**Online Supplement**

**Revisiting the Obesity Paradox in Health Care Expenditures Among Adults With Diabetes**

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**TABLE S1. Unadjusted Expenditures Per Person by Health Care Setting and BMI Category in People With and Without Diabetes**

|  |  |
| --- | --- |
| **BMI Category\*** | **Average Expenditures per Person, $** |
| **Total†** | **Expense1‡** | **Expense2§** | **ER Visits** | **Inpatient Stays** | **OBD Visits** | **OP Visits** |
| **Mean (SE)** | ***P*** | **Mean (SE)** | ***P*** | **Mean (SE)** | ***P*** | **Mean (SE)** | ***P*** | **Mean (SE)** | ***P*** | **Mean (SE)** | ***P*** | **Mean (SE)** | ***P*** |
| *All Respondents including smokers and those with cancer or CVD (ANS sample)* |
| With diabetes | Underweight | 17,908 (1913) | 0.000 | 14,656 (1,834) | 0.000 | 15,611 (1844) | 0.00 | 374 (78) | 0.000 | 8,189 (1,480) | 0.000 | 2,134 (360) | 0.000 | 1,112 (633) | 0.081 |
| Normal | 11,041 (448) | 0.000 | 8,891 (375) | 0.000 | 9,784 (408) | 0.00 | 333 (37) | 0.000 | 3,301 (270) | 0.000 | 2,124 (116) | 0.000 | 841 (121) | 0.000 |
|  Overweight | 10,306 (309) | 0.000 | 8,541 (276) | 0.000 | 9,409 (292) | 0.00 | 300 (20) | 0.000 | 3,000 (192) | 0.000 | 2,258 (110) | 0.000 | 740 (59) | 0.000 |
| Obese | 11,094 (473) | 0.000 | 9,158 (447) | 0.000 | 10,021 (451) | 0.000 | 281 (20) | 0.000 | 2,979 (218) | 0.000 | 2,115 (76) | 0.000 | 682 (42) | 0.000 |
| Severely obese | 12,288 (386) | 0.000 | 10,203 (307) | 0.000 | 11,257 (339) | 0.000 | 337 (20) | 0.000 | 3,000 (188) | 0.000 | 2,454 (108) | 0.000 | 1,013 (102) | 0.000 |
| Without diabetes | Underweight | 4,209 (164) | 0.000 | 3,036 (119) | 0.000 | 3,475 (130) | 0.000 | 191 (14) | 0.000 | 1,152 (83) | 0.000 | 1,027 (51) | 0.000 | 349 (30) | 0.000 |
| Normal | 3,875 (80) | 0.000 | 2,889 (67) | 0.000 | 3,322 (71) | 0.000 | 164 (7) | 0.000 | 993 (43) | 0.000 | 1,029 (21) | 0.000 | 340 (18) | 0.000 |
|  Overweight | 4,054 (78) | 0.000 | 3,115 (67) | 0.000 | 3,576 (73) | 0.000 | 169 (6) | 0.000 | 1,101 (48) | 0.000 | 1,060 (21) | 0.000 | 406 (18) | 0.000 |
| Obese | 4,426 (90) | 0.000 | 3,465 (80) | 0.000 | 3,977 (87) | 0.000 | 201 (8) | 0.000 | ,1168 (51) | 0.000 | 1,170 (29) | 0.000 | 458 (29) | 0.000 |
| Severely obese | 5,203 (144) | 0.000 | 4,103 (118) | 0.000 | 4,711 (135) | 0.000 | 251 (11) | 0.000 | 1,439 (75) | 0.000 | 1,240 (35) | 0.000 | 618 (49) | 0.000 |
| *Excluding smokers and those with cancer or CVD (ADS sample)* |
| With diabetes | Underweight | 9,446 (2,335) | 0.000 | 7,450 (2,175) | 0.001 | 7,837 (2212) | 0.000 | 240 (81) | 0.003 | 3,401 (1619) | 0.037 | 1,017 (181) | 0.000 | 543 (246) | 0.029 |
| Normal | 6,422 (435) | 0.000 | 5,195 (348) | 0.000 | 5,786 (405) | 0.000 | 231 (57) | 0.000 | 712 (181) | 0.000 | 1,424 (156) | 0.000 | 446 (77) | 0.000 |
|  Overweight | 6,245 (276) | 0.000 | 5,223 (245) | 0.000 | 57,55 (269) | 0.000 | 201 (26) | 0.000 | 1,120 (154) | 0.000 | 1,380 (88) | 0.000 | 514 (97) | 0.000 |
| Obese | 7,428 (608) | 0.000 | 6,221 (595) | 0.000 | 6,817 (602) | 0.000 | 189 (22) | 0.000 | 607 (190) | 0.000 | 1,502 (80) | 0.000 | 480 (52) | 0.000 |
| Severely obese | 8,544 (337) | 0.000 | 7,122 (314) | 0.000 | 7,888 (332) | 0.000 | 253 (25) | 0.000 | 1,280 (192) | 0.000 | 1,830 (125) | 0.000 | 900 (188) | 0.000 |
| Without diabetes | Underweight | 2,847 (159) | 0.000 | 1,994 (132) | 0.000 | 2,308 (139) | 0.000 | 133 (15) | 0.000 | 632 (101) | 0.000 | 730 (41) | 0.000 | 227 (29) | 0.000 |
| Normal | 2,703 (73) | 0.000 | 1,957 (66) | 0.000 | 2,288 (71) | 0.000 | 113 (5) | 0.000 | 1,457 (34) | 0.000 | 765 (15) | 0.000 | 249 (20) | 0.000 |
|  Overweight | 2,798 (58) | 0.000 | 2,053 (48) | 0.000 | 2,406 (54) | 0.000 | 129 (6) | 0.000 | 712 (33) | 0.000 | 780 (19) | 0.000 | 294 (19) | 0.000 |
| Obese | 3,067 (76) | 0.000 | 2,319 (65) | 0.000 | 2,705 (72) | 0.000 | 154 (8) | 0.000 | 1,699 (41) | 0.000 | 861 (24) | 0.000 | 309 (17) | 0.000 |
| Severely obese | 3,770 (116) | 0.000 | 2,958 (103) | 0.000 | 3,398 (111) | 0.000 | 197 (12) | 0.000 | 960 (65) | 0.000 | 962 (31) | 0.000 | 459 (47) | 0.000 |

\*BMI <20 kg/m2 = underweight, 20 to <25 kg/m2 = normal weight, 25 to <30 kg/m2 = overweight, 30 to <35 kg/m2 = obese, and ≥35 kg/m2 = severely obese. †Includes expenditures for all health services, including dental, other medical, home health, and so forth. ‡Includes expenditures for inpatient stays, ER visits, office-based physician visits, outpatient department physician visits, and prescription medicine. §Includes expenditures for inpatient stays, ER visits, prescription medicine, and all office-based (OBD) and outpatient department (OP) visits.

 **TABLE S2. Differences in Unadjusted Expenditures per Person in the Analytical Sample (ANS)**

|  |  |
| --- | --- |
| BMI Category\* | **Differences in Average Expenditures per Person, $** |
| **Total†** | **Expense1‡** | **Expense2§** | **ER Visits** | **Inpatient Stays** | **OBD Visits** | **OP Visits** |
| **Mean (SE)** | ***P*** | **Mean (SE)** | ***P*** | **Mean (SE)** | ***P*** | **Mean (SE)** | ***P*** | **Mean (SE)** | ***P*** | **Mean (SE)** | ***P*** | **Mean (SE)** | ***P*** |
| *Between respective BMI category and normal-weight group* |
| With diabetes | Underweight | 6,867 (1903) | 0.000 | 5,765 (1823) | 0.002 | 5,827 (1,819) | 0.002 | 42 (84) | 0.622 | 4,888 (1,487) | 0.001 | 10 (379) | 0.979 | 272 (667) | 0.684 |
|  Overweight | −735 (523) | 0.161 | −350 (432) | 0.419 | −375 (479) | 0.434 | −33 (43) | 0.444 | −301 (340) | 0.377 | 134 (152) | 0.379 | −100 (129) | 0.439 |
| Obese | 53 (589) | 0.928 | 267 (521) | 0.609 | 237 (550) | 0.667 | −51 (43) | 0.238 | −322 (286) | 0.262 | −9 (130) | 0.943 | −158 (120) | 0.190 |
| Severely obese | 1,248 (592) | 0.036 | 1,312 (472) | 0.006 | 1,473 (510) | 0.004 | 5 (43) | 0.913 | −301 (331) | 0.364 | 330 (156) | 0.036 | 172 (159) | 0.282 |
| Without diabetes | Underweight | 334 (170) | 0.051 | 147 (130) | 0.260 | 153 (141) | 0.281 | 27 (15) | 0.067 | 159 (88) | 0.071 | −3 (51) | 0.957 | 9 (37) | 0.807 |
|  Overweight | 180 (106) | 0.091 | 226 (88) | 0.011 | 254 (93) | 0.007 | 5 (9) | 0.546 | 108 (62) | 0.083 | 31 (25) | 0.223 | 66 (23) | 0.006 |
| Obese | 552 (117) | 0.000 | 576 (102) | 0.000 | 655 (108) | 0.000 | 38 (10) | 0.000 | 176 (68) | 0.010 | 141 (31) | 0.000 | 118 (32) | 0.000 |
| Severely obese | 1,328 (161) | 0.000 | 1,214 (141) | 0.000 | 1,389 (155) | 0.000 | 87 (12) | 0.000 | 447 (92) | 0.000 | 210 (40) | 0.000 | 278 (48) | 0.000 |
| *Between people with and without diabetes* |
|  | Underweight | 13,700 (1,923) | 0.000 | 11,620 (1,845) | 0.000 | 12,136 (1,858) | 0.000 | 184 (78) | 0.020 | 7,037 (1,486) | 0.000 | 1,107 (371) | 0.003 | 763 (634) | 0.230 |
| Normal | 7,166 (447) | 0.000 | 6,002 (382) | 0.000 | 6,462 (414) | 0.000 | 169 (37) | 0.000 | 2,309 (279) | 0.000 | 1,094 (117) | 0.000 | 501 (121) | 0.000 |
|  Overweight | 6,252 (299) | 0.000 | 5,426 (270) | 0.000 | 5,833 (283) | 0.000 | 131 (20) | 0.000 | 1,899 (187) | 0.000 | 1,198 (109) | 0.000 | 335 (60) | 0.000 |
| Obese | 6,668 (472) | 0.000 | 5,692 (450) | 0.000 | 6,044 (451) | 0.000 | 80 (21) | 0.000 | 1,811 (220) | 0.000 | 944 (80) | 0.000 | 224 (48) | 0.000 |
| Severely obese | 7,086 (423) | 0.000 | 6,100 (338) | 0.000 | 6,545 (375) | 0.000 | 86 (21) | 0.000 | 1,561 (209) | 0.000 | 1,214 (114) | 0.000 | 394 (110) | 0.000 |
| *Between people with and without diabetes, less normal*‖ |
|  | Underweight | 6,534 (1,906) | 0.001 | 5,619 (1,834) | 0.003 | 5,674 (1,830) | 0.002 | 15 (85) | 0.863 | 4,728 (1,491) | 0.002 | 13 (385) | 0.973 | 262 (667) | 0.695 |
|  Overweight | −915 (509) | 0.074 | −576 (429) | 0.181 | −629 (471) | 0.183 | −89 (44) | 0.388 | −409 (342) | 0.232 | 103 (151) | 0.495 | −166 (130) | 0.204 |
| Obese | −498 (598) | 0.406 | −309 (535) | 0.563 | −418 (563) | 0.459 | −83 (44) | 0.043 | −498 (299) | 0.097 | −150 (134) | 0.264 | −277 (126) | 0.030 |
| Severely obese | −80 (613) | 0.896 | 98 (501) | 0.845 | 84 (543) | 0.878 | −51 (43) | 0.054 | −748 (356) | 0.037 | 119 (163) | 0.465 | −106 (168) | 0.527 |

\*BMI <20 kg/m2 = underweight, 20 to <25 kg/m2 = normal weight, 25 to <30 kg/m2 = overweight, 30 to <35 kg/m2 = obese, and ≥35 kg/m2 = severely obese. †Includes expenditures for all health services, including dental, other medical, home health, and so forth. ‡Includes expenditures for inpatient stays, ER visits, office-based physician visits, outpatient department physician visits, and prescription medicine. §Includes expenditures for inpatient stays, ER visits, prescription medicine, and all office-based (OBD) and outpatient department (OP) visits.‖Estimate of people in respective BMI category minus estimate for people in normal-weight group.

**TABLE S3. Differences in Unadjusted Expenditures per Person in the Sample Excluding Smokers and those with Cancer or CVD (ADS)**

|  |  |
| --- | --- |
| **BMI Category\*** | **Differences in Average Expenditures per Person, $** |
| **Total†** | **Expense1‡** | **Expense2§** | **ER Visits** | **Inpatient Stays** | **OBD Visits** | **OP Visits** |
| **Mean (SE)** | ***P*** | **Mean (SE)** | ***P*** | **Mean (SE)** | ***P*** | **Mean (SE)** | ***P*** | **Mean (SE)** | ***P*** | **Mean (SE)** | ***P*** | **Mean (SE)** | ***P*** |
| *Between respective BMI category and normal-weight group* |
| With diabetes | Underweight | 3,024 (2,265) | 0.183 | 2,256 (2,130) | 0.291 | 2,051 (2,130) | 0.337 | 9 (98) | 0.930 | 2,281 (1,580) | 0.150 | −408 (215) | 0.059 | 96 (262) | 0.714 |
|  Overweight | −178 (463) | 0.701 | 29 (390) | 0.941 | −31 (433) | 0.943 | −31 (63) | 0.624 | 160 (234) | 0.495 | −45 (149) | 0.765 | 68 (123) | 0.583 |
| Obese | 1,006 (762) | 0.188 | 1,027 (711) | 0.150 | 1,032 (743) | 0.167 | −42 (61) | 0.489 | 337 (260) | 0.196 | 78 (148) | 0.600 | 34 (93) | 0.716 |
| Severely obese | 2,122 (537) | 0.000 | 1,928 (449) | 0.000 | 2103 (511) | 0.000 | 21 (63) | 0.737 | 579 (269) | 0.032 | 405 (192) | 0.036 | 454 (204) | 0.027 |
| Without diabetes | Underweight | 143 (176) | 0.416 | 37 (152) | 0.808 | 19 (159) | 0.903 | 20 (16) | 0.212 | 105 (109) | 0.332 | −35 (42) | 0.407 | −22 (35) | 0.527 |
|  Overweight | 95 (88) | 0.279 | 96 (79) | 0.225 | 117 (84) | 0.164 | 16 (8) | 0.040 | 26 (46) | 0.580 | 15 (21) | 0.490 | 45 (26) | 0.083 |
| Obese | 364 (101) | 0.000 | 362 (91) | 0.000 | 417 (97) | 0.000 | 41 (10) | 0.000 | 105 (53) | 0.048 | 96 (25) | 0.000 | 60 (23) | 0.010 |
| Severely obese | 1,067 (138) | 0.000 | 1,001 (125) | 0.000 | 1,109 (134) | 0.000 | 85 (11) | 0.000 | 354 (78) | 0.000 | 197 (34) | 0.000 | 209 (49) | 0.000 |
| *Between people with and without diabetes* |
|  | Underweight | 6,599 (2,320) | 0.005 | 5,456 (2,172) | 0.013 | 5,529 (2,210) | 0.013 | 107 (82) | 0.192 | 2,688 (1,618) | 0.098 | 287 (188) | 0.129 | 316 (248) | 0.205 |
| Normal | 3,719 (448) | 0.000 | 3,237 (357) | 0.000 | 3,497 (415) | 0.000 | 119 (57) | 0.039 | 513 (182) | 0.005 | 659 (157) | 0.000 | 197 (79) | 0.013 |
|  Overweight | 3,446 (285) | 0.000 | 3,170 (257) | 0.000 | 3,349 (278) | 0.000 | 71 (27) | 0.010 | 648 (158) | 0.000 | 600 (90) | 0.000 | 220 (98) | 0.026 |
| Obese | 4,361 (608) | 0.000 | 3,903 (598) | 0.000 | 4,112 (604) | 0.000 | 35 (25) | 0.155 | 745 (199) | 0.000 | 641 (83) | 0.000 | 171 (52) | 0.001 |
| Severely obese | 4,774 (364) | 0.000 | 4,164 (338) | 0.000 | 4,490 (359) | 0.000 | 55 (27) | 0.046 | 739 (201) | 0.000 | 868 (127) | 0.000 | 441 (193) | 0.023 |
| *Between people with and without diabetes, less normal*‖ |
|  | Underweight | 2,880 (2,245) | 0.201 | 2,219 (2126) | 0.298 | 2,031 (2,125) | 0.340 | −11 (99) | 0.909 | 2,175 (,1578) | 0.170 | −373 (223) | 0.096 | 119 (265) | 0.654 |
|  Overweight | −273 (465) | 0.558 | −67 (391) | 0.864 | −148 (432) | 0.732 | −47 (64) | 0.461 | 134 (235) | 0.569 | −59 (149) | 0.690 | 23 (125) | 0.853 |
| Obese | 642 (765) | 0.403 | 665 (715) | 0.354 | 615 (746) | 0.411 | −83 (61) | 0.177 | 232 (268) | 0.388 | −19 (148) | 0.900 | −26 (95) | 0.786 |
| Severely obese | 1,055 (560) | 0.061 | 927 (469) | 0.049 | 993 (534) | 0.064 | −63 (63) | 0.317 | 226 (275) | 0.413 | 208 (197) | 0.291 | 244 (207) | 0.240 |

\*BMI <20 kg/m2 = underweight, 20 to <25 kg/m2 = normal weight, 25 to <30 kg/m2 = overweight, 30 to <35 kg/m2 = obese, and ≥35 kg/m2 = severely obese. †Includes expenditures for all health services including dental, other medical, home health, and so forth. ‡Includes expenditures for inpatient stays, ER visits, office-based physician visits, outpatient department physician visits, and prescription medicine. §Includes expenditures for inpatient stays, ER visits, prescription medicine, an and all office-based (OBD) and outpatient department (OP) visits. ‖Estimate of persons in respective BMI category minus estimate for persons in normal weight group.

**TABLE S4**. **Results of Joint Tests and Two-Way Interactions of Adjusted Expenditures per Person by Health Care Setting and BMI Category in People With and Without Diabetes**

|  |  |
| --- | --- |
| **BMI Category\*** | **Joint Test of Differences in Average Expenditures per Person With Normal BMI Vs. Other BMI** |
| **Total†** | **Expense1‡** | **Expense2§** | **ER Visits** | **Inpatient Stays** | **OBD Visits** | **OP Visits** |
| **df** | ***F*** | ***P*** | **df** | ***F*** | ***P*** | **df** | ***F*** | ***P*** | **df** | ***F*** | ***P*** | **df** | ***F*** | ***P*** | **df** | ***F*** | ***P*** | **df** | ***F*** | ***P*** |
| *All respondents including smokers and those with cancer or CVD (ANS sample)* |
| With diabetes | 4 | 5.29 | 0.0005 | 4 | 5.14 | 0.0006 | 4 | 4.64 | 0.0013 | 4 | 0.89 | 0.4729 | 4 | 2.52 | 0.0425 | 4 | 1.69 | 0.1539 | 4 | 2.04 | 0.0902 |
| Without diabetes | 4 | 7.71 | 0 | 4 | 7.51 | 0 | 4 | 9.37 | 0 | 4 | 5.13 | 0.0006 | 4 | 2.55 | 0.0401 | 4 | 7.05 | 0 | 4 | 8.15 | 0 |
| Joint | 5 | 50.2 | 0 | 5 | 52.46 | 0 | 5 | 50.68 | 0 | 5 | 3.99 | 0.0018 | 5 | 8.45 | 0 | 5 | 20.19 | 0 | 5 | 3.99 | 0.0018 |
| *Test of two-way interactions between diabetes status and BMI categories* |
| Joint | 4 | 1.9 | 0.1117 | 4 | 1.72 | 0.1463 | 4 | 1.51 | 0.2011 | 4 | 2.49 | 0.0442 | 4 | 2.7 | 0.0319 | 4 | 0.93 | 0.4472 | 4 | 1.87 | 0.1164 |
| *Respondents with diabetes excluding smokers and those with cancer or CVD (ADS sample)* |
| With diabetes | 4 | 4.04 | 0.0036 | 4 | 4.12 | 0.0031 | 4 | 3.73 | 0.006 | 4 | 0.73 | 0.5748 | 4 | 1.12 | 0.3479 | 4 | 6.68 | 0 | 4 | 1.1 | 0.3555 |
| Without Diabetes | 4 | 5.52 | 0.0003 | 4 | 6.12 | 0.0001 | 4 | 6.78 | 0 | 4 | 6.95 | 0 | 4 | 2.58 | 0.0383 | 4 | 5.33 | 0.0004 | 4 | 5.12 | 0.0006 |
| Joint | 5 | 31.26 | 0 | 5 | 31.87 | 0 | 5 | 31.28 | 0 | 5 | 4.59 | 0.0005 | 5 | 3.13 | 0.0097 | 5 | 10.54 | 0 | 5 | 2.11 | 0.066 |
| *Test of two-way interactions between diabetes status and BMI categories* |
| Joint | 4 | 1.73 | 0.1456 | 4 | 1.7 | 0.1517 | 4 | 1.42 | 0.2274 | 4 | 1.31 | 0.2672 | 4 | 0.52 | 0.7245 | 4 | 3.76 | 0.0057 | 4 | 0.63 | 0.6393 |

\*BMI <20 kg/m2 = underweight, 20 to <25 kg/m2 = normal weight, 25 to <30 kg/m2 = overweight, 30 to <35 kg/m2 = obese, and ≥35 kg/m2 = severely obese. †Includes expenditures for all health services, including dental, other medical, home health, and so forth. ‡Includes expenditures for inpatient stays, ER visits, office-based physician visits, outpatient department physician visits, and prescription medicine. §Includes expenditures for inpatient stays, ER visits, prescription medicine, and all office-based (OBD) and outpatient department (OP) visits.

**Figure S1.** Adjusted Average Expenditures per Person by BMI Category and Diabetes Status for Both Samples 