Supplemental Table 1. Utilization and Spending variable algorithms

| **Characteristic** | **Definition** | **Utilization** | **Spending** | **Rationale for Medicaid alignment** |
| --- | --- | --- | --- | --- |
| Emergency department visits | Revenue code 0981 or 045\* | Number of distinct all-cause ED visits per person | N/A | ED visits can be identified in Medicaid Professional files with CPT codes (i.e., 99281-99288) and revenue codes; to align with standard Medicare practice we used revenue codes only.  |
|  ED visit with admit | Revenue code 0981 or 045\* plus the following:Medicare: Revenue code 0981 or 045\* on inpatient claimMedicaid: At least one of the following:* Patient status code: admitted to inpatient hospital, transferred to a DRG hospital, transferred to a cancer center/children’s hospital, discharged to a federal hospital, or discharged to a critical access hospital
* Inpatient admission with a start date equal to the ED visit end date
 | Number of distinct all-cause ED visits with admission per person | N/A | ED visits with or without admission were identified in Medicare claims by claim source: inpatient (IP) or outpatient (OP) files. The state Medicaid data does not have that preprocessing, thus we defined ED visit with admission using patient status codes and inpatient admission claims for that day; without admission was defined as all remaining ED visits. |
|  ED visit without admit | Medicare: Revenue code 0981 or 045\* on outpatient claimMedicaid: Revenue code 0981 or 045\* but does not meet the criteria for ED visit with admit. | Number of distinct all-cause ED visits with admission per person | N/A |
| Inpatient settings | Medicare: Any inpatient claim (Inpatient files)Medicaid (must meet all requirements):* Institutional claim
* Valid revenue code
* At least one of the following: place of service code in (21, 51, 56, 61); Valid DRG code; revenue code 100-219
* Place of service is not (31, 32, 54) and billing provider taxonomy is not 314000000X (nursing facility)
 | Total count of days January 1, 2014 – December 31, 2017 calculated using the service start and end dates (inclusive) and summing across all hospitalizations in the period. | Medicare: sum PMT\_AMT + (PER\_DIEM\*UTIL\_DAY) in the IP filesMedicaid: sum TTL\_LNE\_NET\_AMT from qualifying claim lines | We used a prior definition of inpatient admissions1 and assessed concordance with Medicare findings. IP claims were defined in the Institutional data file using revenue, place of service, and DRG codes based on DRG and revenue codes commonly associated with inpatient stays or places of service congruent with Medicare inpatient stays (e.g., inpatient hospital). We excluded places of service that we did not expect to be covered and/or defined as inpatient hospitalization by Medicare (e.g., SNF) and claims where the billing provider taxonomy was a nursing facility. |
| Hospital admissions | Inpatient setting claims, identified above, excluding claims where the discharge status is ‘still a patient’ | Number of distinct all-cause hospital admissions per person | N/A |
| Skilled nursing facilities - Medicare only | Medicare: use all claims in the SNF filesMedicaid: N/A | Total count of days between January 1, 2014 – December 31, 2017 calculated using the service start and end dates (inclusive) and summing across all SNF stays in the period.  | Medicare: PMT\_AMT in SNF filesMedicaid: N/A | For SNF days, Medicaid, unlike Medicare, also covers long-term nursing care, as well as intermediate care facilities (ICF) for the developmentally disabled. Per NC DHHS, all services provided in nursing facilities are identified by one billing provider taxonomy code, which precluded us from distinguishing between post-acute SNF and residential nursing home services in the Medicaid claims. Therefore, we could not create a Medicaid utilization outcome comparable to Medicare SNF. We created two separate categories for Medicaid services - SNF/nursing home and intermediate care facility use - based on the billing provider taxonomy and place of service codes. |
| Post-acute/longer term care – Medicaid only | Medicare: N/AMedicaid: Combination of SNF/Nursing home and Intermediate Care Facility service days | Total count of days calculated by summing the following two categories | Medicare: N/AMedicaid: Sum the following SNF/nursing home and intermediate care facility categories  |
|  SNF/Nursing homes – Medicaid only | Medicare: N/AMedicaid: Institutional claims with billing provider taxonomy code = 314000000X (skilled nursing facility) or place of service codes skilled nursing facility or nursing facility | Total count of days between January 1, 2014 – December 31, 2017 calculated using the service start and end dates (inclusive) and summing across all SNF/NH stays in the period. | Medicare: N/AMedicaid: sum TTL\_LNE\_NET\_AMT from qualifying claim lines |
|  Intermediate care facilities – Medicaid only | Medicare: N/AMedicaid: Institutional claims place of service code for Intermediate Care Facility for Individuals with Intellectual Disabilities and billing provider taxonomy code is not 314000000X (skilled nursing facility) | Total count of days between January 1, 2014 – December 31, 2017 calculated using the service start and end dates (inclusive) and summing across all ICF stays in the period. | Medicare: N/AMedicaid: sum TTL\_LNE\_NET\_AMT from qualifying claim lines |
| Long term services and supports (LTSS) – Medicaid only | Medicare: N/AMedicaid: Professional claims that meet all three of the following criteria:* A claim for Personal Care Services (HDR\_TYP\_CD = '6')
* CPT code 99509 (home visit for assistance with activities of daily living and personal care)
* Procedure modifier code HA, HB, HC, HH, HI, HQ, SC, or TT)
 | Total count of days between January 1, 2014 – December 31, 2017 calculated using the service start and end dates (inclusive) and summing across all SNF/NH stays in the period. | Medicare: N/AMedicaid: sum TTL\_LNE\_NET\_AMT from qualifying claim linesThis value is a subset of the Carrier costs. | Long-term services and supports (LTSS) are covered by Medicaid only, and identified based on a combination of claim type, CPT, and procedure modifier codes. |
| Behavioral health services | Search all claims for the following: * Psychiatric diagnostic evaluation: CPT codes 90791, 90792
* Psychotherapy: CPT codes 90832-90834, 90836-90840, 90846, 90847, 90849, 90853
* Evaluation and management (E&M) services with a psychologist or psychiatrist: CPT codes 99201-99205, 99211-99215, 99217-99223, 99231-99233, 99241-99245, 99251-99255, 99281-99288, 99304-99310, 99315-99316, 99318, 99324-99328, 99334-99337, 99341-99345, 99347-99350, 99366, 99401-9404, 99406-99409, 99411-99412 -and- psychology or psychiatrist taxonomy on the claim (beginning with 2084 or 103T)
* Neurostimulation services: CPT codes 90867-90870
* Psychiatric emergency department visit: Revenue code 0981 or 045\* -and- at least one behavioral health diagnosis on the claim
* Intensive behavioral health services: CPT codes H0012, H0013, H0017, H0018, H0019, H0046, H2020, S5145, H2036, S9484, H0015, H0035, H2012, H2035, S9480, H2022, H2033, H0010, H0014, H0020, H0040, H2034 -or- state category of service 0021, 0047, 0017, 0041 -or- revenue code 100, 183, 911, 919
* Collaborative care: CPT codes 99492, 99493, 99494
* Waiver services: Enrollment in the waiver program at the time of service –and- at least one of the following CPT codes: 97532, A0090, B4150, B4152-B4155, B4157-B4162, E0700, G9003, G9004, H0045, H2010, H2011, H2015, H2016, H2025, S5102, S5110, S5111, S5125, S5135, S5150, S5161, S5165, S5170, T1004, T1005, T1015, T1016, T1019, T1020, T1999, T2013, T2014, T2020, T2021, T2025, T2027-T2029, T2033, T2034, T2038-T2041, T4535, T4539, T5999,
* Applied behavior analysis: CPT codes 0359T, 0360T, 0361T, 0362T, 0363T, 0364T, 0365T, 0373T, 0374T, 0368T, 0369T, 0366T, 0367T, 0372T, 0370T, 0371T
 | Total number of BH service days are summed per subcategory (e.g., psychotherapy) calculated using the start and end dates (inclusive) and summing across that subcategory and then across all subcategories for the total number of BH service days.  | This value is captured under other settings and not presented separately.  | Behavioral health services were defined based on prior work that used CPT, provider taxonomy, revenue, and category of service codes.2 Not all behavioral health services were expected to be covered by Medicare, such as residential and substance abuse treatment intensive behavioral health services. |
| Home health | Medicare: use all claims in the Medicare home health filesMedicaid:* Institutional claim with at least one of the following: Revenue code 0023, 056\*-060\*; CPT code 99500-99602; claim=HH; type of bill=301-399; or place of service=13 (assisted living)
* AND patient does not have an OP facility visit that day (any of the following):
	+ ED visit: revenue code 450-452, 456, 459 or CPT code 99281-99292, 99466-99476
	+ Outpatient surgery: revenue code 360-362, 367, 369, 481, 490, 499, 790, 799 or CPT code 10021-36410, 36420-58999, 60000-69990, 92920-92944, 93501-93581, 0016T-0261T, 0392T-0393T, 0016U-0023U
	+ Observation: revenue code 760- 762, 769 or CPT code 99217-99220
	+ Ambulance: CPT code A0021-A0999
* Excludes DME claim lines (CPT codes A4206-A4650, A4661-A4926, A4933-A9999, E0100-E8002, K0001-K0902, L0100-L9999)
 | Total count of days where the beneficiary received home health services between January 1, 2014 – December 31, 2017, calculated using the service start and end dates (inclusive) and summing across all home health services in the period. | Medicare: sum PMT\_AMT in home health filesMedicaid: sum TTL\_LNE\_NET\_AMT from qualifying claim lines | For home health in Medicaid, we compared the Institutional claims with claim type=Home Health to a prior definition1 based on revenue codes, CPT codes, and type of bill variables and found poor concordance. We used the prior definition for reproducibility (i.e. CPT codes identifiable in other administrative claims for comparison), modified to include claims indicating place of service as assisted living. The assisted living place of service is unlikely to be found in the Medicare claims. |
| Hospice | Medicare: use all claims in the Medicare hospice filesMedicaid: place of service=’34’ (hospice) | Total count of days where the beneficiary received hospice services between January 1, 2014 – December 31, 2017, calculated using the service start and end dates (inclusive) and summing across all hospice services in the period. | Medicare: sum PMT\_AMT in hospice filesMedicaid: sum TTL\_LNE\_NET\_AMT from qualifying claim lines | In the absence of specific CPT codes or other searchable variables, we identified hospice in Medicaid based on place of service being hospice. |
| Outpatient facility | Medicare: use all claims in the Medicare outpatient filesMedicaid: All Institutional claim lines that are not captured in the preceding outcome and spending categories | N/A | Medicare: sum PMT\_AMT in outpatient filesMedicaid: sum TTL\_LNE\_NET\_AMT from qualifying claim lines | Medicaid outpatient facility was defined as all Institutional claims that were not captured in the other outcome or cost categories |
| Carrier | Medicare: use all claims in the Medicare carrier filesMedicaid: use all claims in the Professional (PR) files | N/A | Medicare: sum PMT\_AMT in carrier filesMedicaid: sum TTL\_NET\_PAY\_AMT in PR files, once per claim | Medicaid carrier was defined as all Medicaid Professional data files. |
| Durable medical equipment (DME) | Medicare: use all claims in the Medicare DME filesMedicaid: CPT code A4206-A4650, A4661-A4926, A4933-A9999, E0100-E8002, K0001-K0902, or L0100-L9999 -and- patient does not have an OP visit that day (see definition under Home Health outcome) | N/A | Medicare: sum PMT\_AMT in DME filesMedicaid: sum TTL\_LNE\_NET\_AMT from qualifying claim lines | For Medicaid DME costs, similar to the home health days algorithm, we compared the Medicaid claim type = DME to a list of previously published CPT codes for DME.1 We found that most of the DME CPT codes were included in the Medicare DME data files, so we used that definition for better alignment. |
| Dental – Medicaid only | Medicare: N/AMedicaid: use all claims in the Dental Medicaid files | N/A | Medicare: N/AMedicaid: sum TTL\_NET\_PAY\_AMT in Dental files, once per claim | Dental services are covered by Medicaid only. |

1Health Care Cost Institute. Multi-Payer Analysis of Health Care Spending in North Carolina; Analytic Methodology. 2020

2Franklin MS, Bush C, Jones KA, et al. Inequities in Receipt of the North Carolina Medicaid Waiver Among Individuals with Intellectual Disability or Autism Spectrum Disorder. *J Dev Behav Pediatr* 2022;43:393-401