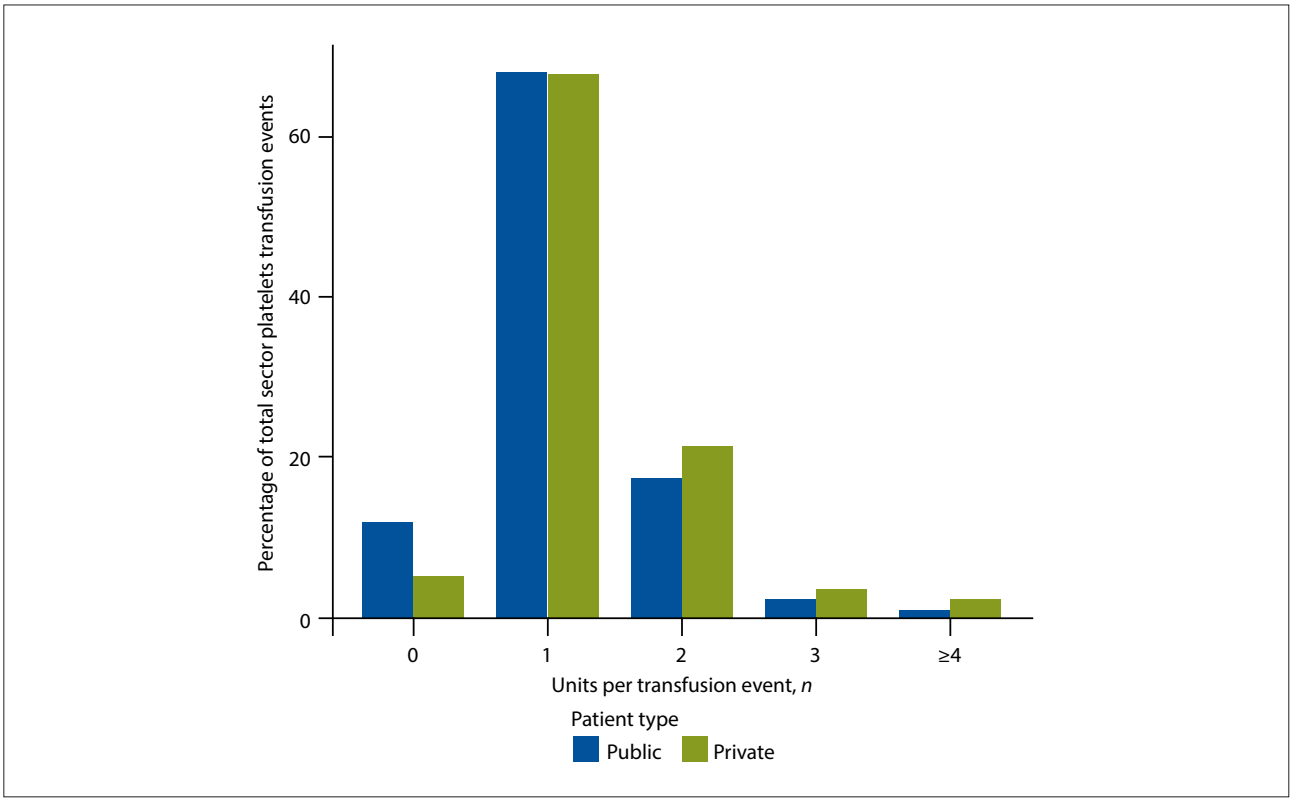

Fig. 3. The percentage of adult platelet product units issued per transfusion event for South African public (n=178 810) and private (n=186 708) healthcare sectors between 1 January 2014 and 31 December 2021.

Table 2. Per capita adult platelet product use in the South African public and private healthcare sectors, 2014 - 2021*

	Public sector			Private sector		
Year	Platelet units issued, *n*	Estimated sector population in millions†	Per capita utilisation per 1 000 population	Platelet units issued, *n*	Estimated sector population in millions†	Per capita utilisation per 1 000 population
2014	24 265	39.43	0.62	29 289	7.92	3.70
2015	25 910	40.32	0.64	27 896	7.84	3.56
2016	26 694	40.83	0.65	27 828	7.89	3.53
2017	25 291	41.79	0.61	28 765	7.87	3.65
2018	25 235	41.26	0.61	31 671	7.81	4.06
2019	25 304	43.57	0.58	34 435	8.33	4.13
2020	25 983	45.20	0.57	32 129	7.29	4.40
2021	22 174	45.22	0.49	32 909	8.03	4.10
Average	25 107	42.20	0.59	30 615	7.87	3.89

*Utilisation figures and population estimates excluding the Western Cape Province.
†Adult platelet products were issued across all the age groups, and thus no exclusions for population estimates were made.[19,20-26]

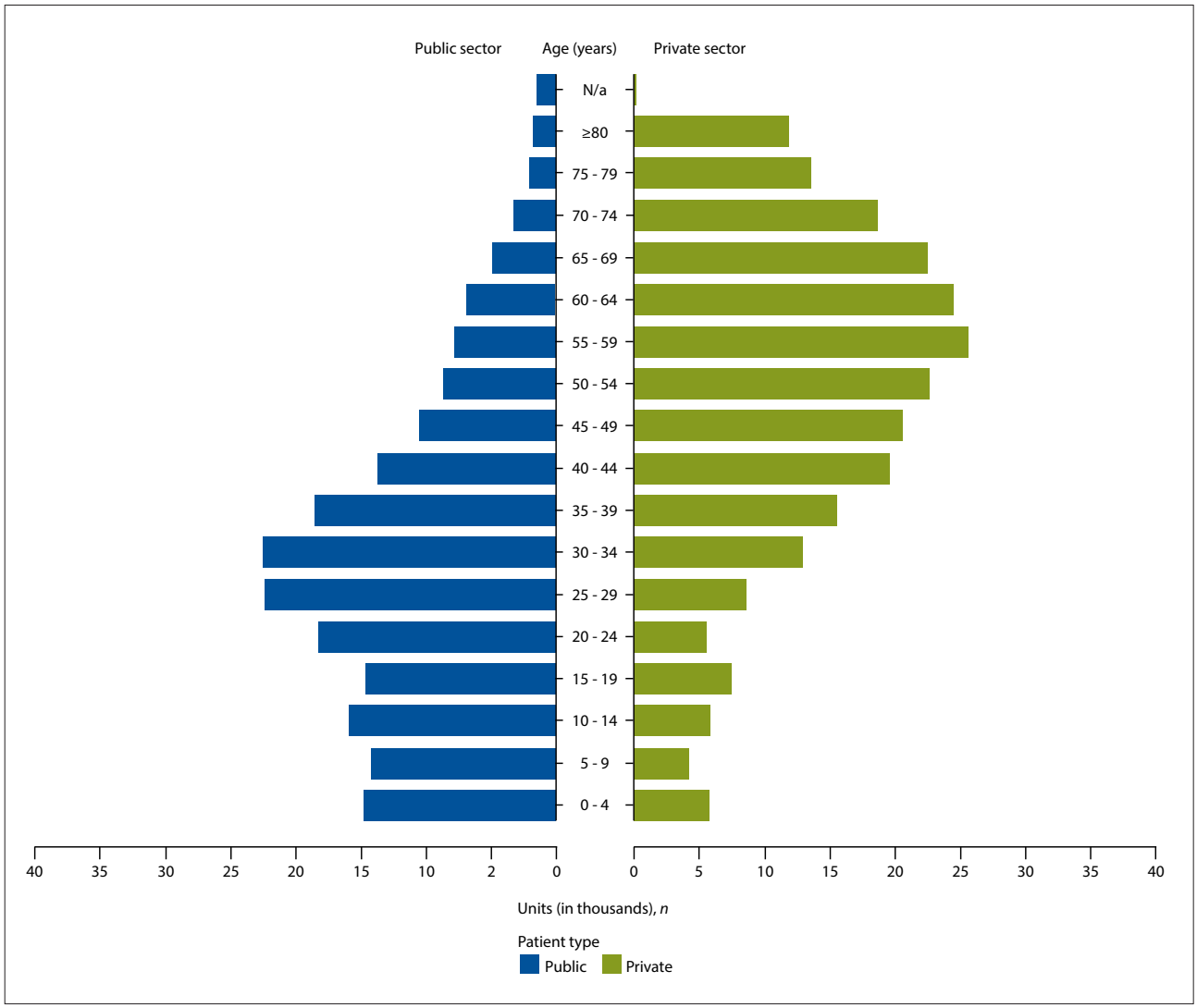

Fig. 4. The total number of units of adult platelet products issued within the South African public (n=200 856) and private (n=244 942) healthcare sectors between 2014 and 2021, by age group. (N/a = not available.)

Conclusion

In summary, we have critically analysed and compared adult platelet product utilisation between the public and private healthcare sectors of SA. Our results show distinct utilisation patterns between the sectors. The drivers of these distinct patterns are complex, multifaceted and interconnected, ranging from socioeconomic population characteristics and demographics to differing disease patterns and varying transfusion practices and healthcare challenges. Given the significant variability in utilisation patterns between the two healthcare sectors, estimating future blood product demand remains challenging, as growth in the private sector may lead to a sharp increase in the demand for platelet transfusion, while large movement of patients from the public to the private sector could lead to a significant decline in demand. The impact of the NHI on these movements between the healthcare sectors is also currently unclear. To provide valuable insights for policy, additional research is required to understand the socioeconomic as well as disease drivers underpinning these utilisation patterns. Considering our results alongside a consideration for the possible clinical drivers may aid the transfusion services to prepare for the rollout of NHI in SA.

Data availability. Anonymised data may be shared subject to the approval of the data request and/or study protocol by SANBS and the SANBS HREC. Upon conclusion of a non-disclosure agreement between the SANBS and any requesting individual or organisation, the data fields, data dictionary and analysis code will be made available as per approved request.

Declaration. None.

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Author contributions. LB: conceptualisation, data curation, formal analysis, investigation, methodology, software, validation, visualisation, writing –

original, writing – review and editing. RS: conceptualisation, supervision, methodology, writing – original (introduction), writing – review and editing. PLW: clinical supervision, clinical analysis, writing – review. JRCP: supervision, resources, funding acquisition, writing – review and editing. KvdB: supervision, project administration, writing – review and editing, resources.

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Conflicts of interest. None.

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