Economic Burden and Healthcare Resource Use of Alopecia Areata in an Insured Population in the USA

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**SUPPLEMENTARY MATERIAL**

**Economic Burden of Alopecia Areata in the United States**

**Table S1**  Pharmacy expenditure and the proportion of patients using medication in each category: by drug category

| Related spending, mean, $ | Patients using medication, n (%) |
|--------------------------|----------------------------------|
|                          | AA cases | Matched controls | Difference | % of total difference | AA cases | Matched controls |
| **Total pharmacy costs** | 3287     | 1844             | 1443       |                       |          |                 |
| Immunosuppressive agents | 1044     | 419              | 625        | 43.3                  | 813 (5.7) | 847 (2.0)       |
| Dermatological agents   | 233      | 48               | 185        | 12.8                  | 7746 (54.0) | 6726 (15.6) |
| Antiviral agents        | 156      | 45               | 111        | 7.7                   | 1700 (11.9) | 4541 (10.6) |
| Immunoglobulins         | 98       | 26               | 72         | 5.0                   | 39 (0.3)   | 90 (0.2)        |
| HER2 inhibitors         | 79       | 38               | 41         | 2.8                   | 8 (0.06)   | 20 (0.05)       |
| Miscellaneous           | 41       | 1                | 40         | 2.7                   | 86 (0.6)   | 207 (0.5)       |
| Immunostimulants        | 111      | 86               | 25         | 1.8                   | 1379 (9.6) | 3626 (8.4)     |
| Sex hormones            | 101      | 74               | 27         | 1.9                   | 2440 (17.0) | 6550 (15.2) |
| Multikinase inhibitors  | 48       | 15               | 33         | 2.3                   | 6 (0.04)   | 10 (0.02)       |
| Growth hormones         | 36       | 3                | 33         | 2.3                   | 8 (0.06)   | 4 (0.01)        |
| Adrenal cortical steroids | 35   | 14               | 21         | 1.5                   | 7767 (54.2) | 11,061 (25.7) |
| Other                   | 1305     | 1076             | 229        | 15.9                  | —         | —               |

*AA* alopecia areata, *HER2* human epidermal growth factor receptor 2

AA cases, *N* = 14,340; matched controls, *N* = 42,998
Table S2  
Pharmacy expenditure and the proportion of patients using medication in each category: within the top four categories

| Related spending, mean, $ | Patients using medication, n (%) |
|----------------------------|----------------------------------|
|                            | AA cases | Matched controls | Difference | % of total difference | AA cases | Matched controls |
| **Total pharmacy costs**   | 3287     | 1844             | 1443       |                      |         |                 |
| Immunosuppressive agents   | 1044     | 419              | 625        | 43.3                 | —        | —                |
| TNF-α inhibitors           | 523      | 234              | 289        | 20.0                 | 174 (1.2)| 249 (0.6)       |
| Interleukin inhibitors     | 148      | 50               | 98         | 6.8                  | 66 (0.5) | 62 (0.1)        |
| Selective immunosuppressants | 342    | 118              | 224        | 15.5                 | 714 (5.0)| 774 (1.8)       |
| Other                      | 31       | 17               | 14         | 1.0                  | —        | —                |
| **Dermatologic agents**    |          |                  |            |                      |         |                 |
| Topical corticosteroids    | 109      | 11               | 98         | 6.8                  | 5870 (40.9)| 2962 (6.9)    |
| Topical acne agents        | 38       | 10               | 28         | 1.9                  | 1263 (8.8)| 1095 (2.5)    |
| Miscellaneous topical agents | 19    | 2                | 17         | 1.2                  | 510 (3.6)| 157 (0.4)      |
| Other                      | 67       | 25               | 42         | 2.9                  | —        | —                |
| **Antiviral agents**       |          |                  |            |                      |         |                 |
| Antiviral combinations     | 127      | 29               | 98         | 6.7                  | 73 (0.5) | 55 (0.1)        |
| Protease inhibitors        | 6        | 1                | 5          | 0.3                  | 4 (0.03) | 3 (0.01)        |
| Purine nucleosides         | 6        | 4                | 2          | 0.1                  | 952 (6.6)| 1982 (4.6)     |
| Other                      | 17       | 10               | 7          | 0.5                  | —        | —                |
| **Immunoglobulins**        |          |                  |            |                      |         |                 |
| Immunoglobulin IV and SC   | 79       | 38               | 41         | 3.3                  | 14 (0.10)| 7 (0.02)        |
| Immunoglobulin IV          | 41       | 1                | 40         | 1.3                  | 12 (0.08)| 8 (0.02)        |
| Immunoglobulin SC          | 111      | 86               | 25         | 0.7                  | 2 (0.01) | 4 (0.01)        |
| Other                      | 101      | 74               | 27         | -0.3                 | —        | —                |
| **Other**                  | 1756     | 1306             | 450        | 31.2                 | —        | —                |

AA alopecia areata, IV intravenous, SC subcutaneous, TNF tumor necrosis factor

AA cases, N = 14,340; matched controls, N = 42,998
| Table S3  | Ambulatory procedure expenditure and the proportion of patients having each procedure |
|-----------|-------------------------------------------------------------------------------------|
| **Related spending, mean, $** | **Patients having procedure, n (%)** |
| AA cases | Matched controls | Difference | % of total difference | AA cases | Matched controls |
|----------|-----------------|------------|----------------------|----------|-----------------|
| Total ambulatory costs | 3641 | 2063 | 1578 | – | – | – |
| Total ambulatory costs explained by procedures (CPT codes) | 3198 | 1849 | 1349 | 85.5 | 14,331 (99.9) | 36,819 (85.6) |
| Anesthesia | 53 | 35 | 18 | 1.1 | 851 (5.9) | 2095 (0.0) |
| Surgical procedures | 659 | 423 | 236 | 15.0 | 11,747 (81.9) | 20,195 (0.5) |
| General | 0 | 0 | 0 | 0 | 3 (0.0) | 12 (0.0) |
| Integumentary system | 204 | 54 | 150 | 9.5 | 7402 (51.6) | 3990 (0.1) |
| Skin, SC and accessory structures | 25 | 10 | 15 | 1.0 | 996 (6.9) | 1464 (0.0) |
| Nails | 2 | 2 | 1 | 0 | 157 (1.1) | 299 (0.0) |
| Pilonidal cyst | 0 | 1 | –1 | 0 | 2 (0.0) | 6 (0.0) |
| Integumentary system, introduction or removal | 104 | 2 | 102 | 6.5 | 6015 (41.9) | 359 (0.0) |
| Integumentary system, repair (closure) | 15 | 9 | 6 | 0.4 | 297 (2.1) | 565 (0.0) |
| Integumentary system, destruction | 25 | 11 | 14 | 0.9 | 1450 (10.1) | 1934 (0.0) |
| Breast | 33 | 20 | 13 | 0.8 | 141 (1.0) | 257 (0.0) |
| Musculoskeletal system | 96 | 85 | 11 | 0.7 | 1341 (9.4) | 2847 (0.1) |
| Respiratory system | 23 | 16 | 7 | 0.5 | 390 (2.7) | 510 (0.0) |
| Cardiovascular system | 55 | 36 | 19 | 1.2 | 7599 (53.0) | 15,521 (0.4) |
| Heart and pericardium | 5 | 7 | –2 | –0.1 | 6 (0.0) | 17 (0.0) |
| Arteries and veins | 50 | 30 | 20 | 1.3 | 7599 (53.0) | 15,518 (0.4) |
| Venous procedures | 24 | 13 | 11 | 0.7 | 7583 (52.9) | 15,453 (0.4) |
| Medical Specialties                          | Procedures Count | Procedures Count | Percentage | Procedures Count | Procedures Count |
|---------------------------------------------|------------------|------------------|------------|------------------|------------------|
| Hemic and lymphatic systems                 | 4                | 10               | –6         | –0.4             | 32 (0.2)         |
| Mediastinum and diaphragm                   | 0                | 0                | 0          | 0                | 1 (0.0)          |
| Digestive system                            | 111              | 85               | 26         | 1.6              | 793 (5.5)        |
| Urinary system                              | 18               | 17               | 1          | 0.1              | 308 (2.1)        |
| Male genital system                         | 4                | 3                | 1          | 0.1              | 91 (0.6)         |
| Reproductive system                         | 0                | 0                | 0          | –                | 0 (0)            |
| Intersex surgery                            | 0                | 0                | 0          | –                | 0 (0)            |
| Female genital system                       | 64               | 54               | 10         | 0.7              | 668 (4.7)        |
| Maternity care and delivery                 | 5                | 6                | –1         | 0                | 91 (0.6)         |
| Endocrine system                            | 4                | 4                | 0          | 0                | 18 (0.1)         |
| Nervous system                              | 41               | 39               | 2          | 0.1              | 383 (2.7)        |
| Eye and ocular adnexa                       | 23               | 12               | 11         | 0.7              | 193 (1.3)        |
| Auditory system                             | 5                | 2                | 2          | 0.2              | 298 (2.1)        |
| Operating microscope procedures             | 0                | 0                | 0          | –                | 6 (0.0)          |
| Radiology                                   | 513              | 289              | 224        | 14.2             | 7339 (51.2)      |
| Diagnostic imaging                          | 233              | 137              | 96         | 6.1              | 4596 (32.1)      |
| Diagnostic ultrasound                       | 85               | 48               | 37         | 2.4              | 2920 (20.4)      |
| Radiologic ultrasound                       | 4                | 2                | 1          | 0.1              | 123 (0.9)        |
| Breast mammography                          | 50               | 33               | 18         | 1.1              | 2965 (20.7)      |
| Bone/joint studies                          | 6                | 3                | 3          | 0.2              | 593 (4.1)        |
| Radiation oncology                          | 94               | 42               | 52         | 3.3              | 49 (0.3)         |
| Nuclear medicine                            | 41               | 25               | 16         | 1.0              | 357 (2.5)        |
| Pathology and laboratory procedures         | 360              | 182              | 178        | 11.3             | 11,613 (81.0)    |
| Medicine services and procedures            | 698              | 442              | 257        | 16.3             | 10,187 (71.0)    |
| Chemotherapy administration                | 38               | 14               | 24         | 1.5              | 158 (1.1)        |
| Non-chemotherapy administration             | 32               | 19               | 13         | 0.8              | 2095 (14.6)      |
| Immunology and allergy                      | 29               | 13               | 16         | 1.0              | 510 (3.6)        |
| CVD procedures                              | 78               | 74               | 4          | 0.2              | 2380 (16.6)      |
| Dialysis                                    | 2                | 22               | –20        | –1.3             | 3 (0.0)          |
| Category                                      | AA Cases | Controls | OR (95% CI) | P-value |
|-----------------------------------------------|----------|----------|-------------|---------|
| Gastroenterology                              | 3        | 66       | 66 (0.5)    | 129 (0.0) |
| Ophthalmology                                 | 39       | 2618     | 2618 (18.3) | 7923 (0.2) |
| Pulmonary                                     | 8        | 944      | 944 (6.6)   | 1825 (0.0) |
| Special dermatological procedures             | 14       | 82       | 82 (0.6)    | 20 (0.0)   |
| Phototherapy                                  | 12       | 74       | 74 (0.5)    | 16 (0.0)   |
| Photodynamic                                  | 0        | 23       | 23 (0.0)    | 20 (0.0)   |
| Psychiatry                                    | 139      | 1440     | 1440 (10.0) | 2967 (0.1) |
| Medical genetic                               | 0        | 23       | 23 (0.0)    | 31 (0.0)   |
| Neurology and neuromuscular                   | 27       | 496      | 496 (3.5)   | 1022 (0.0) |
| Special otorhinolaryngologic                  | 8        | 659      | 659 (0.0)   | 1018 (0.0) |
| Health behavior assessment                    | 0        | 94       | 94 (0.0)    | 170 (0.0)  |
| Osteopathic                                   | 1        | 55       | 55 (0.0)    | 89 (0.0)   |
| Chiropractic                                  | 41       | 1587     | 1587 (0.1)  | 4941 (0.1) |
| Vaccine and immunization                      | 26       | 3659     | 3659 (0.3)  | 9240 (0.2) |
| CNS assessments/tests                         | 1        | 534      | 534 (0.0)   | 673 (0.0)  |
| Evaluation and management services            | 857      | 14,205   | 14,205 (99.1) | 34,942 (0.8) |
| Category II codes                             | 0        | 1319     | 1319 (9.2)  | 2712 (0.1) |
| Category III codes                            | 1        | 41       | 41 (0.3)    | 33 (0.0)   |
| Inactive codes                                | 57       | 2856     | 2856 (19.9) | 4346 (10.1) |

AA alopecia areata, CNS central nervous system, CVD cardiovascular disease, SC subcutaneous

AA cases, N = 14,340; matched controls, N = 42,998
Table S4  Sensitivity analysis: healthcare resource utilization and costs excluding patients with a cancer diagnosis within 365 days pre- and post-index

| Variable                      | AA cases (N = 13,444) | Matched controls (N = 40,312) | p value |
|-------------------------------|-----------------------|-------------------------------|---------|
| Inpatient visits              |                       |                               |         |
| Number of visits, mean (SD)   | 0.1 (0.3)             | 0.1 (0.3)                     | 0.94    |
| Costs, $                      | 1040 (9279)           | 967 (10,599)                  | 0.45    |
| Emergency department visits   |                       |                               |         |
| Number of visits, mean (SD)   | 0.2 (0.7)             | 0.2 (0.7)                     | < 0.0001|
| Costs, $                      | 479 (2025)            | 311 (1557)                    | < 0.0001|
| Ambulatory visits             |                       |                               |         |
| Number of visits, mean (SD)   | 13.1 (12.7)           | 7.2 (9.5)                     | < 0.0001|
| Costs, $                      | 3153 (5344)           | 1773 (5096)                   | < 0.0001|
| Other visits$^a$              |                       |                               |         |
| Number of visits, mean (SD)   | 0.9 (3.9)             | 0.6 (3.7)                     | < 0.0001|
| Costs, $                      | 514 (2890)            | 359 (4539)                    | < 0.0001|
| Prescriptions filled          |                       |                               |         |
| Number of prescriptions, mean (SD) | 16.2 (20.9)     | 13.8 (20.5)                   | < 0.0001|
| Costs, $                      | 2911 (14,201)         | 1530 (10,096)                 | < 0.0001|
| Total costs, $                | 8096 (20,973)         | 4940 (18,333)                 | < 0.0001|

AA alopecia areata, SD standard deviation

$^a$ Includes durable medical equipment, home health care, and additional miscellaneous categories
## Appendix

### Comorbidities of interest

| Group                        | Disease                                      | ICD-9  | ICD-10                      |
|------------------------------|----------------------------------------------|--------|-----------------------------|
| Cardiovascular disease       | Atherosclerosis                              | 414.0x, 440* | I25.1x, I25.11x, I25.70x–I25.79x, I25.81x, I25.83, I25.84, I70 |
|                              | Chest pain                                   | 786.5X, 413 | I20, I25.119, R07.1, R07.2, R07.8x, R07.9 |
|                              | Palpitations                                 | 785.1  | R00.2                       |
|                              | Dyspnea/shortness of breath                  | 786.02, 786.09, 786.05 | R06.01, R06.0x |
| Autoimmune disorder          | Hashimoto’s disease/autoimmune thyroiditis   | 245.2  | E06.3                       |
|                              | Rheumatoid arthritis                         | 714.0–714.33, 720.0 | M05*, M06*, M08.0–M08.48, M45* |
|                              | Type 1 diabetes                              | 250.01, 250.03, 250.11, 250.13, 250.21, 250.23, 250.31, 250.33, 250.41, 250.43, 250.51, 250.53, 250.61, 250.63, 250.71, 250.73, 250.81, 250.83, 250.91, 250.93 | E10*, O24.0–O24.03 |
|                              | Systemic lupus erythematosus                 | 286.53, 710.0, | M32*                       |
|                              | Sjögren’s (Sicca) syndrome                   | 710.2  | M35.0x                      |
| Atopic disease               | Atopic dermatitis                            | 691.8  | L20                         |
|                              | Allergic rhinitis                            | 477    | J30.1–J30.9                 |
|                              | Psoriasis                                    | 696.0, 696.1, 696.8 | L40                        |
|                              | Celiac disease                               | 579.0  | K90.0                       |
|                              | Allergic eczema                              | 373.32, 692.3–692.6, 692.8x, 692.9 | H01.11X, L23, L20.84 |
|                              | Conjunctivitis                               | 077, 098.40, 130.1, 370.3–370.49, 370.40, 372.0x, 771.6 | A36.86, A39.89, A54.31, A74.0, B00.53, B02.31, B30, B60.12, H10, H16.20–H16.229, P39.1 |
|                              | Asthma                                       | 493*   | J45                         |
| Anemia                       | Anemia                                       | 280, 281, 282, 283, 284, 285 | D50–D59, D61–64.9 |