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### Supplementary Methods:

For this study, data linkage was performed to combine electronic patient care record data with key Victorian datasets. These included:

1. Victorian Emergency Minimum Dataset: Victorian Department of Health administrative and clinical data related emergency department (ED) presentations at public hospitals in the state. Data is submitted by individual health services and is then subject to validation checks. For this study, EMS patient identifiers were matched with Department of Health identifiers using Dataflux software with deterministic data linkage and fuzzy matching for variables such as names and dates. ED presentations for matched patients were then linked to ambulance cases as follows:
  - a. Where the patient was transported to hospital by ambulance, the VEMD arrival time was required to be within one hour of the ambulance ED arrival time.
  - b. Where the patient contacted ambulance but was not transported to hospital, the VEMD arrival time was required to be within 48 hours of the emergency call for ambulance. If multiple VEMD records existed within the 48-hour period, the presentation occurring closest in time to the ambulance call was used.
2. Victorian Admitted Episodes Dataset: Victorian Department of Health demographic, clinical and administrative data relating to each admitted episode of care occurring in public and private hospitals, as well as rehabilitation centres, extended care facilities and day procedure centres in the state. For this study, EMS patient identifiers were matched with Department of Health identifiers using Dataflux software with deterministic data linkage and fuzzy matching for variables such as names and dates. For matched patients, individual admitted episodes of care occurring up to 48 hours after the emergency ambulance call were linked to the ambulance patient care record data. Where multiple admitted episodes were recorded within the 48 hours, the episode occurring closest in time to the ambulance call was used.
3. Victorian Death Index: Victorian Department of Justice and Community Safety capturing the date and cause of all deaths in Victoria. For matched patients, death records were then linked to all ambulance contacts occurring in the study period.

### II: Study definitions:

Etiology of shock was defined in accordance with the final discharge diagnosis from hospital using the International Classification of Diseases (ICD) 10 AM codes. The ICD-10 codes used identify patients with cardiogenic shock remains constant across the different ICD-10-AM editions of codes used by hospitals over the study period (i.e. ICD-10-AM: 8<sup>th</sup> edition in 2014-15; 9<sup>th</sup> edition in 2015-16 & 2016-17; 10<sup>th</sup> edition in 2017-18 & 2018-19).

### Cardiogenic Shock:

1. ST-elevation myocardial infarction: I210-I213, I220-I229, I256
2. Non-ST elevation myocardial infarction: I214, I219
3. Unstable angina: I200
4. Stable coronary syndromes: I201, I208, I209, I248-I252, I254, I255, I258, I259
5. Atrial fibrillation: I480-I489
6. Supraventricular tachycardia: I471

7. Other arrhythmia: I441, I442, I456, I458- I461, I469, I470, I472, I479, I490-I499
8. Heart failure: I420-I438,I500-I509
9. Myocarditis: I012, I090,I400-I418,I514,
10. Valvular heart disease: I050-I089,I340-I379,I390-I394

#### Septic shock:

1. Respiratory diagnoses: J00-J998
2. Pneumonia: J100, J110, J120-J189, J22
3. Asthma: J450-J46
4. Exacerbation of COPD: J431-J449, J47-J709,J982,J983
5. Other respiratory: J00-J998 excluding codes categorised above
6. Infectious diagnoses: A000-B99

#### Hypovolemic shock:

1. Aortic aneurysm or dissection: I7100-I7103, I711-I719
2. Gastrointestinal diagnoses: K000-K938
3. GORD, gastritis, oesophagitis: K20-K238,K290-K30
4. Peptic ulcer disease: K250-K289
5. Hepatobiliary: K700-K839,K870
6. Pancreatitis: K850-K869,K871
7. Other gastrointestinal: K000-K938 excluding codes categorised above

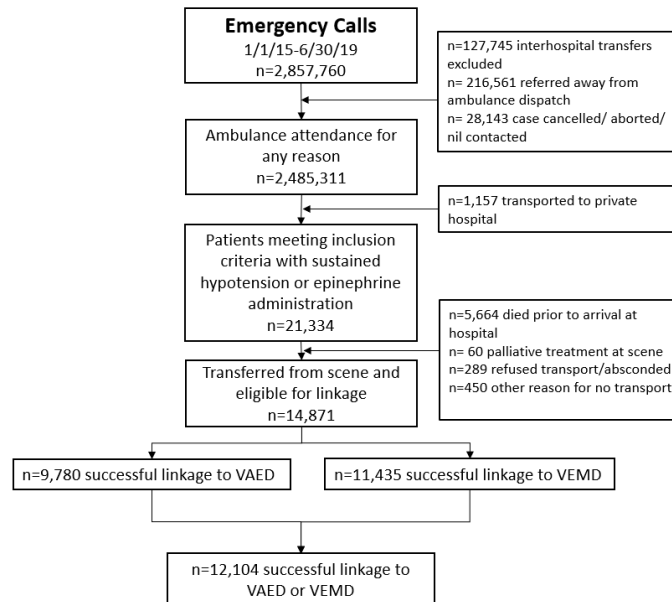
#### Obstructive shock:

1. Pulmonary embolism: I260, I269
2. Pneumothorax: J930-J939
3. Pericarditis: I010, I092,I241,I300-I328

#### Other shock:

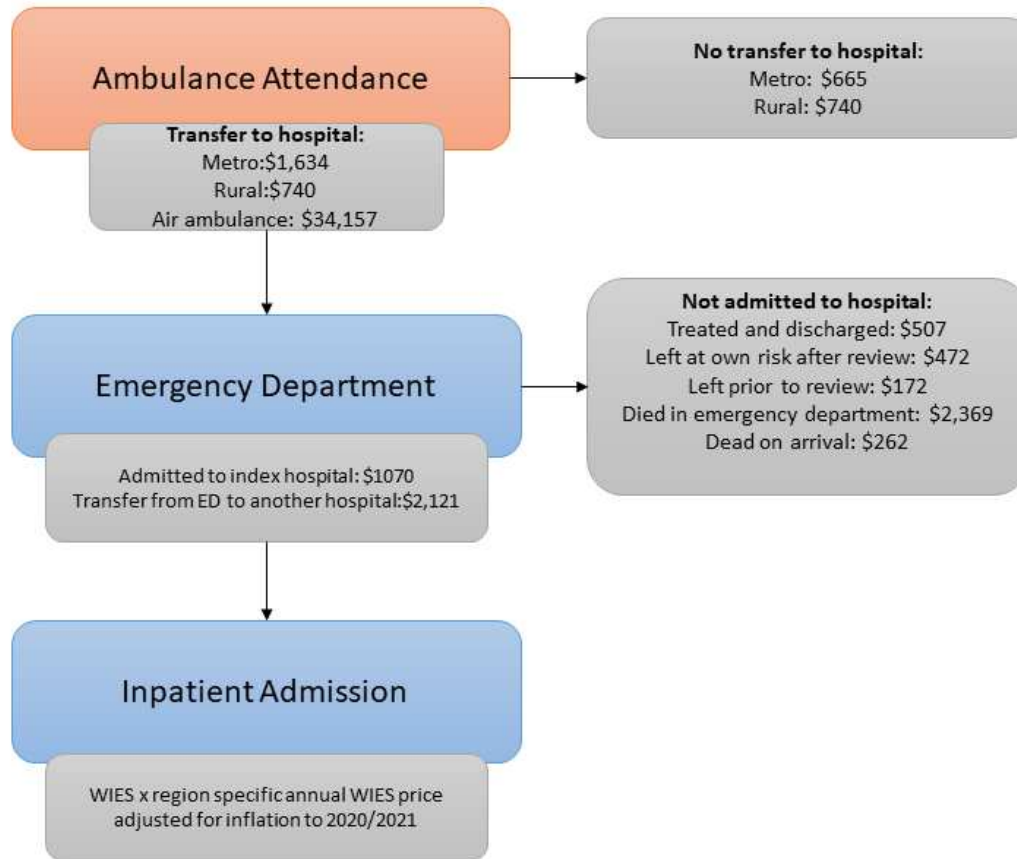
1. Rheumatological diagnoses: M0000-M99923
2. Mental Health diagnoses: F000-F99
3. Neurological diagnoses: G000-G998
4. Endocrine diagnoses: E000-E899
5. Other medical diagnoses: H000-H959, L00-L998, M0000-M99923, N000-N999, O000-O998, P000-Q999, S001-Z999
6. Pericarditis: I010, I092,I241,I300-I328
7. Non-specific pain: R000-R99
8. Pulmonary embolism: I260, I269
9. Pneumothorax: J930-J939
10. Other vascular: I600-I99 excluding codes categorised above
11. Neoplastic diagnoses: C000-D899

## Supplementary Figure 1: Consort diagram of cohort derivation



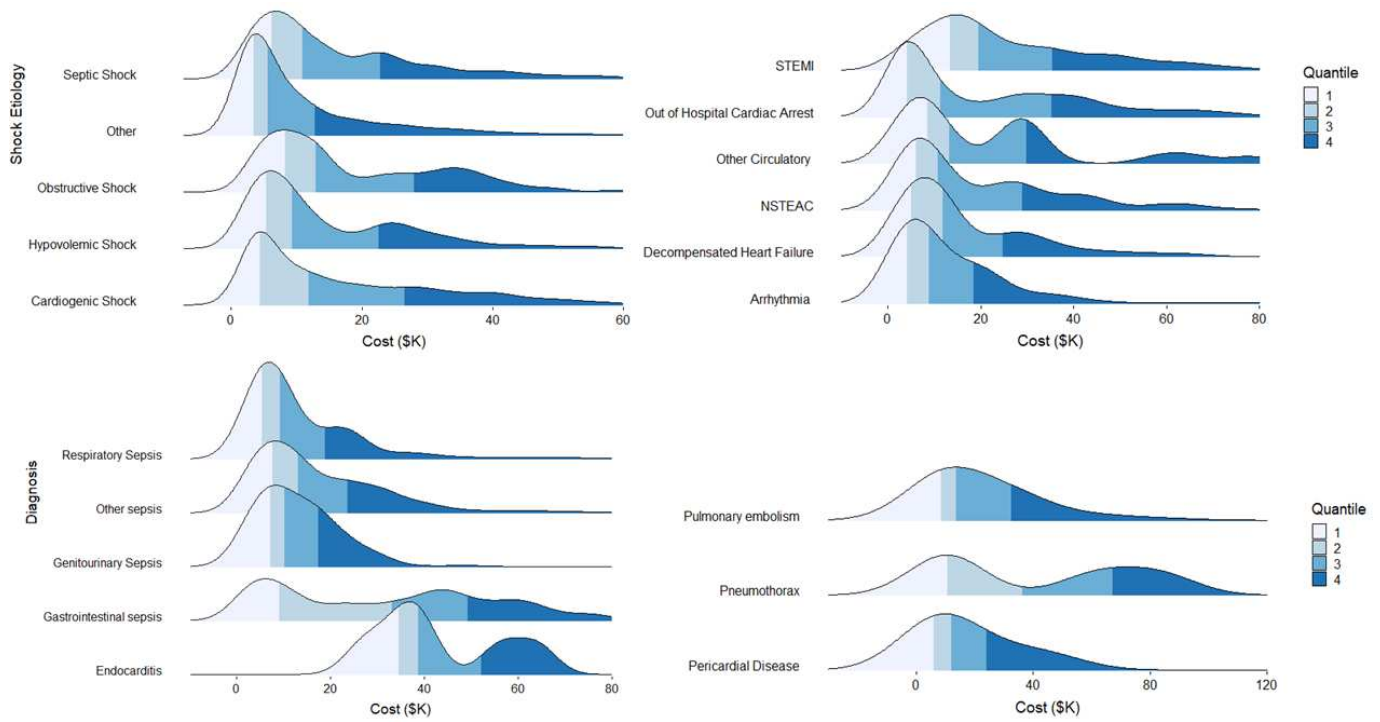
VACIS=Victorian Ambulance clinical Information System, VAED=Victorian Admitted Episodes Database, VEMD=Victorian Emergency Minimum Dataset

**Supplementary Figure 2: Diagram depicting patient flow and cost scenarios at separate stages of treatment pathway.**



Abbreviation: WIES, Weighted Inlier Equivalent Separation

**Supplementary Figure 3: Ridgeplot assessing estimated cost by etiology and diagnostic groups with each ridge divided into quantiles.**



**Supplementary Table 1: Pre-hospital and emergency department scenario costs adjusted for 2020-2021 financial year**

<b>Scenario</b>	<b>Cost per episode (2020-2021 adjusted costs)</b>
<b>Ambulance Scenarios</b>	
Metropolitan treat and transport	\$1,634.01
Metropolitan treat, no transport	\$665.18
Rural treat and transport	\$2,131.95
Rural treat, no transport	\$740.70
Rural fixed wing transport	\$6,308.82
Rural helicopter transport	\$34,157.57
<b>Emergency Department Scenarios</b>	
Admitted to hospital	\$1,070.47
Discharged from ED(complete episode)	\$507.33
Non-admitted, referred to another hospital	\$2,121.23
Did not wait to be seen	\$172.25
Left at own risk after seen	\$471.90
Died in ED	\$2,369.15
Dead on arrival	\$263.44

**Supplementary table 2: Weighted Inlier Equivalent Separation (WIES) price per unit used to estimated inpatient hospital costs, indexed to 2020-2021 financial year**

WIES Prices adjusted to 2020-2021 levels			
Financial Year	Metropolitan	Subregional	Small rural
2014-2015	\$4,816.32	\$4,897.60	\$5,138.14
2015-2016	\$4,901.86	\$5,142.37	\$5,019.42
2016-2017	\$4,926.00	\$5,156.37	\$5,015.18
2017-2018	\$4,981.82	\$5,240.81	\$5,048.15
2018-2019	\$5,015.43	\$5,274.87	\$5,061.09

Data available from Department of Health and Human Services policy and funding guidelines 2014 to 2019, Chapter 3.1.1 Acute admitted Services Price Tables(1).



**Supplementary table 3: Modelling of pre-shock employment status according to Australian Bureau of Statistics (ABS) data**

Age group (Years)	Males					
	Number	Probability			Number working in any capacity	Number EFT
		No Work	Part-Time	Full-time		
15-19	58	49.2%	35.2%	15.6%	29	19
20-24	199	18.2%	29.4%	52.4%	163	133
25-30	181	10.2%	14.1%	75.7%	163	150
30-34	233	7.5%	9.3%	83.3%	216	205
35-39	332	7.6%	8.0%	84.4%	307	293
40-44	466	9.1%	8.7%	82.2%	424	403
45-49	576	11.3%	8.9%	79.8%	511	485
50-54	709	13.4%	9.7%	76.9%	614	580
55-59	916	21.0%	10.8%	68.2%	724	674
60-64	1032	36.7%	14.7%	48.6%	653	577
65-69	1207	68.2%	12.6%	19.2%	384	308
70-74	1370	84.6%	8.1%	7.3%	211	155
75-79	1303	95.3%	3.3%	1.4%	61	40
80+	3106	100.0%	0.0%	0.0%	0	0

Age group (Years)	Females					
	Number	Probability			Number working in any capacity	Number EFT
		No Work	Part-Time	Full-time		
15-19	107	44.5%	47.4%	8.1%	59	34
20-24	295	24.9%	37.2%	37.9%	222	167
25-30	321	23.3%	23.6%	53.1%	246	208
30-34	338	26.1%	29.1%	44.8%	250	201
35-39	378	24.7%	35.8%	39.5%	285	217
40-44	419	21.1%	36.0%	42.9%	331	255
45-49	499	19.9%	34.8%	45.3%	400	313
50-54	517	22.4%	32.7%	44.9%	401	317
55-59	572	32.1%	31.6%	36.3%	388	298
60-64	660	50.2%	27.1%	22.7%	329	239
65-69	772	78.6%	14.8%	6.6%	165	108
70-74	780	91.8%	6.5%	1.7%	64	39
75-79	1010	98.5%	1.3%	0.2%	15	9
80+	2973	100.0%	0.0%	0.0%	0	0

Supplementary Table 4: Data inputs into model.

Model Inputs	Data Source	Definite/based on existing data/hypothesised	Data alteration performed	Conservative assumptions made
<b>Employment data</b>				
Total wage earning generated by patients	Australian Bureau of Statistics (2)	Based on existing data	GDP assumed to be \$40.6 per hour. Full-time working year, 48-weeks at 38 hours worked per week	No adjustment for inflation over the three-year horizon
Employment status	Australian Bureau of Statistics (3)	Based on existing data	Stratification and matching according to 5 yearly age strata	Patients aged >80 assumed not to be employed in any capacity
Total EFT generated by patients	Australian Bureau of Statistics (3)	Based on existing data	Stratification and matching according to 5 yearly age strata. Total EFT calculated as the sum of part-time and full-time positions and mean weekly hours worked part time in each age strata	Patients aged >80 assumed not to be employed in any capacity
Earned wages/EFT ratio	Australian Bureau of Statistics (2)	Based on existing data	Derived by calculating GDP and EFT generated in the patient cohort. Calculated at \$73,827 per 1.0 EFT per annum	
<b>Markov Model</b>				
Number of patients	Victorian Ambulance Clinical Information System	Definite		
Number of patients alive at 30 days	Victorian Death Index	Definite	Assumed that no patients will return to work	No consideration of reduced time off work in

			within 30 days of index presentation with shock	patients who returned to work earlier than 30 days
Number of patients alive at 12 months	Victorian Death Index	Definite		
Number of patients employed at 12 months	Other publications (4–6)	Based on existing data	Assumed that of those who survive, only 50% will return to work	Prior data in patients with septic shock has shown that only 43% return to work at 1-year. We have chosen a conservative figure of 50%.
Number of patients alive at 3 years	Victorian Death Index	Definite	Mortality data at 3 years was obtained for patients presenting in 2015. The % of survivors in each age and gender strata was then applied to the whole cohort, assuming comparable rates of survival.	

**Supplementary Table 5: Linear regression model assessing factors which influence estimated healthcare costs**

Variable	Cost	95% CI		P-value
Age≥65	1490.86	542.30	2439.42	<0.001
Male Gender	-1980.15	-2837.93	-1122.36	<0.001
Shock Etiology:				
Cardiogenic	REF			
Septic	493.93	-805.86	1793.73	0.46
Hypovolemic	1628.82	-37.90	3295.54	0.06
Obstructive	1263.48	-3163.79	5690.74	0.58
Other	-4806.42	-6080.96	-3531.87	<0.001
Number of pre-existing comorbidities:				
1	569.02	-558.86	1696.90	0.32
2	-681.27	-1987.53	624.99	0.31
3	-38.31	-1545.94	1469.33	0.96
≥4	-1646.22	-3614.40	321.95	0.10
Transfer to another hospital from emergency department	12766.06	10702.49	14829.63	<0.001
Event Location				
Metropolitan	REF			
Inner Regional	-1957.01	-3019.34	-894.68	<0.001
Remote	-2264.35	-4383.21	-145.49	0.04
In hours presentation	-386.74	-1266.91	493.44	0.39
Mortality within 24-hours of presentation	-12723.59	-14270.40	-11176.77	<0.001
Pre-hospital intubation	9481.63	8034.75	10928.51	<0.001
Intensive care admission	22254.13	21196.13	23312.14	<0.001

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