

# Substantial Healthcare Utilization (HCU) and Costs Among Nonalcoholic Steatohepatitis (NASH) Patients with Comorbid Diabetes Mellitus (DM): Real-world Analysis of 2007-2015 US Medicare Data

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## BACKGROUND

- Nonalcoholic fatty liver disease/nonalcoholic steatohepatitis (NAFLD/NASH) patients often present with related comorbidities such as diabetes mellitus (DM), cardiovascular disease (CVD), chronic kidney disease (CKD), and hypertension.<sup>1</sup>
- However, data are lacking regarding healthcare resource utilization (HCRU) and healthcare costs in NAFLD/NASH patients with compensated cirrhosis (CC) by additional comorbid conditions.

## AIM

- To evaluate the impact of concurrent comorbid conditions on HCRU and healthcare costs among NAFLD/NASH patients with CC.

## METHODS

- Design:** This was a retrospective, observational cohort study (see Figure 1).
- Data Source:** 20% sample US Medicare from 2007-2015 (including Part A, Part B, and Part D).
- Study population:** NASH/NAFLD diagnosed patients (patients with  $\geq 1$  claim of ICD-9-CM [571.8, 571.9] or ICD-10 [K76.0, K75.81] diagnosis codes for NAFLD/NASH) with CC aged  $\geq 18$  years who have Medicare fee-for-service (FFS) coverage.
- Exclusion criteria:** Patients with other defined causes of liver disease were excluded (alcoholism, alcoholic liver disease, viral hepatitis, mumps hepatitis, HIV, Wilson's disease, autoimmune hepatitis, chronic toxic hepatitis, Gaucher, lysosomal acid lipase deficiency, primary biliary cholangitis, hemochromatosis and primary sclerosing cholangitis).
- Index date:** The first CC claim date was the CC index date.
  - Patients had Medicare coverage for at least 6 months prior to CC index date.
  - ICD-9 diagnosis code 571.5 (cirrhosis of liver without mention of alcohol).
  - ICD-10 diagnosis codes (K74.6, K74.60, and K74.69 unspecified or other cirrhosis of liver).
- Study Outcomes:**
  - Demographics/comorbidities at CC index date.
  - HCRU and healthcare costs during the 6 months pre-index and 6 months post-index period.
    - HCRU included annual number of medical visits (all visits, inpatient, outpatient, physician) and annual number of pharmacy fills.
    - All visits normalized to number of claims per patient (PP) annually and costs adjusted for inflation as per 2015 USD.
- Follow-up:** From CC index date to the earliest of death, end of Medicare coverage, December 31, 2015, or 6 months after index date; minimum 1 month follow-up required.

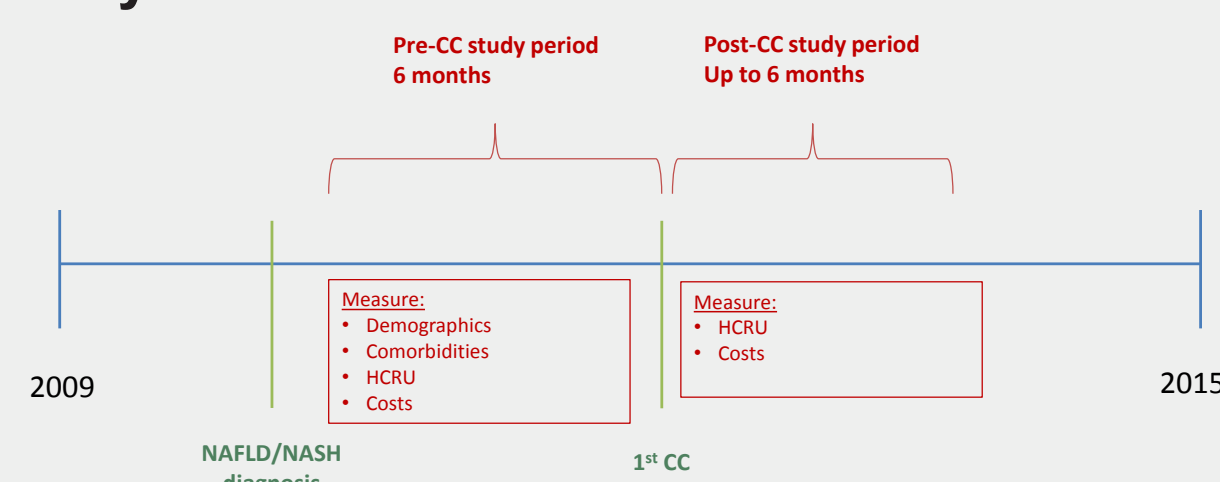
**Table 1. Patient Selection Flowchart**

Patient Selection Process	No. of patients
20% sample of Medicare patients with coverage between 2008-2015	10,826,456
Patients who had NAFLD/NASH diagnosis code between 1/1/2008 and 11/30/2015	621,253
Patients without any excluding diseases between 2007-2015	393,796
Patients who were defined with CC between 2007-2015	12,200
Patients have at least 1 month follow-up after CC index date	10,584
Patients with incident CC* and Medicare coverage at least 6 months pre-CC index date	3,775

\*No ESLD (DCC/HCC/Liver transplant before CC index date)

- 6% percent of the Medicare patients in this study had NAFLD/NASH
- 3% of the NAFLD/NASH patients in this study had CC.

**Figure 1. Study Period and Outcomes**



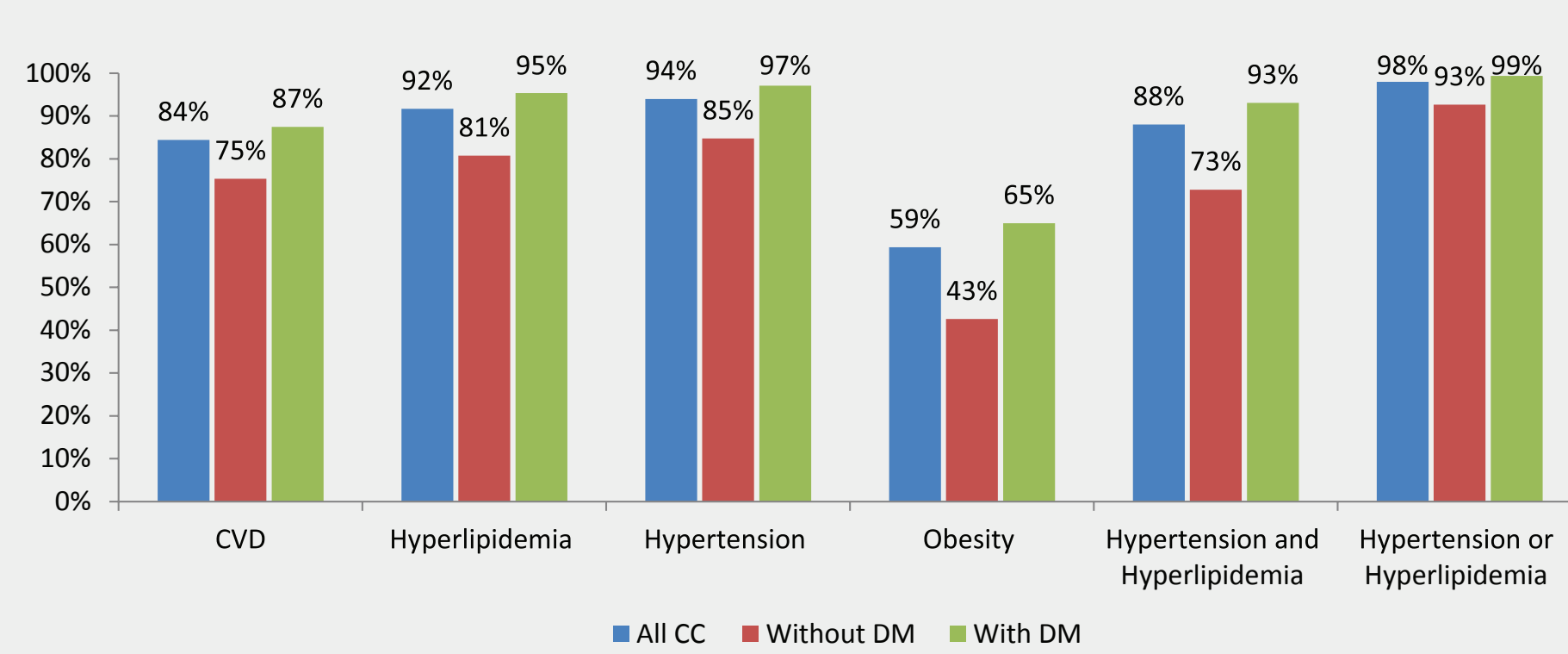
## RESULTS

**Table 2. NAFLD/NASH CC Patient Demographics**

	All CC	Without DM	With DM
Patients N, %	3,775	949 (25%)	2826 (75%)
Female, %	63%	62%	64%
Age mean, (SD)	66.95 (10.90)	67.47 (12.07)	66.78 (10.47)
Age group, %			
18-64	30%	26%	32%
65-69	29%	32%	28%
70-74	20%	19%	20%
75-79	12%	12%	12%
80+	9%	11%	8%
Race, %			
White	87%	88%	87%
Black	5%	5%	4%
Other	8%	7%	9%

- Medicare NAFLD/NASH CC patients had a mean age of 67 ( $\pm 10.9$ ), a higher female proportion (63%), were primarily white (87%), and had high prevalence of DM (75%).

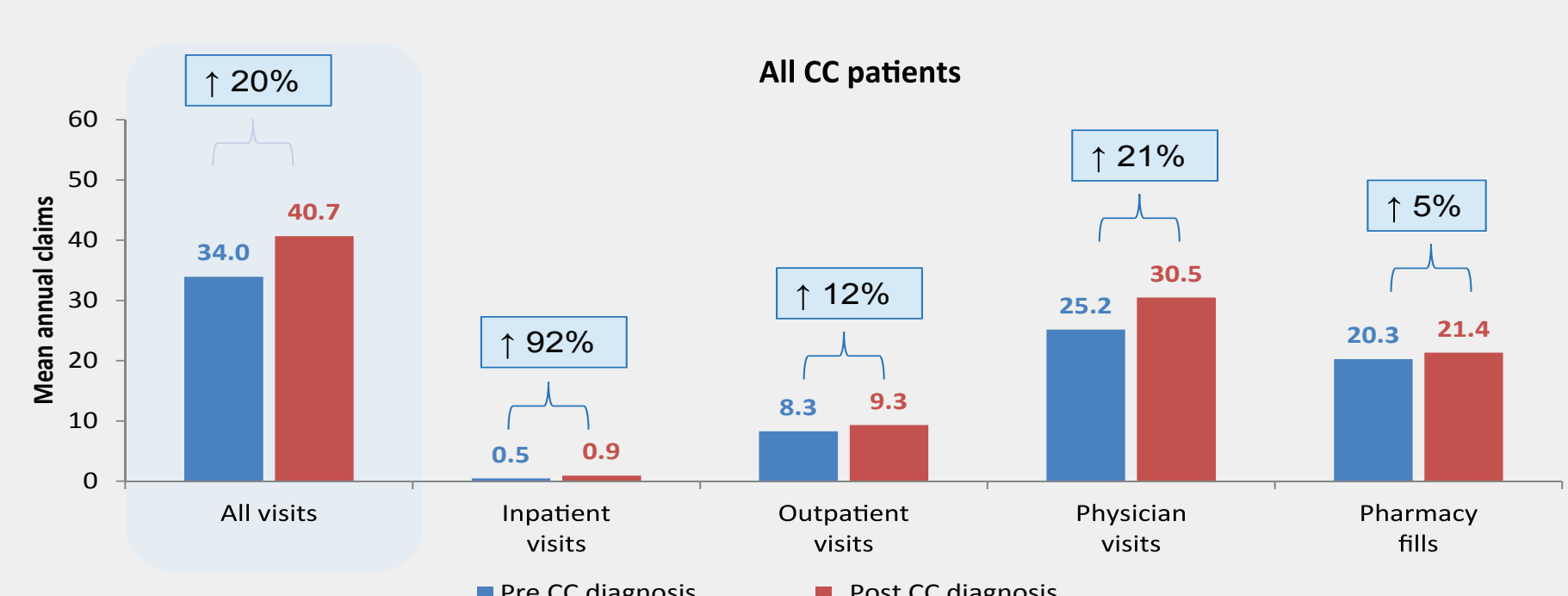
**Figure 2. NAFLD/NASH CC Patient Comorbidities**



P<0.0001 in all comorbidity comparisons for patients without DM and with DM

- NAFLD/NASH CC patients had a high comorbidity burden: 75% had DM, 84% had CVD, and 88% had both hypertension and hyperlipidemia.
- CC patients with DM had a significantly higher rate of additional comorbidities, such as CVD, and hypertension. 93% of patients with DM also had the comorbid conditions of hypertension and hyperlipidemia.

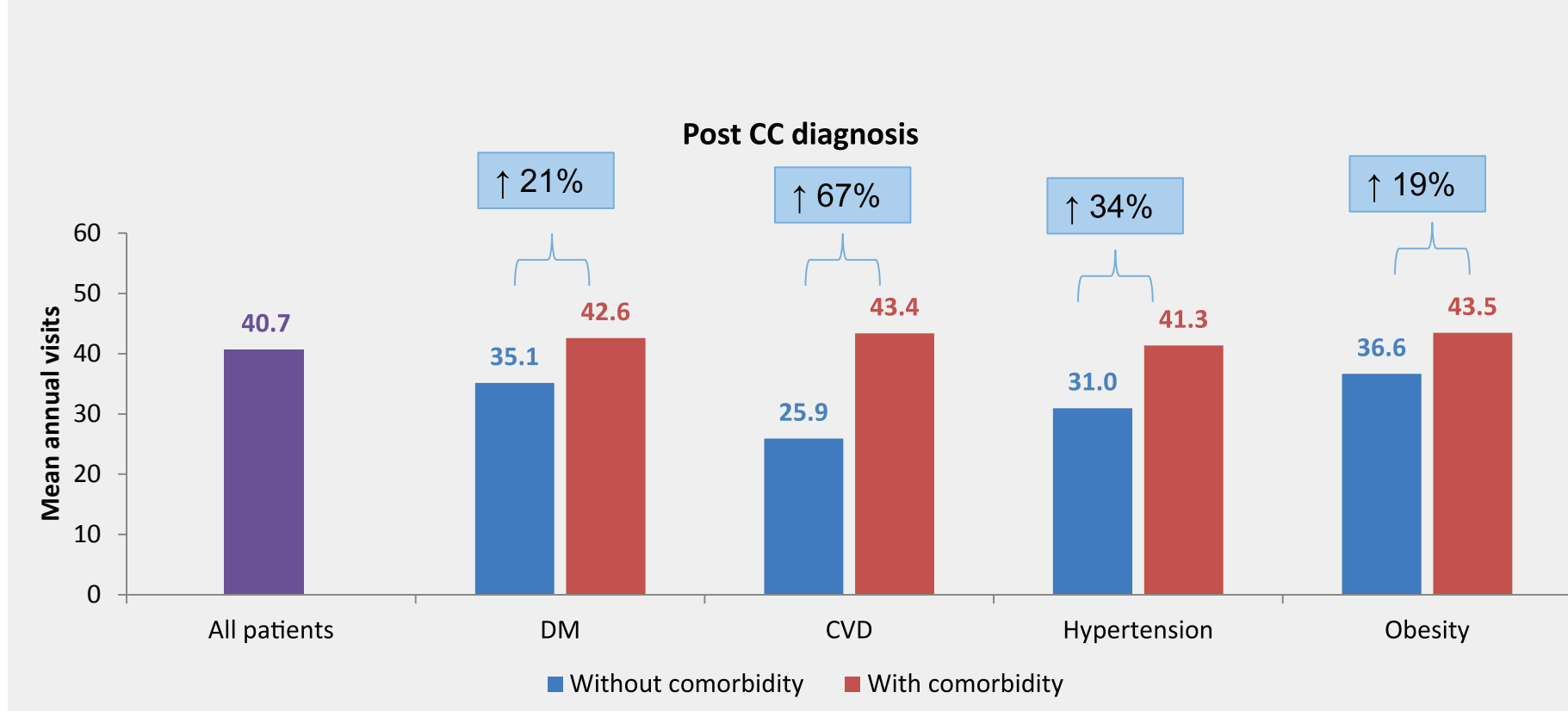
**Figure 3. NAFLD/NASH CC Patient Healthcare Resource Utilization**



P<0.0001 in all pre- and post-diagnosis comparisons  
Note: Physician visits also includes durable medical equipment; outpatient visits also includes Skilled nursing facility, Home health, Hospice

- Annual HCRU significantly increased following CC diagnosis: the number of annual inpatient and physician visits increased leading to a 20% (34.0 vs. 40.7) increase in all visits.

**Figure 4. Total Annual Number of Visits for CC Patients**



P<0.0001 in all with and without comorbidity comparisons  
Total cohort N=3,775; with DM N=2,826; with CVD N=3,187; with hypertension N=3,548; with obesity N=2,240

- Significantly higher annual number of total visits (including inpatient, outpatient, and physician) for NAFLD/NASH CC patients with specific comorbidities: Patients with additional comorbidities of DM, CVD, or hypertension all had higher number of total visits.

**Table 3. Annual Healthcare Resource Utilization for CC Patients**

		All visits	Inpatient visits	Outpatient visits	Physician visits	Pharmacy fills
All patients	Pre CC	33.9	0.5	8.3	25.2	20.3
	Post CC	40.7	0.9	9.3	30.5	21.4
Without DM	Pre CC	28.5	0.4	7.3	20.8	14.9
	Post CC	35.1	0.8	8.0	26.3	15.8
With DM	Pre CC	35.8	0.5	8.6	26.6	22.0
	Post CC	42.6	1.0	9.7	31.9	23.2
Without CVD	Pre CC	23.9	0.1	6.4	17.4	14.6
	Post CC	25.9	0.4	7.2	18.3	15.8
With CVD	Pre CC	35.8	0.5	8.7	26.6	21.3
	Post CC	43.4	1.0	9.7	32.7	22.4

Total cohort N=3,775; with DM N=2,826; with CVD N=3,187  
Note: Physician visits also includes durable medical equipment; outpatient visits also includes Skilled nursing facility, Home health, Hospice

- Total annual HCRU was higher post-CC diagnosis compared to pre-CC diagnosis for all patients. All visits post-CC diagnosis were higher for all patients by 20%, higher for without DM patients by 23%, higher for with DM patients by 19%, higher for without CVD patients by 8%, and higher for with CVD patients by 21%.

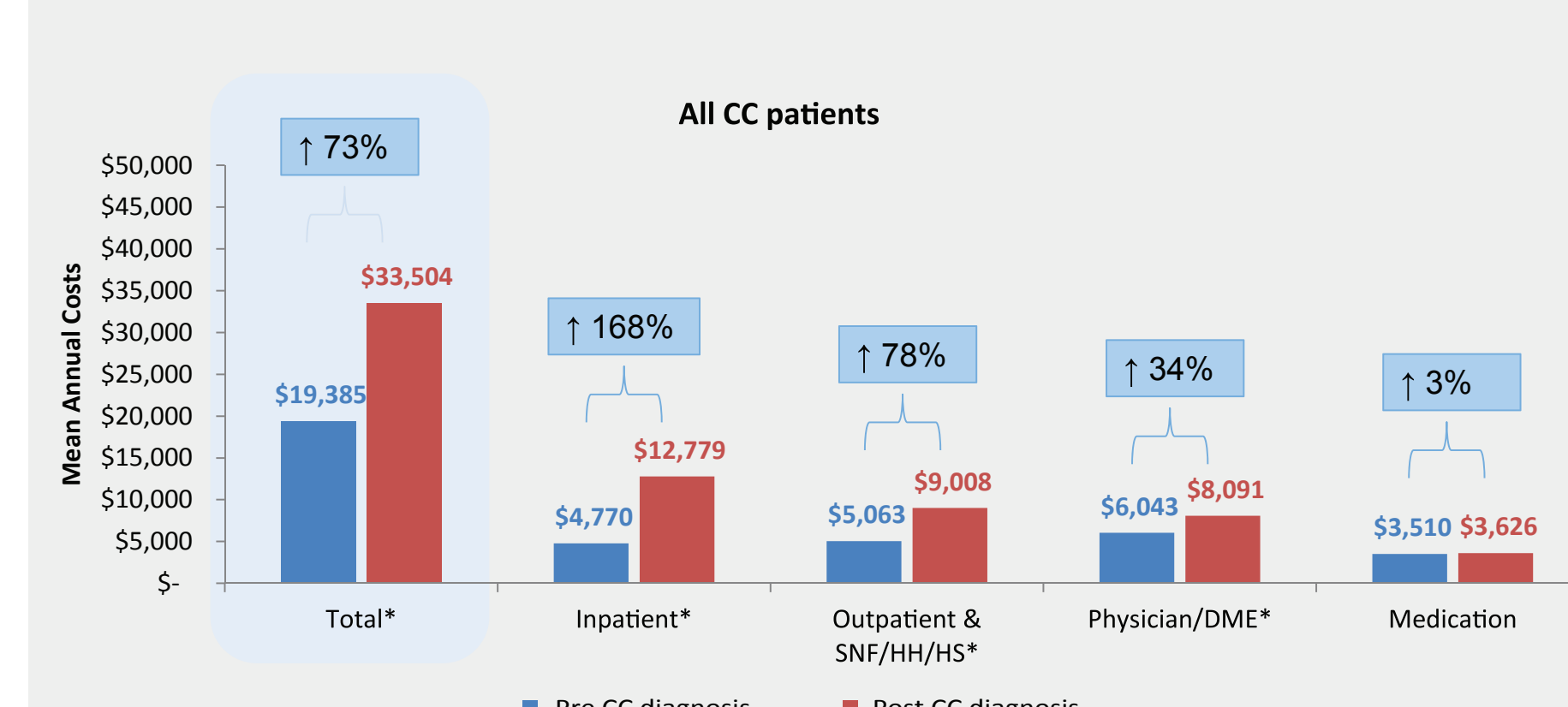
**Table 4. Annual Healthcare Costs for CC Patients**

		All visits	Inpatient visits	Outpatient visits	Physician visits	Pharmacy fills
All patients	Pre CC	\$ 19,385	\$ 4,770	\$ 5,063	\$ 6,043	\$ 3,510
	Post CC	\$ 33,504	\$ 12,779	\$ 9,008	\$ 8,091	\$ 3,626
Without DM	Pre CC	\$ 15,633	\$ 4,033	\$ 4,120	\$ 5,334	\$ 2,145
	Post CC	\$ 27,953	\$ 10,977	\$ 7,637	\$ 7,022	\$ 2,317
With DM	Pre CC	\$ 20,646	\$ 5,017	\$ 5,379	\$ 6,281	\$ 3,969
	Post CC	\$ 35,359	\$ 13,382	\$ 9,466	\$ 8,448	\$ 4,063
Without CVD	Pre CC	\$ 9,892	\$ 1,256	\$ 2,628	\$ 3,585	\$ 2,423
	Post CC	\$ 17,086	\$ 4,446	\$ 5,401	\$ 4,609	\$ 2,631
With CVD	Pre CC	\$ 21,137	\$ 5,418	\$ 5,512	\$ 6,496	\$ 3,711
	Post CC	\$ 36,460	\$ 14,280	\$ 9,657	\$ 8,718	\$ 3,805

Total cohort N=3,775; with DM N=2,826; with CVD N=3,187  
Note: Physician visits also includes durable medical equipment; outpatient visits also includes Skilled nursing facility, Home health, Hospice

- Total annual healthcare costs were higher post-CC diagnosis compared to pre-CC diagnosis for all patients. Total costs post-CC diagnosis were higher for all patients by 73%, higher for without DM patients by 79%, higher for with DM patients by 71%, higher for without CVD patients by 73%, and higher for with CVD patients by 72%.

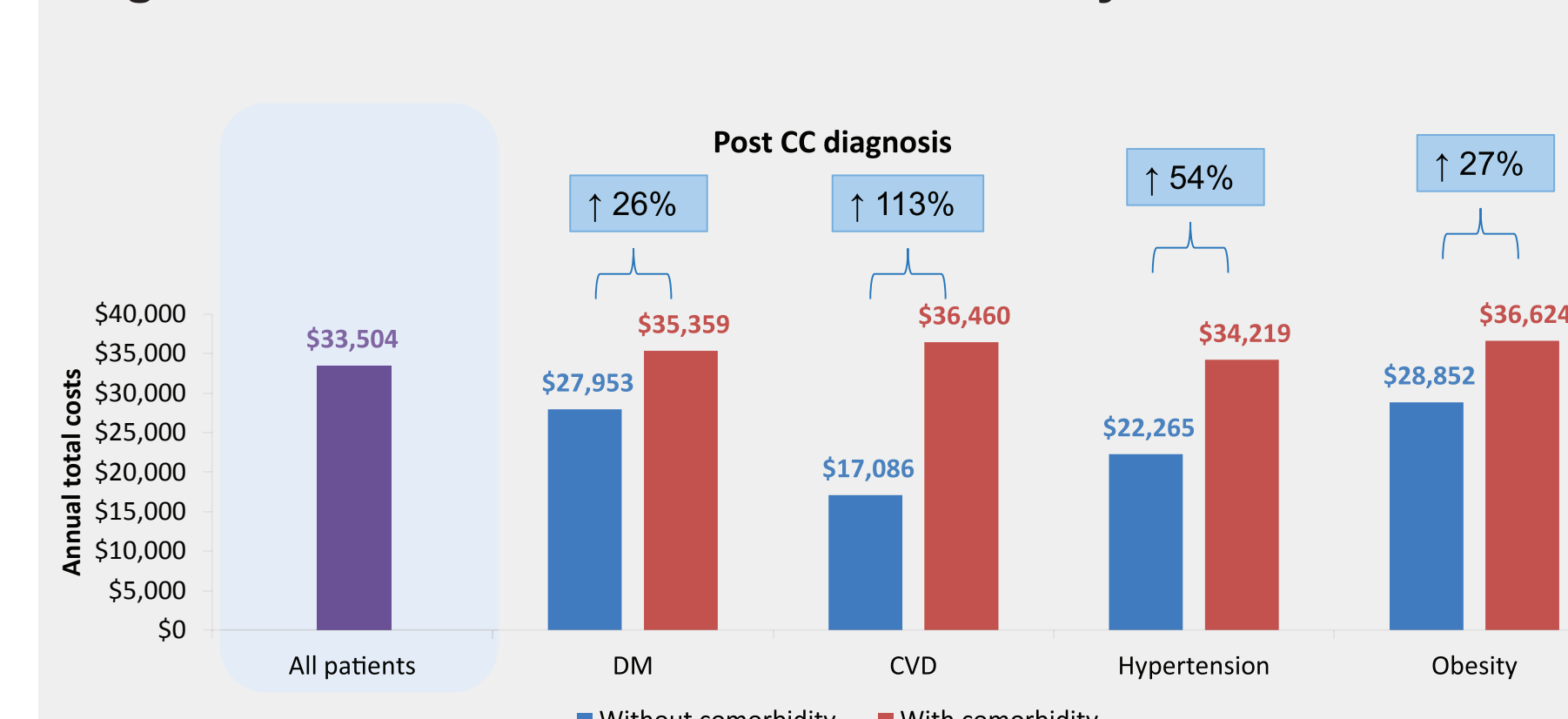
**Figure 5. Annual Total Healthcare Costs for CC Patients**



\*P<0.0001 in pre- and post-diagnosis comparisons  
DME, durable medical equipment; SNF, skilled nursing facility; HH, home health; and HS, hospice

- Total annual total healthcare costs for NAFLD/NASH patients significantly increased by 73% (\$19,385 vs. \$33,504) following CC diagnosis, primarily driven by higher inpatient (168%) and outpatient (78%) costs.

**Figure 6. Annual Total Healthcare Costs by Comorbidities**



P<0.0001 in all with and without comorbidity comparisons  
Total cohort N=3,775; with DM N=2,826; with CVD N=3,187; with hypertension N=3,548; with obesity N=2,240

- Total annual total healthcare costs for NAFLD/NASH CC patients with additional comorbidities were significantly higher: DM, CVD, and hypertension patients all had higher annual healthcare costs (26% to 113%).

## CONCLUSIONS

- This study of Medicare NAFLD/NASH CC patients found:
  - Along with NAFLD/NASH and advanced liver disease, these patients have a high prevalence of DM (75%) and additional comorbidities, such as CVD (84%), hypertension (94%), and hyperlipidemia (92%).
  - These patients experienced a significant increase in annual HCRU following CC diagnosis (20%) and utilization was significantly higher for patients with additional comorbid conditions such as DM (21%) and CVD (67%) compared to patients without these additional conditions.
  - NAFLD/NASH patients' annual healthcare costs significantly increased by over 70% following CC diagnosis, and were significantly higher for CC patients with additional comorbid conditions such as DM (26%), CVD (113%), and hypertension (54%) compared to patients without these conditions.
  - Early identification and effective treatment of NASH/NAFLD CC patients is needed to reduce the risk of disease progression and higher associated HCRU and costs.

## REFERENCES

- Luis Calzadilla Bertot and Leon Anton Adams. The Natural Course of Non-Alcoholic Fatty Liver Disease. Int J Mol Sci 2016 May 17(5):774

## LIMITATIONS

- Results are limited to the US Medicare population with CC.
- Results by DM are not adjusted for controlled variables.
- As with any claims databases, these data were subject to data coding limitations, data entry error, and misclassification of NAFLD/NASH.

## DISCLOSURES

- Study funded by Gilead Sciences, Inc