



# Western Australian Burden of Disease Study 2015: Healthcare spending attributable to modifiable risk factors in WA

## Introduction

Burden of disease studies provide an assessment of the impact of injuries, diseases and risk factors on a population. The Western Australian Burden of Disease Study (WABoDS) 2015 provides estimates of the burden attributable to diseases, risk factors, and injuries in the WA population (1).

Risk factors are ‘attributes, characteristics or exposures that increase the likelihood of a person developing a disease or health disorder’ and can be categorised as either behavioural, metabolic, or environmental (2, 3). The modifiable risk factors included in the WABoDS 2015 were behavioural risk factors, such as tobacco use and dietary risks; metabolic risk factors, such as overweight and obesity and high blood pressure; and environmental risk factors, such as air pollution and high sun exposure (3). Definitions of risk factors can be found in the Australian Burden of Disease Study method report (2). There are also risk factors which are social determinants, however these are not incorporated into the Australian or WA burden of disease studies and are therefore not included in this bulletin.

This bulletin examines the costs attributable to 18 modifiable risk factors disaggregated by disease group, age group, sex and area of expenditure for WA for the 2015–16 financial year. Knowledge of healthcare spending attributable to modifiable risk factors can help to inform choices and priorities, including the design of evidence-based health promotion and prevention programmes. A separate bulletin, which examines the healthcare costs associated with WABoDS disease groups and conditions, is also available to inform decision makers (4).

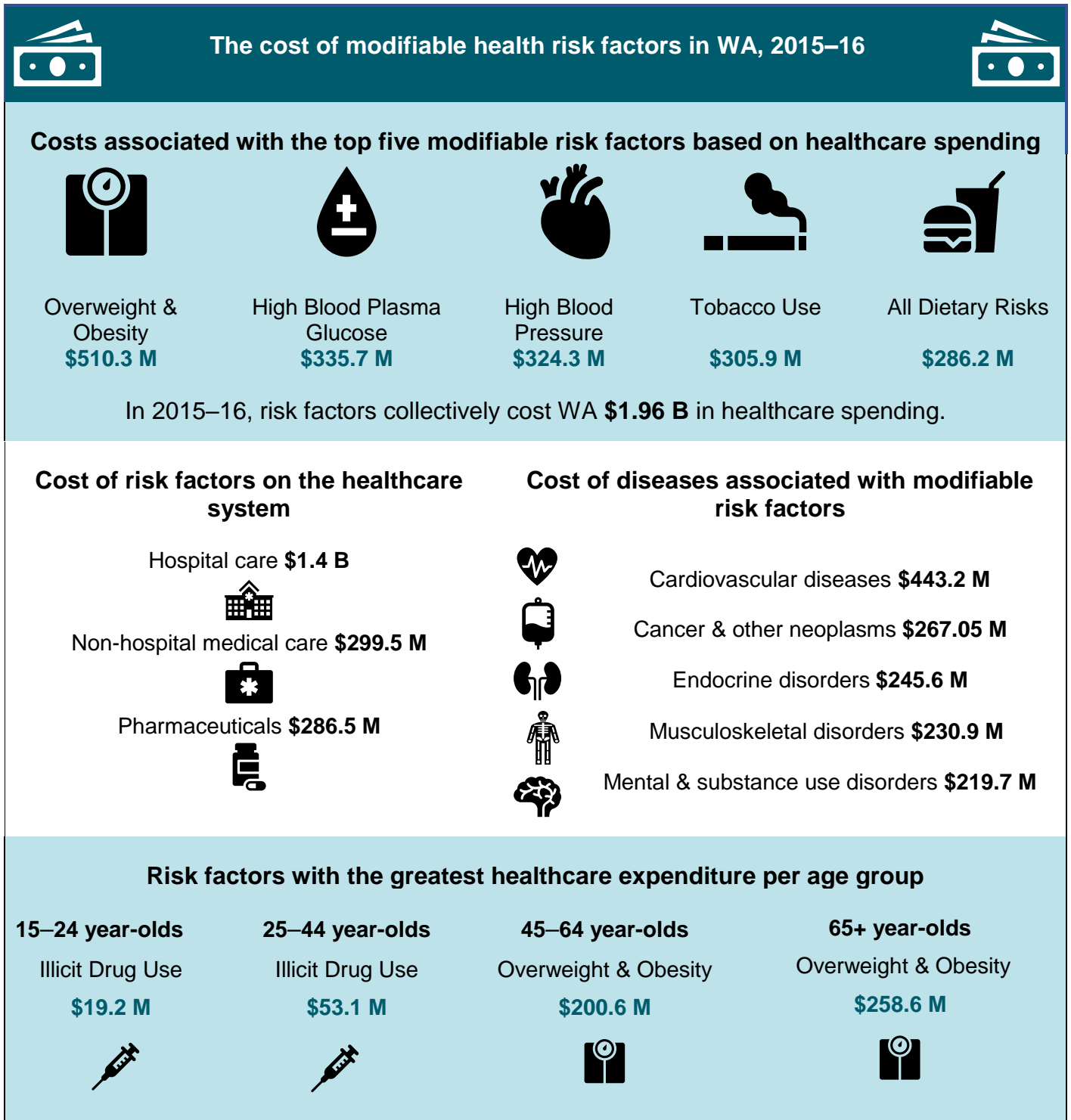
## Methods

The methodology used to estimate the costs attributable to the 18 WABoDS risk factors relies on healthcare expenditure data used by the Australian Institute of Health and Welfare (AIHW) for their 2015–16 Disease Expenditure Study (5). The AIHW provided this healthcare expenditure data for WA for 2015–16, which was used to estimate the healthcare costs associated with WABoDS risk factors, apportioned by disease group, age group and sex, and area of expenditure (hospital, non-hospital medical or pharmaceuticals) (5). The methods section in the WABoDS bulletin, “Healthcare costs of disease groups and conditions”, provides detailed information on the types of healthcare expenditure used to produce the estimates and the types of expenditure that were excluded (4).

To calculate the healthcare costs attributable to the modifiable risk factors, we used the Population Attributable Fractions (PAFs), derived for the WABoDS 2015 for each condition and risk factor, disaggregated by age group and sex (1). The PAFs were only applied to estimates for non-fatal burden of disease, as measured by Years Lived with Disability (YLD). The PAFs were then multiplied by the associated expenditure estimates provided by the AIHW. The dental expenditure area did not contain the age or sex disaggregation required to apply the PAFs and was not included (5).

The costs attributable to risk factors do not include all the healthcare costs associated with their management. For example, in the case of iron deficiency, select costs associated with managing this risk factor such as use of non-subsidised iron supplements, are not included. Additionally, results from this bulletin cannot be compared with results from studies other than the WABoDS due to methodological differences.

# Key findings



Notes: M = million, B = billion

## Results

In 2015–16, the 18 modifiable WABoDS risk factors combined were responsible for an estimated \$1.96 billion of WA healthcare spending, accounting for 19.2% of healthcare spending attributable to WABoDS risk factors. With similar spending on males (\$1,018.0 million) and females (\$938.5 million). The highest spending attributable to health risk factors was on hospital care (\$1,370.5 million), including public hospital admissions (\$629.2 million), public hospital emergency department presentations (\$82.4 million), public hospital outpatient services (\$208.2 million) and private hospital services (\$450.8 million); followed by non-hospital medical care (\$299.5 million) and pharmaceuticals (\$286.5 million) (Table 1). Estimates of dental expenditure (a total of \$306.9 million) were excluded due to the inability to link the expenditure and the risk factors.

### Healthcare expenditure attributable to individual risk factors

When the risk factors were considered individually, the top five risk factors contributing to WA healthcare expenditure were overweight and obesity, high blood plasma glucose, high blood pressure, tobacco use and all dietary risks, which cost from \$286.2 to \$510.3 million each (Table 1). Overweight and obesity was the risk factor associated with the most healthcare expenditure, costing the State \$510.3 million (77.4% on hospital care, 10.1% on non-hospital medical care, and 12.5% on pharmaceuticals). For most risk factors, the majority of spending was on hospital care with the exception of unsafe sex, where the majority of spending was on pharmaceuticals (67.3%). High sun exposure, child abuse and neglect, and intimate partner violence had a relatively higher proportion of costs attributable to non-hospital medical care compared to other risk factors. Similarly, high blood plasma glucose, illicit drug use and unsafe sex had a relatively higher proportion of costs attributable to pharmaceuticals compared to other risk factors.

**Table 1.** Contribution of health expenditure (in millions) by individual risk factor and area of expenditure in WA, 2015–16.

Risk Factor	Total*	Hospital	Non-Hospital Medical	Pharmaceuticals
Overweight & obesity	\$510.3	\$395.1 (77.4%)	\$51.3 (10.1%)	\$63.9 (12.5%)
High blood plasma glucose	\$335.7	\$208.3 (62.1%)	\$55.0 (16.4%)	\$72.4 (21.6%)
High blood pressure	\$324.3	\$234.2 (72.2%)	\$38.2 (11.8%)	\$51.9 (16.0%)
Tobacco use	\$305.9	\$216.6 (70.8%)	\$39.9 (13.1%)	\$49.5 (16.2%)
All dietary risks	\$286.2	\$216.0 (75.4%)	\$31.5 (11.0%)	\$38.8 (13.5%)
Alcohol use	\$163.6	\$132.6 (81.1%)	\$21.0 (12.8%)	\$10.0 (6.1%)
Illicit drug use	\$113.4	\$78.8 (69.5%)	\$10.2 (9.0%)	\$24.4 (21.5%)
Low bone mineral density	\$95.9	\$82.8 (86.3%)	\$9.7 (10.2%)	\$3.4 (3.6%)
Physical inactivity	\$95.7	\$71.2 (74.4%)	\$9.9 (10.4%)	\$14.6 (15.2%)
High sun exposure	\$93.8	\$60.0 (64.0%)	\$32.9 (35.1%)	\$0.9 (1.0%)
High cholesterol	\$90.3	\$74.4 (82.4%)	\$7.9 (8.7%)	\$8.0 (8.9%)
Child abuse & neglect	\$88.5	\$39.0 (44.1%)	\$38.2 (43.1%)	\$11.3 (12.8%)
Impaired kidney function	\$63.9	\$49.2 (77.0%)	\$5.3 (8.3%)	\$9.4 (14.7%)
Occupational exposures & hazards	\$61.3	\$36.6 (59.7%)	\$17.5 (28.5%)	\$7.2 (11.8%)
Intimate partner violence	\$44.0	\$21.2 (48.3%)	\$16.2 (36.9%)	\$6.5 (14.8%)
Unsafe sex	\$39.7	\$8.9 (22.4%)	\$4.1 (10.3%)	\$26.7 (67.3%)
Air pollution	\$28.5	\$23.2 (81.4%)	\$2.4 (8.5%)	\$2.9 (10.1%)
Iron deficiency	\$24.6	\$19.6 (79.8%)	\$2.3 (9.2%)	\$2.7 (11.0%)
Joint effect**	\$1,956.5	\$1,370.5 (70.1%)	\$299.5 (15.3%)	\$286.5 (14.6%)

\*The dental expenditure area has not been included. \*\*The cost of individual risk factors cannot be added together to determine the total expenditure attributable to all risk factors as this does not account for the interaction between them. Consequently, the sums of the columns do not equal the totals given.

The leading risk factors for non-fatal burden (YLD) of disease in 2015 was overweight and obesity, tobacco use, alcohol use, high blood plasma glucose and dietary factors (3). The discrepancies between burden and expenditure ranking contributed to risk factors may due to the exclusion of dental expenditure as well as wider economic factors that are not included in this study, such as price, demand and accessibility.

### Expenditure areas for the top five risk factors contributing the highest healthcare expenditure

Hospital costs include expenditure on public and private hospitals (i.e. public and private inpatient admissions, public emergency department presentations, and public outpatient clinics). Public hospital admissions accounted for the largest proportion of spending attributable to high blood plasma glucose (25.4%), high blood pressure (37.9%), tobacco use (36.1%) and all dietary risks (35.2%), and the second largest proportion of spending attributable to overweight and obesity (28.8%) (Figure 1). Comparatively, the largest proportion of healthcare spending attributable to overweight and obesity was on private hospital services (36.5%). Of the risk factors considered for 2015–16, the highest public hospital admitted patient costs were attributable to overweight and obesity (\$147.1 million), whereas the highest public hospital outpatient costs were attributable to high blood plasma glucose (\$79.1 million). The pharmaceutical benefits scheme and general practitioner services were the third and fifth largest expenditure areas attributable to risk factors respectively, for the five risk factors responsible for the most healthcare expenditure in WA in 2015–16.

Rank	Overweight and Obesity	High Blood Plasma Glucose	High Blood Pressure	Tobacco Use	All Dietary Risks
1 <sup>st</sup>	Private hospital services, \$186.3M, 36.5%	Public hospital admitted patient, \$85.3M, 25.4%	Public hospital admitted patient, \$122.8M, 37.9%	Public hospital admitted patient, \$110.4M, 36.1%	Public hospital admitted patient, \$100.8M, 35.2%
2 <sup>nd</sup>	Public hospital admitted patient, \$147.1M, 28.8%	Public hospital outpatient, \$79.1M, 23.6%	Private hospital services, \$77.2M, 23.8%	Private hospital services, \$59.1M, 19.3%	Private hospital services, \$75.7M, 26.5%
3 <sup>rd</sup>	Pharmaceutical benefits scheme, \$63.9M, 12.5%	Pharmaceutical benefits scheme, \$72.4M, 21.6%	Pharmaceutical benefits scheme, \$51.9M, 16.0%	Pharmaceutical benefits scheme, \$49.5M, 16.2%	Pharmaceutical benefits scheme, \$38.8M, 13.5%
4 <sup>th</sup>	Public hospital outpatient, \$51.4M, 10.1%	Private hospital services, \$40.8M, 12.2%	Public hospital outpatient, \$19.7M, 6.1%	Public hospital outpatient, \$32.0M, 10.5%	Public hospital outpatient, \$29.5M, 10.3%
5 <sup>th</sup>	General practitioner service, \$20.9M, 4.1%	General practitioner services, \$25.4M, 7.6%	General practitioner services, \$18.7M, 5.8%	General practitioner services, \$19.8M, 6.5%	General practitioner services, \$13.2M, 4.6%

**Figure 1.** Top five areas of healthcare expenditure for risk factors with the highest healthcare expenditure in WA, 2015–16. M = Million; % = percentage of overall healthcare expenditure spent on an area for each risk factor.

## Healthcare spending attributable to risk factors by WABoDS disease group

Combined, modifiable risk factors were responsible for \$443.2 million spending on cardiovascular diseases, \$267.1 million on cancers, and \$245.6 million on endocrine disorders (Table 2). This represented 43.8%, 30.3% and 76.0% of total healthcare spending for these disease groups respectively for 2015–16. Healthcare spending on these three disease groups represented nearly half (48.9%) of all spending attributable to risk factors. For cardiovascular diseases, \$305.3 million of healthcare spending was attributable to high blood pressure, \$195.7 million to all dietary factors, and \$109.4 million to tobacco (see Appendix, Table 3). For cancer and other neoplasms, \$93.8 million of healthcare spending was attributable to high sun exposure, \$71.3 million to tobacco, and \$53.4 million to overweight and obesity. For endocrine disorders, \$245.6 million of healthcare spending was attributable to high blood plasma glucose.

**Table 2.** WA healthcare expenditure (in millions) attributable to combined risk factors by disease group, 2015–16.

Disease Group*	Expenditure (exclude dental) by disease groups**	Expenditure attributable to joint risk factors (% of total)***	Percentage
Cardiovascular diseases	\$1,011.8	\$443.2 (22.7%)	43.8%
Cancer and other neoplasms	\$881.4	\$267.1 (13.6%)	30.3%
Endocrine disorders	\$323.3	\$245.6 (12.6%)	76.0%
Musculoskeletal disorders	\$1,294.3	\$230.9 (11.8%)	17.8%
Mental and Substance use Disorders	\$851.4	\$219.7 (11.2%)	25.8%
Injury (external cause)	\$909.0	\$181.3 (9.3%)	19.9%
Respiratory diseases	\$362.2	\$96.0 (4.9%)	26.5%
Infectious diseases	\$639.7	\$80.8 (4.1%)	12.6%
Kidney and urinary diseases	\$405.8	\$58.0 (3.0%)	14.3%
Gastrointestinal disorders	\$713.1	\$42.4 (2.2%)	5.9%
Hearing and vision disorders	\$447.2	\$38.1 (1.9%)	8.5%
Blood and metabolic disorders	\$505.5	\$24.6 (1.3%)	4.9%
Neurological conditions	\$311.1	\$24.0 (1.2%)	7.7%
Reproductive and maternal conditions	\$905.6	\$5.1 (0.3%)	0.6%
<b>Total</b>	<b>\$10,205.8</b>	<b>\$1,956.5 (100.0%)</b>	<b>19.2%</b>

\*Disease groups with zero spending attributable to risk factors are not included (i.e. oral disorders, skin disorders and infant and congenital conditions). \*\*Dental expenditure has been omitted from the healthcare expenditure \*\*\*Joint effect cost.

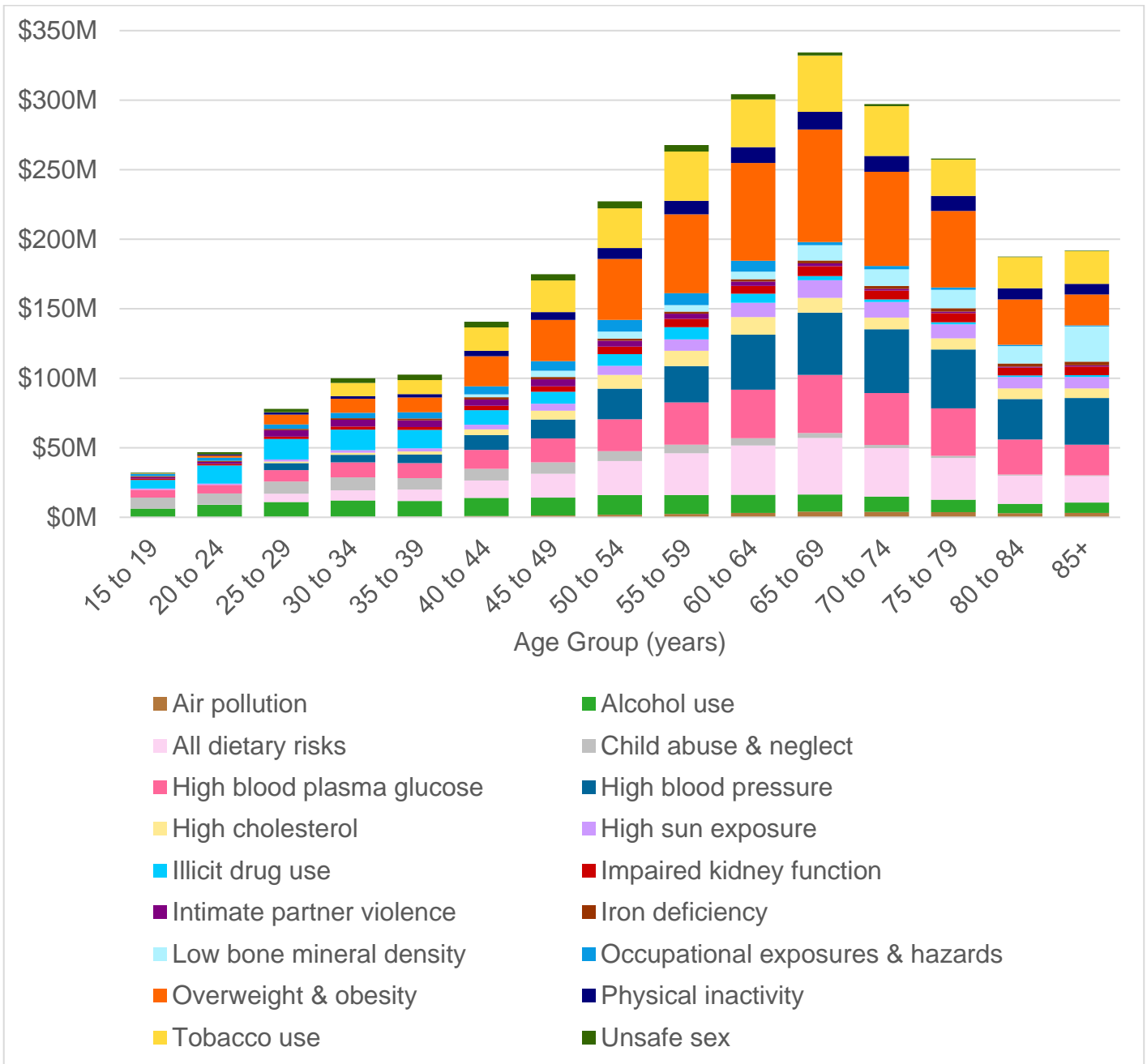
## Difference in risk factor attributable cost by age group

In 2015–16, the majority of spending attributable to risk factors was for older age groups: 78.6% (\$1.5 billion) of total spending attributable to risk factors was for Western Australians aged 45 years and older. The age group with the highest proportion of healthcare expenditure attributable to risk factors was 65 to 69 year-olds at \$224.8 million. Conversely, 2.7% (\$53.4 million) of spending attributable to risk factors was associated with the younger population (0 to 19 years). These were derived from the joint effect of risk factors, and were not shown on figure 2.

The risk factors responsible for the highest amount of health expenditure by age group (Figure 2) were;

- Child abuse and neglect (\$7.8 million), alcohol use (\$6.4 million) and illicit drug use (\$6.2 million) for 15 to 19 year-olds,

- illicit drug use (\$66.1 million), alcohol use (\$55.7 million), and overweight and obesity (\$50.8 million) for 20 to 44 year-olds,
- overweight and obesity (\$200.6 million), tobacco use (\$121.1 million) and all dietary risks (\$107.0 million) for 45 to 64 year-olds,
- overweight and obesity (\$258.6 million), high blood pressure (\$195.8 million), and high blood plasma glucose (\$160.6 million) for over 64 year-olds.



Note: 1. The cost of individual risk factors cannot be added together to determine the total expenditure attributable to all risk factors for each age group as this does not account for the interaction between them. 2. The numbers for children under 15 were not presented due to small numbers.

**Figure 2.** WA healthcare spending attributable to different risk factors by age group, 2015-16.

## Summary

In 2015–16 in WA, an estimated \$1.96 billion of healthcare spending was attributable to the combination of 18 modifiable risk factors, with males having a slightly higher expenditure than females. The risk factors with the highest financial impacts individually were overweight and obesity (\$510.3 million), high blood plasma glucose (\$335.7 million), high blood pressure (\$324.3 million), tobacco use (\$305.9 million) and all dietary risks (\$286.2 million). Leading risk factors by attributable expenditure varied between younger and older age groups with majority of expenditure among 20 to 44 year-olds going towards illicit drug use (\$66.1 million), compared to overweight and obesity for both 45 to 64 year-olds (\$200.6 million) and over 64 year-olds (\$258.6 million). The majority (78.6%) of healthcare expenditure attributable to risk factors was for Western Australians aged 45 years and above.

The modifiable risk factors that had the highest financial impacts on healthcare expenditure were associated with cardiovascular diseases (\$443.2 million), cancers and other neoplasms (\$267.0 million), endocrine disorders (\$245.6 million), musculoskeletal disorders (\$230.9 million) and mental and substance use disorders (\$219.7 million). The majority of the costs attributable to risk factors were for hospital care (\$1,370.5 million), followed by non-hospital medical care (\$299.5 million) and pharmaceuticals (\$286.5 million). Among the leading risk factors by cost, private hospital services and public hospital admissions accounted for the greatest proportion of attributable spending, with the exception of high blood plasma glucose for which public hospital admissions and public hospital outpatient services accounted for the greatest proportion of attributable spending.

The estimates from this bulletin can be used to understand the financial impacts of modifiable risk factors on the WA population and healthcare system. As potentially preventable risk factors, these financial impacts could be reduced through well-designed and evidence-based policies, regulation, health services, and programmes. The estimates of healthcare costs attributable to the WABoDS risk factors provide the evidence for policy and decision makers to inform the development of such programmes.

## Acknowledgments

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## Enquiries

For any queries or further analysis regarding this bulletin, please contact [epi@health.wa.gov.au](mailto:epi@health.wa.gov.au).

## References

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2. Australian Institute of Health and Welfare. *Australian Burden of Disease Study: methods and supplementary material 2015*. Canberra: AIHW; 2020.
3. Department of Health Western Australia. *Western Australian Burden of Disease Study 2015 - Contribution of risk factors to burden*. Perth: Department of Health WA; 2020.
4. Department of Health Western Australia. *Western Australian Burden of Disease Study 2015: Healthcare costs of disease groups and conditions*. Perth: Department of Health WA; 2021.
5. Australian Institute of Health and Welfare. *Disease Expenditure Study: Overview of analysis and methodology 2015-16*. Canberra: AIHW; 2019.

## Appendix

**Table 3.** Healthcare spending attributable to individual risk factors by disease group (in millions), WA, 2015–16.

Risk factors	Disease Groups														
	Cardio-vascular	Endocrine	Cancer	Musculo-skeletal	Mental/substance use	Gastro-intestinal	Injuries	Kidney/urinary	Respiratory	Infectious	Hearing/vision	Blood/metabolic	Neurological	Reproductive / maternal	Total
Overweight & obesity	\$100.7	\$76.8	\$53.4	\$184.9		\$30.0		\$24.1	\$16.7		\$14.3		\$9.3		\$510.3
High blood plasma glucose	\$28.9	\$245.6	\$12.0					\$35.4			\$10.3		\$3.4		\$335.7
High blood pressure	\$305.3							\$16.9					\$2.1		\$324.3
Tobacco use	\$109.4	\$5.5	\$71.3	\$15.5		\$3.9			\$74.5	\$16.2	\$7.7		\$2.1		\$305.9
All dietary risks	\$195.7	\$60.7	\$21.3	\$2.8		\$0.7		\$4.1	\$0.5		\$0.3		\$0.2		\$286.2
Alcohol use	\$15.8		\$18.0		\$42.7	\$6.0	\$71.1			\$6.7			\$3.3		\$163.6
Illicit drug use			\$0.7		\$70.3	\$4.1	\$14.2			\$24.2					\$113.4
Low bone mineral density							\$95.9								\$95.9
Physical inactivity	\$36.6	\$29.1	\$23.4										\$6.7		\$95.7
High sun exposure			\$93.8												\$93.8
High cholesterol	\$90.3														\$90.3
Child abuse & neglect					\$80.9		\$7.6								\$88.5
Impaired kidney function	\$7.4			\$0.6				\$55.3					\$0.7		\$63.9
Occupational exposures & hazards			\$9.7	\$35.6					\$8.3		\$7.7				\$61.3
Intimate partner violence					\$36.2		\$2.7							\$5.1	\$44.0
Unsafe sex			\$3.7			\$0.3				\$35.7					\$39.7
Air pollution	\$21.5		\$0.8						\$3.5	\$2.8					\$28.5
Iron deficiency												\$24.6			\$24.6

Notes: 1. Oral disorders, skin disorders and infant and congenital disorders have been excluded. 2. Risk factors were ordered by the highest cost to the lowest cost. 3. The cost of individual risk factors cannot be added together to determine the total expenditure attributable to risk factors as this does not account for the interaction between the risk factors.