

Supplementary Material to: Tan JK, Kadir HA, Lim GH, et al. Fluid overload-related hospitalisations in patients with diabetes mellitus: Trends in healthcare utilisation and the role of chronic kidney disease. *Ann Acad Med Singap* 2024;53:435-45.
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Table S1. STROBE Statement: Checklist of items for the reporting of observational studies.

	Item no.	Recommendation	Page no.	Relevant text from manuscript
Title and abstract	1	(a) Indicate the study's design with a commonly used term in the title or the abstract	1	
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	2	
Introduction				
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4-5	However, the fluid overload-related healthcare utilisation characteristics of individuals with diabetes have not been described.
Objectives	3	State specific objectives, including any prespecified hypotheses	5	Therefore, we aimed to examine the long-term trends in hospitalisations due to fluid overload and explore plausible reasons for the trends.
Method				
Study design	4	Present key elements of the study design early in the paper	5-6	..examined trends of fluid overload in each year's registry cohort from 2013 to 2022
Setting	5	Describe the setting, locations and relevant dates, including periods of recruitment, exposure, follow-up and data collection	5	We used data from the multi-institutional SingHealth Diabetes Registry (SDR).
Participants	6	(a) <i>Cohort study</i> . Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up. <i>Case-control study</i> . Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls.	6	It includes all individuals aged 18 and above with DM, excluding those with pre-diabetes. Cases are ascertained annually using criteria that

		<i>Cross-sectional study.</i> Give the eligibility criteria, and the sources and methods of selection of participants.		include diagnosis codes (International Classification of Disease, Nine [ICD-9] and Ten [ICD-10]), prescription records and laboratory test records.
		(b) <i>Cohort study.</i> For matched studies, give matching criteria and the number of exposed and unexposed. <i>Case-control study.</i> For matched studies, give matching criteria and the number of controls per case.	NA	NA
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders and effect modifiers. Give diagnostic criteria, if applicable.	7	A total of 17 sociodemographic and clinical variables related to diabetic complications were evaluated for their association with fluid overload hospitalisations.
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than 1 group.	6	<i>Fluid overload-related hospitalisations were determined using ICD-10 diagnosis codes (E877, I50, I500, J81 N04 and R601) for the diagnoses of fluid overload, heart failure, congestive heart failure, pulmonary edema, nephrotic syndrome and generalised edema, respectively.</i>
Bias	9	Describe any efforts to address potential sources of bias	24	To minimise this bias, we considered fluid overload as both principal and discharge diagnoses and

Study size	10	Explain how the study size was arrived at	NA	utilised a range of ICD codes. <i>Comment: All participants in the registry were included.</i>
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Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why.	7	Analysis was performed for 4 age bands, age band 1 (18-44 years), age band 2 (45-64 years), age band 3 (65-74 years) and age band 4 (≥ 75 years), to describe the effects of age on the trend estimates.
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	8	We used Joinpoint regression methodology (20) to analyse the trends in the event rates of fluid overload. We allowed a maximum of 1 joinpoint in the models based on the number of observations (10 calendar years) and used a Monte Carlo permutation method for model selection. Generalised estimating equation (GEE) models were used to evaluate the association between fluid overload and explanatory variables, as each person contributes multiple observations across time in the study period.
		(b) Describe any methods used to examine subgroups and interactions	7	Analysis was performed for 4 age bands, age band 1 (18-44 years), age band 2 (45-64 years), age band 3 (65-74

				years) and age band 4 (≥ 75 years), to describe the effects of age on the trend estimates. We presented age-specific event rates because the underlying population catered to by the SingHealth cluster changes yearly.
		(c) Explain how missing data were addressed	NA	<i>Comment: In our registry based study, we recognise that loss to follow-up was an important issue. We utilised GEE to handle missing data and loss to follow up.</i>
		(d) <i>Cohort study.</i> If applicable, explain how loss to follow-up was addressed. <i>Case-control study.</i> If applicable, explain how the matching of cases and controls was addressed <i>Cross-sectional study.</i> If applicable, describe analytical methods taking account of sampling strategy.	NA	<i>Comment: In our registry based study, we recognise that loss to follow-up was an important issue. We utilised GEE to handle missing data and loss to follow up.</i>
		(e) Describe any sensitivity analyses	NA	NA
Results				
Participants	13*	(a) Report numbers of individuals at each stage of study (e.g. numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up and analysed)	9	This study included 259,607 unique patients. The characteristics of the registry are described in Table S2. Throughout the study period, the registry's gender and ethnicity distribution closely resembled that of the Singapore population.

		(b) Give reasons for non-participation at each stage	10	The SDR is a dynamic cohort (1) and details of the population movement in and out of the registry is shown in Fig. S1.
		(c) Consider use of a flow diagram	Fig. S1	Fig. S1
Descriptive data	14*	(a) Give characteristics of study participants (e.g. demographic, clinical, social) and information on exposures and potential confounders	Table S2	
		(b) Indicate number of participants with missing data for each variable of interest	NA	NA
		(c) <i>Cohort study</i> . Summarise follow-up time (e.g. average and total amount)	NA	NA
Outcome data	15*	<i>Cohort study</i> . Report numbers of outcome events or summary measures over time	10	The proportion of unique patients with fluid overload-related hospitalisations and the length of stay (LOS) from 2013 to 2022 is detailed in Table 1.
		<i>Case-control study</i> . Report numbers in each exposure category or summary measures of exposure	NA	NA
		<i>Cross-sectional study</i> . Report numbers of outcome events or summary measures	NA	NA
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (e.g. 95% confidence interval). Make clear which confounders were adjusted for and why they were included.	10	During this period, we observed an increase in the proportion of patients in the registry admitted for fluid overload. In 2013, 0.94% of the registry (877 individuals) had at least 1 hospitalisation where fluid overload was the principal diagnosis. The prevalence decreased to 0.67% in 2017 before increasing sharply to 1.34% (1849 individuals) in 2022.

(b) Report category boundaries when continuous variables were categorised	NA	NA
(c) If relevant, consider translating the estimates of relative risk into absolute risk for a meaningful time period.	NA	NA

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Other analyses	17	Report other analyses done (e.g. analyses of subgroups and interactions, and sensitivity analyses)	13, 14	
Discussion				
Key results	18	Summarise key results with reference to study objectives	20	In this study, we observed a rising rate of fluid overload-related hospitalisations among individuals with diabetes over a 10-year period. Corresponding to this was the rising healthcare burden attributable to fluid overload, as manifested by an increase in total inpatient bed days and average LOS. We found that stages G3B-G5 chronic kidney disease (CKD), ischaemic heart disease (IHD), acute myocardial infarction (AMI) and hypertension were most strongly associated with fluid overload as both the principal and discharge diagnoses. Moreover, the prevalence of stage G5 CKD among patients with fluid overload had increased in tandem with the hospitalisations for fluid overload over the past 5 years.
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias.	24	The limitations of our study stem from the dynamic nature of the SDR, particularly regarding patients who exit the

				registry to seek clinical care at other healthcare institutions.
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies and other relevant evidence	20-22	
Generalisability	21	Discuss the generalisability (external validity) of the study results	24	Finally, our results may not be generalisable to other healthcare settings where the prevalence and risks of CKD and IHD differ, hence further analyses in countries with similarly high prevalence of CKD will be informative.
Other information				
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	NA	<i>Comment: No funding</i>

DM: diabetes mellitus; NA: not applicable; STROBE: Strengthening the Reporting of Observational Studies in Epidemiology

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups

Table S2. Population structure, demographics and comorbidities of the SDR population from 2013 to 2022.

		Year									
		2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
All patients											
Population size		92,990	96,846	105,181	111,963	120,221	127,989	134,670	140,859	137,584	137,627
Females (%)		50.26	49.98	49.78	49.55	50.20	48.92	48.79	48.32	48.33	48.21
Ethnicity											
Ethnicity	Chinese (%)	70.7	70.5	70.6	70.3	71.7	70.1	70.2	69.9	69.1	69.0
	Malay (%)	14.7	14.9	14.8	14.9	14.4	15.1	14.9	14.8	15.1	15.2
	Indian (%)	10.6	10.5	10.6	10.7	10.9	10.5	10.5	10.7	11.0	10.8
	Others (%)	4.1	4.0	4.0	4.0	3.1	4.2	4.4	4.6	4.9	5.1
Age (years)											
Age (years)	Mean (SD)	64.6 (12.5)	64.9 (12.5)	65.1 (12.5)	65.2 (12.5)	66.0 (12.3)	65.4 (12.8)	65.7 (12.8)	65.7 (13.2)	65.5 (13.4)	65.9 (13.5)
	IQR	57-74	57-74	57-74	57-74	58-74	58-74	58-74	58-74	58-74	58-75
	Min, Max	18, 105	18, 104	18, 105	18, 106	18, 105	18, 118	18, 113	0, 108	2, 109	0, 110
Diabetes type											
Diabetes type	Type 1 (%)	0.59	0.60	0.64	0.62	0.66	0.73	0.76	0.91	0.97	1.02
	Type 2 (%)	99.33	99.31	99.27	99.27	99.23	99.15	99.09	98.92	98.82	98.78
	Others ^a (%)	0.09	0.09	0.09	0.11	0.11	0.12	0.16	0.17	0.21	0.20
By age band											
Age band 1 (18-44 years)											
Age band 1 (18-44 years)	Count	5254	5366	5776	6237	5894	7538	8037	8759	9306	9289
	Percent of total population	5.7	5.5	5.5	5.6	4.9	5.9	6.0	6.2	6.8	6.7
	Mean age (SD)	37.1 (6.5)	37.1 (6.5)	37.1 (6.4)	36.9 (6.6)	37.0 (6.5)	36.7 (6.4)	36.6 (6.3)	36.7 (6.2)	36.4 (6.3)	36.4 (6.3)
	Comorbidities^b										
	DM only (%)	3.5	3.3	3.6	3.5	6.2	6.0	6.7	6.0	5.4	5.6
	DM + HTN only (%)	4.2	3.4	4.2	3.7	4.6	4.7	4.8	4.4	4.0	3.4
	DM + HLD only (%)	26.2	28.6	27.8	31.0	32.5	35.1	34.8	34.8	35.9	36.3

	DM + HTN + HLD (%)	66.0	64.7	64.5	61.8	56.7	54.2	53.7	54.8	54.7	54.7
	Mean BMI (SD)	25.7 (5.4)	30.0 (6.7)	30.1 (6.6)	30.1 (6.8)	30.2 (6.8)	30.6 (6.9)	30.6 (6.9)	30.8 (7.1)	30.8 (6.9)	30.8 (7.1)
	Mean HbA1c (%) (SD)	8.2 (2.1)	8.1 (2.1)	8.2 (2.1)	8.1 (2.0)	8 (2.0)	7.8 (2.0)	7.7 (2.0)	7.8 (2.1)	7.8 (2.0)	7.8 (2.0)
	Mean LDL-C (SD)	2.8 (0.96)	2.84 (0.94)	2.79 (0.99)	2.66 (0.98)	2.56 (0.91)	2.64 (0.95)	2.64 (0.93)	2.61 (0.96)	2.66 (0.95)	2.69 (1.00)
Age band 2 (45-64 years)	Count	40,298	40,936	43,582	45,799	46,303	50,271	51,255	51,956	49,876	47,849
	Percent of total population	43.3	42.3	41.4	40.9	38.5	39.3	38.1	36.9	36.3	34.8
	Mean age (SD)	56.8 (5.2)	56.8 (5.2)	56.9 (5.1)	57.0 (5.2)	57.2 (5.1)	57.0 (5.2)	57.1 (5.2)	57.2 (5.2)	57.1 (5.3)	57.1 (5.3)
	Comorbidities^b										
	DM only (%)	0.9	0.9	0.9	0.8	1.3	1.6	1.5	1.2	1.0	1.0
	DM + HTN only (%)	3.5	3.1	3.1	2.1	3.1	3.3	3.3	2.7	2.3	2.3
	DM + HLD only (%)	13.1	13.4	13.2	13.5	15.3	16.4	16.9	15.6	15.3	15.3
	DM + HTN + HLD (%)	82.5	82.5	82.8	83.6	80.4	78.7	78.3	80.5	81.4	81.4
	Mean BMI (SD)	27.4 (5.1)	27.4 (5.0)	27.5 (5.1)	27.4 (5.2)	27.4 (5.3)	27.5 (5.3)	27.6 (5.4)	27.7 (5.5)	27.7 (5.5)	27.6 (5.5)
	Mean HbA1c (%) (SD)	7.6 (1.6)	7.4 (1.6)	7.6 (1.6)	7.6 (1.6)	7.6 (1.6)	7.4 (1.6)	7.4 (1.6)	7.5 (1.6)	7.5 (1.5)	7.5 (1.5)
Mean LDL-C (SD)	2.46 (0.84)	2.51 (0.85)	2.48 (0.83)	2.39 (0.81)	2.24 (0.79)	2.29 (0.84)	2.3 (0.84)	2.25 (0.84)	2.27 (0.85)	2.27 (0.86)	
Age band 3 (65-74 years)	Count	26,587	28,154	31,006	33,221	38,044	39,538	42,578	45,705	44,507	44,434
	Percent of total population	28.6	29.1	29.5	29.7	31.6	30.9	31.6	32.4	32.3	32.3
	Mean age (SD)	69.2 (3.0)	69.1 (2.9)	69.1 (2.8)	69.0 (2.8)	69.2 (2.8)	69.2 (2.8)	69.3 (2.8)	69.4 (2.8)	69.4 (2.9)	69.4 (2.9)
	Comorbidities^b										
	DM only (%)	0.4	0.5	0.4	0.4	0.6	0.7	0.7	0.5	0.4	0.5

	DM + HTN only (%)	3.3	2.9	3.0	1.8	3.2	3.1	3.1	2.2	2.0	1.9
	DM + HLD only (%)	5.1	5.4	5.5	5.2	7.2	7.9	8.2	7.0	6.7	7.1
	DM + HTN + HLD (%)	91.2	91.2	91.2	92.6	89.0	88.3	88.0	90.2	91.0	90.6
	Mean BMI (SD)	25.9 (4.6)	25.9 (4.5)	26.0 (4.6)	25.8 (4.5)	25.8 (4.6)	25.9 (4.7)	25.9 (4.7)	26.0 (4.9)	26.0 (4.9)	25.8 (4.9)
	Mean HbA1c (%) (SD)	7.2 (1.3)	7.0 (1.3)	7.2 (1.3)	7.1 (1.2)	7.2 (1.2)	7.0 (1.3)	7.1 (1.3)	7.2 (1.3)	7.2 (1.2)	7.1 (1.2)
	Mean LDL-C (SD)	2.27 (0.73)	2.32 (0.74)	2.29 (0.73)	2.20 (0.71)	2.07 (0.68)	2.10 (0.73)	2.10 (0.73)	2.05 (0.73)	2.08 (0.74)	2.07 (0.76)
Age band 4 (≥75 years)	Count	20,851	22,390	24,817	26,706	29,980	30,642	32,800	34,061	33,518	35,667
	Percent of total population	22.4	23.1	23.6	23.9	24.9	23.9	24.4	24.2	24.4	25.9
	Mean age (SD)	80.8 (4.8)	80.8 (4.8)	80.9 (4.9)	81.0 (4.9)	81.2 (4.9)	81.3 (5.1)	81.5 (5.1)	81.6 (5.2)	81.5 (5.3)	81.4 (5.4)
	Comorbidities^b										
	DM only (%)	0.3	0.3	0.3	0.2	0.4	0.3	0.4	0.2	0.2	0.3
	DM + HTN only (%)	3.9	3.5	3.5	1.9	3.7	3.2	3.4	2.2	1.8	1.8
	DM + HLD only (%)	3.6	3.5	3.5	2.6	4.3	4.4	4.9	3.5	2.4	3.1
	DM + HTN + HLD (%)	92.1	92.7	92.7	95.4	91.6	92.0	91.3	94.1	95.6	94.9
	Mean BMI (SD)	24.8 (4.6)	24.8 (4.4)	24.8 (4.5)	24.5 (4.4)	24.5 (4.5)	24.6 (4.8)	24.5 (4.6)	24.4 (4.6)	24.5 (4.7)	24.3 (4.8)
	Mean HbA1c (%) (SD)	6.9 (1.2)	6.8 (1.2)	6.9 (1.2)	7.0 (1.2)	7.1 (1.2)	6.9 (1.2)	6.9 (1.3)	7.1 (1.3)	7.1 (1.2)	7 (1.2)
Mean LDL-C (SD)	2.21 (0.72)	2.25 (0.74)	2.21 (0.71)	2.13 (0.69)	2.03 (0.70)	2.02 (0.70)	2.02 (0.71)	1.97 (0.72)	1.99 (0.72)	1.98 (0.73)	
BMI: body mass index; DM: diabetes mellitus; HLD: hyperlipidaemia; HTN: hypertension; IQR: interquartile range; LDL-C: low-density lipoprotein-cholesterol; SD: standard deviation; SDR: SingHealth Diabetes Registry											
^a Other diabetes type include drug-induced, gestational, monogenic and secondary diabetes.											
^b Comorbidities were tabulated based on available data and do not include all patients in the registry.											

Table S3. Event rates for fluid overload by age bands.

Year	Age band	Principal diagnosis						Discharge diagnosis					
		Event rate (per 10,000 persons) [95% CI]	AAPC	Segment 1	APC [95% CI]	Segment 2	APC [95% CI]	Event rate (per 10,000 persons) [95% CI]	AAPC	Segment 1	APC [95% CI]	Segment 2	APC [95% CI]
2013	1	40.0 [26.1, 61.2]	4.89 [0.18, 12.33]*	2013-2017	- [0.44, 38.22, 6.46]	2017-2022	19.01 [8.42, 55.45]*	106.6 [82.1, 138.3]	2.71 [-0.34, 6.15]	2013-2017	-8.00 [-22.04, 0.3]	2017-2022	12.18 [6.93, 25.68]*
2014		31.7 [19.7, 50.9]						110.0 [85.3, 141.7]					
2015		29.4 [18.3, 47.3]						119.5 [94.5, 151.0]					
2016		32.1 [20.7, 49.7]						88.2 [67.8, 114.7]					
2017		20.4 [11.6, 35.8]						78.0 [58.5, 104.0]					
2018		33.2 [22.4, 49.0]						84.9 [66.5, 108.3]					
2019		39.8 [28.2, 56.3]						104.5 [84.5, 129.3]					
2020		29.7 [20.2, 43.6]						137.0 [114.7, 163.6]					
2021		48.4 [36.1, 64.7]						133.2 [111.9, 158.7]					
2022		63.5						143.2					

		[49.2, 81.9]						[120.9, 169.5]					
2013	2	69.7 [62.1, 78.3]	2.70 [1.23, 4.42]*	2013- 2017	-8.18 [- 15.16, - 3.34]*	2017- 2022	12.32 [8.86, 17.99]*	208.9 [195.4, 223.4]	2.44 [0.19, 5.19]*	2013- 2017	-5.25 [- 17.8, 1.48]	2017- 2022	9.05 [4.25, 22.26]*
2014		65.5 [58.1, 73.8]						184.4 [171.8, 197.9]					
2015		65.2 [58.0, 73.2]						179.0 [166.9, 191.9]					
2016		50.4 [44.3, 57.4]						181.2 [169.4, 193.9]					
2017		49.2 [43.3, 56.0]						144.7 [134.2, 156.0]					
2018		60.3 [53.9, 67.4]						174.9 [163.8, 186.7]					
2019		65.8 [59.1, 73.1]						210.1 [198.1, 222.9]					
2020		67.4 [60.7, 74.8]						234.2 [221.6, 247.6]					
2021		80.8 [73.3, 89.0]						220.5 [208.0, 233.8]					
2022		91.7 [83.6, 100.7]						240.8 [227.4, 254.9]					
2013	3	98.9 [87.7, 111.6]	1.76 [0.75, 3.04]*	2013- 2017	-	2017- 2022	14.02 [11.6, 17.54]*	281.7 [262.5, 302.3]	2.62 [0.25, 5.65]*	2013- 2017	-7.78 [- 22.16, - 0.18]*	2017- 2022	11.79 [6.93, 24.07]*
2014		88.8 [78.5, 100.5]						262.8 [244.8, 282.2]					

2015		81.0 [71.6, 91.6]				229.6 [213.5, 246.9]							
2016		70.1 [61.7, 79.7]				227.0 [211.5, 243.5]							
2017		59.1 [51.9, 67.4]				187.9 [174.8, 202.1]							
2018		74.1 [66.1, 83.1]				208.9 [195.3, 223.5]							
2019		76.3 [68.5, 85.1]				266.1 [251.2, 281.8]							
2020		86.2 [78.1, 95.1]				323.4 [307.5, 340.0]							
2021		105.6 [96.5, 115.5]				315.7 [299.8, 332.3]							
2022		118.8 [109.2, 129.3]				327.9 [311.7, 344.9]							
2013	4	149.6 [134.0, 167.0]	5.31 [3.99, 7.12]*	2013- 2017	-6.05 [- 13.65, - 1.17]*	2017- 2022	15.39 [12.39, 20.37]*	3.37 [0.98, 6.5]*	2013- 2017	-5.72 [- 20.13, 2.06]	2017- 2022	11.26 [6.39, 24.81]*	
2014		135.8 [121.4, 151.8]											502 [474.2, 531.4]
2015		133.0 [119.5, 148.0]											487.6 [461.5, 515.1]
2016		115.3 [103.2, 128.9]											435.5 [411.7, 460.6]
2017		115.1											395.6

		[103.6, 127.8]			[374.1, 418.3]		
2018		127.3 [115.3, 140.5]			431.4 [409.2, 454.8]		
2019		165.2 [152.0, 179.6]			579.3 [554.5, 605.1]		
2020		172.0 [158.8, 186.4]			643.9 [618.3, 670.4]		
2021		206.5 [191.8, 222.2]			668.0 [641.8, 695.2]		
2022		230.7 [215.7, 246.9]			662.0 [636.6, 688.2]		

* Annual percentage change (APC) or Average annual percentage change (AAPC) is statistically significant ($P < 0.05$).

CI: confidence interval

Table S4. Characteristics of patients by eGFR category and year.

Proportion (%) of patients by eGFR category and year (across the whole SDR)											
		Year									
		2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
eGFR category	G1	41.7	42.4	42.7	42.1	39.7	35.7	36.2	35.2	34.9	34.3
	G2	35.4	34.6	34.7	35.4	36.8	40.2	39.8	40.4	40.2	40.6
	G3A	10.2	10.3	10.2	10.2	10.6	11.2	11.1	11.2	11.2	11.2
	G3B	6.5	6.6	6.5	6.5	6.8	6.8	6.7	6.9	6.9	6.8
	G4	3.4	3.4	3.4	3.4	3.5	3.4	3.4	3.5	3.6	3.7
	G5	2.8	2.7	2.6	2.5	2.7	2.8	2.8	2.8	3.1	3.3
<i>Note: Proportions correspond to Fig. 2a</i>											
Proportion (%) of patients by eGFR category and year (patients with principal diagnosis of fluid overload)											
		Year									
		2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
eGFR category	G1	13.3	11.1	12.1	11.6	9.6	11.1	11.7	8.9	9.9	9.8
	G2	21.0	24.9	25.6	25.3	25.6	23.2	22.3	22.6	21.7	22.3
	G3A	17.1	15.1	17.3	16.6	15.4	16.9	15.4	13.1	13.6	12.7
	G3B	19.2	17.8	17.6	18.6	19.1	19.7	18.3	17.2	16.8	15.7
	G4	16.5	18.8	17.6	18.2	19.1	16.1	18.3	19.9	17.4	18.1
	G5	12.9	12.4	9.8	9.7	11.2	12.9	14.1	18.4	20.7	21.4
<i>Note: Proportions correspond to Fig. 2b</i>											
Proportion (%) of patients by eGFR category and year (patients with discharge diagnosis of fluid overload)											
		Year									
		2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
eGFR category	G1	12.9	10.9	11.6	12.8	10.5	13.2	13.2	12.8	12.0	12.6

	G2	24.6	24.7	25.2	24.1	25.5	26.1	24.0	23.1	23.2	24.6
	G3A	15.1	15.5	16.2	15.9	14.6	14.6	14.1	12.4	13.1	13.2
	G3B	16.6	16.8	16.6	16.0	16.9	16.7	15.9	15.0	15.2	14.3
	G4	15.5	16.6	16.5	16.6	18.1	15.7	16.6	17.3	16.7	15.1
	G5	15.4	15.6	14.0	14.6	14.4	13.7	16.3	19.4	19.8	20.3

Note: Proportions correspond to Fig. 2c

Proportion (%) of patients by eGFR category and year (patients without principal diagnosis of fluid overload)

		Year									
		2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
eGFR category	G1	42.0	42.7	42.9	42.3	39.9	35.9	36.5	35.5	35.3	34.7
	G2	35.5	34.7	34.8	35.4	36.8	40.3	40.0	40.6	40.5	40.9
	G3A	10.2	10.2	10.1	10.1	10.6	11.1	11.1	11.2	11.2	11.2
	G3B	6.4	6.5	6.4	6.4	6.7	6.7	6.6	6.8	6.8	6.7
	G4	3.3	3.3	3.2	3.3	3.4	3.3	3.3	3.4	3.4	3.4
	G5	2.7	2.6	2.5	2.5	2.7	2.7	2.7	2.6	2.9	3.1

Note: Proportions correspond to Fig. 2d

Proportion (%) of patients by eGFR category and year (patients without discharge diagnosis of fluid overload)

		Year									
		2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
eGFR category	G1	42.7	43.4	43.6	42.9	40.4	36.3	37.0	36.1	35.9	35.3
	G2	35.8	35.0	35.0	35.7	37.0	40.6	40.4	41.1	40.9	41.3
	G3A	10.1	10.1	10.0	10.0	10.5	11.1	11.0	11.2	11.1	11.2
	G3B	6.2	6.2	6.2	6.2	6.5	6.5	6.4	6.6	6.6	6.5
	G4	3.0	3.0	3.0	3.1	3.1	3.1	3.0	3.0	3.1	3.2
	G5	2.3	2.3	2.3	2.2	2.4	2.5	2.3	2.1	2.5	2.6

Note: Proportions correspond to Fig. 2e

Proportion (%) of patients by eGFR category and year (new patients with principal diagnosis of fluid overload)										
		Year								
		2014	2015	2016	2017	2018	2019	2020	2021	2022
eGFR category	G1	11.1	12.1	11.6	9.6	11.1	11.7	8.9	9.9	9.8
	G2	24.9	25.6	25.3	25.6	23.2	22.3	22.6	21.7	22.3
	G3A	15.1	17.3	16.6	15.4	16.9	15.4	13.1	13.6	12.7
	G3B	17.8	17.6	18.6	19.1	19.7	18.3	17.2	16.8	15.7
	G4	18.8	17.6	18.2	19.1	16.1	18.3	19.9	17.4	18.1
	G5	12.4	9.8	9.7	11.2	12.9	14.1	18.4	20.7	21.4
<i>Note: Proportions correspond to Fig. 3a</i>										
Proportion (%) of patients by eGFR category and year (new patients with discharge diagnosis of fluid overload)										
		Year								
		2014	2015	2016	2017	2018	2019	2020	2021	2022
eGFR category	G1	10.9	11.6	12.8	10.5	13.2	13.2	12.8	12.0	12.6
	G2	24.7	25.2	24.1	25.5	26.1	24.0	23.1	23.2	24.6
	G3A	15.5	16.2	15.9	14.6	14.6	14.1	12.4	13.1	13.2
	G3B	16.8	16.6	16.0	16.9	16.7	15.9	15.0	15.2	14.3
	G4	16.6	16.5	16.6	18.1	15.7	16.6	17.3	16.7	15.1
	G5	15.6	14.0	14.6	14.4	13.7	16.3	19.4	19.8	20.3
<i>Note: Proportions correspond to Fig. 3b</i>										
Proportion (%) of patients by eGFR category and year (patients from previous year's registry with principal diagnosis of fluid overload)										
		Year								
		2014	2015	2016	2017	2018	2019	2020	2021	2022
eGFR category	G1	11.1	12.1	11.6	9.6	11.1	11.7	8.9	9.9	9.8

	G2	24.9	25.6	25.3	25.6	23.2	22.3	22.6	21.7	22.3
	G3A	15.1	17.3	16.6	15.4	16.9	15.4	13.1	13.6	12.7
	G3B	17.8	17.6	18.6	19.1	19.7	18.3	17.2	16.8	15.7
	G4	18.8	17.6	18.2	19.1	16.1	18.3	19.9	17.4	18.1
	G5	12.4	9.8	9.7	11.2	12.9	14.1	18.4	20.7	21.4

Note: Proportions correspond to Fig. 3c

Proportion (%) of patients by eGFR category and year (patients from previous year's registry with discharge diagnosis of fluid overload)

		Year									
		2014	2015	2016	2017	2018	2019	2020	2021	2022	
eGFR category	G1	10.9	11.6	12.8	10.5	13.2	13.2	12.8	12.0	12.6	
	G2	24.7	25.2	24.1	25.5	26.1	24.0	23.1	23.2	24.6	
	G3A	15.5	16.2	15.9	14.6	14.6	14.1	12.4	13.1	13.2	
	G3B	16.8	16.6	16.0	16.9	16.7	15.9	15.0	15.2	14.3	
	G4	16.6	16.5	16.6	18.1	15.7	16.6	17.3	16.7	15.1	
	G5	15.6	14.0	14.6	14.4	13.7	16.3	19.4	19.8	20.3	

Note: Proportions correspond to Fig. 3d

Proportion (%) of patients by eGFR category and year (patients re-entering registry with principal diagnosis of fluid overload)

		Year								
		2015	2016	2017	2018	2019	2020	2021	2022	
eGFR category	G1	14.3	10.4	11.1	20.0	13.3	2.5	10.8	10.1	
	G2	42.9	27.1	30.2	30.0	21.9	26.1	21.6	25.4	
	G3A	14.3	16.7	15.9	22.5	15.2	14.3	19.9	14.3	
	G3B	11.9	18.8	14.3	7.5	17.1	17.7	19.3	18.0	
	G4	11.9	8.3	15.9	10.0	18.1	11.8	14.8	18.0	
	G5	4.8	18.8	12.7	10.0	14.3	27.7	13.6	14.3	

Note: Proportions correspond to Fig. 3e

Proportion (%) of patients by eGFR category and year (patients re-entering registry with discharge diagnosis of fluid overload)

		Year									
		2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
eGFR category	G1			11.6	11.8	12.2	13.4	12.8	13.0	13.4	12.8
	G2			39.7	28.1	30.3	28.9	24.7	25.5	24.4	26.0
	G3A			11.6	15.7	13.8	19.5	16.4	13.0	17.7	14.5
	G3B			12.4	14.6	14.4	16.1	17.9	15.9	14.7	17.0
	G4			14.1	14.6	15.4	11.4	13.7	13.2	13.8	15.1
	G5			10.7	15.2	13.8	10.7	14.6	19.6	16.1	14.5

Note: Proportions correspond to Fig. 3f

eGFR: estimated glomerular filtration rate

Table S5. Characteristics of patients by IHD status and year.

Proportion (%) of patients by IHD status and year (across the whole SDR)											
		Year									
		2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
IHD	Absent	82.3	80.7	80.0	78.9	77.7	77.0	76.6	76.3	74.5	73.7
	Present	17.7	19.3	20.0	21.2	22.3	23.0	23.4	23.7	25.5	26.4
<i>Note: Proportions correspond to Fig. S3a</i>											
Proportion (%) of patients by IHD status and year (patients with principal diagnosis of fluid overload)											
		Year									
		2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
IHD	Absent	28.4	27.2	22.8	24.8	23.1	28.3	30.0	29.7	27.1	27.5
	Present	71.6	72.8	77.2	75.3	76.9	71.7	70.0	70.4	72.9	72.5
<i>Note: Proportions correspond to Fig. S3b</i>											
Proportion (%) of patients by eGFR category and year (patients with discharge diagnosis of fluid overload)											
		Year									
		2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
IHD	Absent	29.9	28.2	27.6	28.9	25.6	30.8	33.5	35.2	29.5	31.0
	Present	70.1	71.8	72.4	71.1	74.4	69.2	66.5	64.8	70.5	69.0
<i>Note: Proportions correspond to Fig. S3c</i>											
Proportion (%) of patients by eGFR category and year (patients without principal diagnosis of fluid overload)											
		Year									
		2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
IHD	Absent	82.8	81.2	80.5	79.2	78.1	77.4	77.0	76.8	75.0	74.3
	Present	17.2	18.8	19.5	20.8	21.9	22.6	23.0	23.2	25.0	25.7

Note: Proportions correspond to Fig. S3d

Proportion (%) of patients by eGFR category and year (patients without discharge diagnosis of fluid overload)

		Year									
		2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
IHD	Absent	83.9	82.2	81.4	80.1	78.9	78.2	78.0	77.8	76.1	75.3
	Present	16.1	17.8	18.6	19.9	21.1	21.8	22.1	22.2	23.9	24.7

Note: Proportions correspond to Fig. S3e

Proportion (%) of patients by eGFR category and year (new patients with principal diagnosis of fluid overload)

		Year									
		2014	2015	2016	2017	2018	2019	2020	2021	2022	
IHD	Absent	41.8	34.7	36.6	36.8	43.9	50.4	45.7	40.5	39.0	
	Present	58.3	65.3	63.4	63.2	56.1	49.7	54.3	59.5	61.0	

Note: Proportions correspond to Fig. S4a

Proportion (%) of patients by eGFR category and year (new patients with discharge diagnosis of fluid overload)

		Year									
		2014	2015	2016	2017	2018	2019	2020	2021	2022	
IHD	Absent	39.1	39.5	43.1	39.0	45.3	51.7	52.2	43.1	43.1	
	Present	60.9	60.5	56.9	61.0	54.7	48.3	47.8	57.0	56.9	

Note: Proportions correspond to Fig. S4b

Proportion (%) of patients by eGFR category and year (patients from previous year's registry with principal diagnosis of fluid overload)

		Year									
		2014	2015	2016	2017	2018	2019	2020	2021	2022	
IHD	Absent	22.8	19.7	22.0	21.2	22.8	22.2	24.2	23.2	24.6	

	Present		77.2	80.3	78.0	78.8	77.2	77.8	75.8	76.8	75.4
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Note: Proportions correspond to Fig. S4c

Proportion (%) of patients by eGFR category and year (patients from previous year's registry with discharge diagnosis of fluid overload)

		Year									
		2014	2015	2016	2017	2018	2019	2020	2021	2022	
IHD	Absent	24.8	24.6	25.9	24.2	25.2	27.4	29.9	25.8	27.1	
	Present	75.2	75.4	74.1	75.8	74.8	72.7	70.1	74.2	72.9	

Note: Proportions correspond to Fig. S4d

Proportion (%) of patients by eGFR category and year (patients re-entering registry with principal diagnosis of fluid overload)

		Year									
		2015	2016	2017	2018	2019	2020	2021	2022		
IHD	Absent	29.8	26.7	27.5	35.0	37.1	35.3	30.7	27.7		
	Present	70.2	73.3	72.5	65.0	62.9	64.7	69.3	72.4		

Note: Proportions correspond to Fig. S4e

Proportion (%) of patients by eGFR category and year (patients re-entering registry with discharge diagnosis of fluid overload)

		Year									
		2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
IHD	Absent			32.8	30.6	26.8	35.6	36.9	39.5	33.8	34.4
	Present			67.2	69.4	73.3	64.4	63.1	60.5	66.2	65.6

Note: Proportions correspond to Fig. S4f

eGFR: estimated glomerular filtration rate

Table S6. Counts and relative frequencies of ICD-10 codes used for outcome ascertainment.

ICD-10 Code	E877	I50	I500	J81 or R601	N04	Total
	Fluid overload	Heart failure	Congestive heart failure	Pulmonary edema or generalised edema (respectively)	Nephrotic syndrome	
Primary diagnosis (no. [%])	6896 [38.7]	63 [0.4]	9825 [55.1]	1039 [5.8]	14 [0.08]	17,837 [100]
Discharge diagnosis (no. [%])	24,180 [42.7]	80 [0.1]	28,672 [50.7]	3609 [6.4]	24 [0.04]	56,565 [100]

ICD: International Classification of Diseases

Fig. S1. Progression of patients through the SDR from 2013 to 2022.

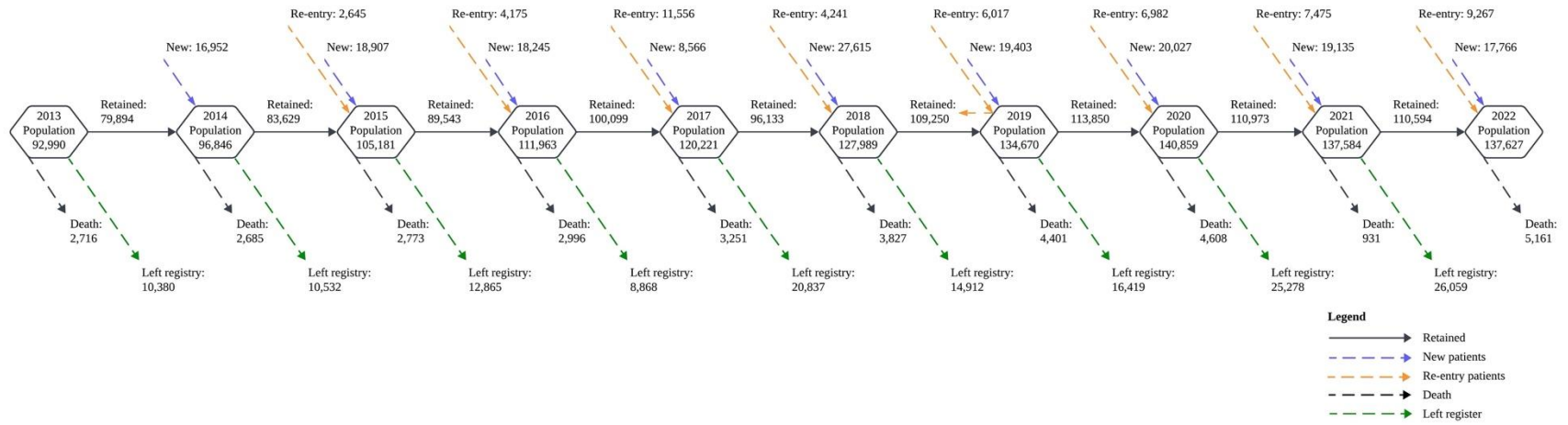


Fig. S2. Stock and flow diagram for patients with fluid overload in the SDR.

a. Fluid Overload (Principal diagnosis)



b. Fluid Overload (Discharge diagnosis)

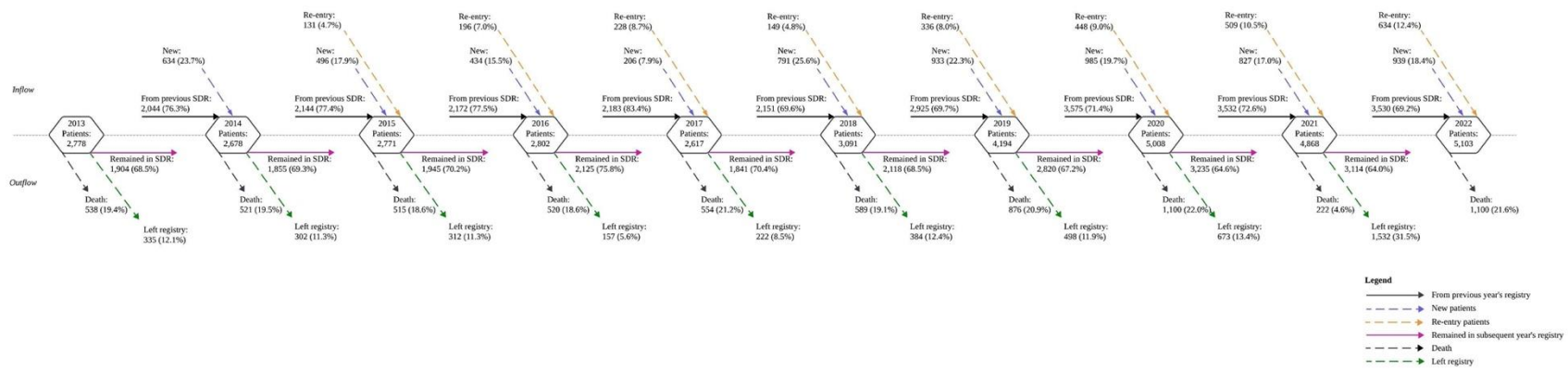


Fig. S3. Characteristics of IHD status among different subgroups of patients in the SDR.

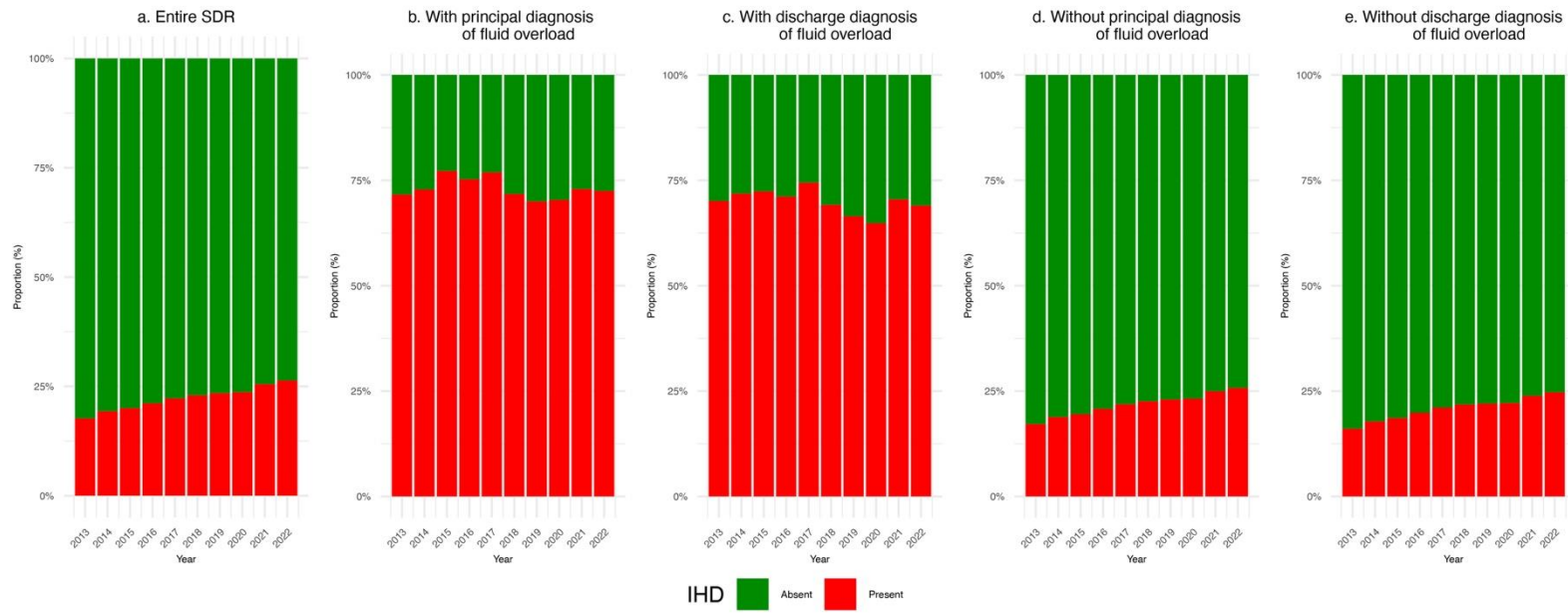


Fig. S4. Characteristics of IHD status among patients with fluid overload.

