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Hypospadias

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1.0 Introduction

Hypospadias, one of the most common birth defects, has been reported to affect up to 1 in 300 males¹. This condition is characterized by a urethral opening that is proximal to the normal glanular location, and correction of hypospadias usually requires a surgical approach. At present, our understanding of the epidemiology, treatment approaches, and clinical outcomes associated with hypospadias is limited, and has been informed by what are predominantly single-institution, geographically-localized, center-of-excellence reports that may not be reflective of a larger, population-level experience^{2,3}.

In order to provide the broadest possible epidemiologic understanding of hypospadias, it is important that the data source capture a large-scale, nationwide cohort of children with hypospadias. For the purpose of the Urologic Diseases in America analysis of hypospadias, the Optum[®] Clinformatics[®] Data Mart (CDM) database was selected. The CDM is a robust dataset, which provides information on the healthcare utilization of a population of privately insured individuals who reside throughout the United States.

One of the great values of the CDM is its ability to track patients longitudinally, so that one may, for example, follow a child from the time he is diagnosed with hypospadias through treatment and then through to outcome. This is of great interest, as it permits a better understanding of treatment quality over the entire treatment episode for hypospadias. For example, there are reported re-operation rates for patients undergoing surgical correction of hypospadias; however, these can vary from institution to institution, and it is not known what re-operation rates may exist on a population level. In order to begin to understand how quality of care may be defined for patients undergoing hypospadias repair, at the foundation level, an understanding of such data is necessary.

The CDM is also a valuable instrument for defining cost of care, as it captures expenditures associated with treatment. The primary focus of the CDM dataset is health care utilization through physicians' offices,

hospital outpatient centers, ambulatory surgery centers, and inpatient hospital stays. To that end, an analysis utilizing the CDM can provide an understanding of the costs associated with hypospadias that are accrued throughout all sites of repair. In addition, as hormonal manipulation may be performed as an adjuvant or neo-adjuvant to surgical therapy, the ability of CDM to capture drug utilization is also particularly valuable.

The objective of this research compendium is to assess the prevalence, treatment, and cost of this commonly occurring birth defect among a large geographically diverse privately insured pediatric population.

2.0 Methods

2.1 Data Source: Clinformatics[®] Data Mart Database (CDM)

To assess hypospadias prevalence, treatment, and associated expenditures among a national pediatric population, we utilized the Optum[®] Clinformatics[®] Data Mart (CDM) database from the years 2004-2016. The CDM database consists of de-identified adjudicated administrative health claims for approximately 15-18 million lives covered annually by commercial insurance in all 50 US states. We purchased the CDM data from for the hypospadias analysis. In addition to the standard data elements detailed below, the year and month of death were also included in the database.

2.1.1 Member Eligibility Files

The member eligibility files in the CDM dataset contain year of birth, gender, race/ethnicity, state of residence, and eligibility period (eligibility and effective dates) information on each member. Records in the files are at the individual level and are linkable to claims by the enrollee unique identifier.

2.1.2 Inpatient Confinement Files

Inpatient confinement files contain records summarizing each inpatient episode serviced in an acute care hospital or skilled nursing facility. A record in this file contains basic summary information on the hospitalization, including enrollee unique identifier,

admission and discharge dates, up to 25 International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) or International Classification of Diseases, Tenth Revision, Clinical Modification (ICD-10-CM) diagnostic codes, up to 25 ICD-9-CM or ICD-10-CM procedure codes, place of service, and standardized cost.

2.1.3 Medical Claims Files

The Medical claims files include requests for reimbursement from health care professional services provided in all places of services (e.g., inpatient hospital, outpatient facilities, physician office, and laboratory). Medical claims files contain “line-level detail” information, i.e., each claim may include multiple records for services rendered on one claim. Contents of a record in these files include enrollee unique identifier, a claim number, service date, up to 25 ICD-9-CM or ICD-10-CM diagnostic codes, up to 25 ICD-9-CM or ICD-10-CM procedure codes, one Current Procedural Terminology/Healthcare Common Procedure Coding System (CPT/HCPCS) medical procedure code, type of service, place of service, and standardized cost.

2.1.4 Pharmacy Claims Files

Pharmacy claims files contain all final action claims submitted by pharmacies for prescription drugs filled in an outpatient setting. The files contain information on the drug name, National Drug Code, days and quantity of supply, drug dose and strength, etc.

2.2 General Methods for CDM Claim Data Files

In this section, we described how the following were defined in the hypospadias analysis: 1) hypospadias claims; 2) hypospadias patients; 3) birth date in CDM; 4) race/ethnicity in CDM; and 5) region in CDM.

2.2.1 Hypospadias Claims

A claim was classified as being related to hypospadias if an ICD-9-CM or ICD-10-CM diagnostic code indicative of hypospadias (Appendix A) appeared in any diagnostic code field.

2.2.2 The Definition of a Hypospadias Patient

An enrollee was considered a hypospadias patient if they met the inclusion criteria to be part of the study population (see Section 2.3 “Study Population”) and had one or more claims with a hypospadias diagnosis in any diagnosis field in confinement and medical files between birth and the first two years of life. We required a two year follow-up period because we assumed that all children with hypospadias would have had an insurance claim filed with a hypospadias diagnosis by two years of age given that most hypospadias corrective procedures occur between 3 and 18 months of age⁴.

2.2.3 Birth Date

CDM provides birth year for enrollees but does not provide exact birth date. However, granularity of the age variable may be especially important for hypospadias analyses given that age is commonly reported in weeks or months rather than years among young pediatric populations. Previous sensitivity analyses among this population indicate that enrollment date is a valid and reliable estimate for birth date among children who are enrolled in private insurance during their birth year⁵. Consequently, we utilized enrollment date as a proxy for birth date for those enrolling during their birth year.

2.2.4 Race/Ethnicity

The race/ethnicity information currently provided by CDM are rolled-up into the categories of White, Black, Hispanic, Asian, and unknown.

2.2.5 Region

The region information currently provided by CDM was condensed into the categories of Northeast, Midwest, South, and West (Appendix B).

2.3 Study Population

The study population covered by these analyses was all privately insured enrollees in CDM who:

- 1) enrolled during their birth year (2004-2016);
- 2) were male;

- 3) resided in the 50 U.S. states or Washington, DC; and
- 4) were continuously and fully enrolled from birth through the first two years of life.

2.4 Prevalence of Hypospadias

Prevalence of hypospadias in a given year was estimated from the number and percentage of privately insured enrollees in CDM (defined in Section 1.3) born in that year who qualified as hypospadias patients (defined in Section 1.2.2). Analyses were conducted for the years 2005-2016, and results were reported overall and stratified by race and geographic region of residence (Appendix B).

2.5 Treatment of Hypospadias

2.5.1 Physician Office Visits

Hypospadias-related physician visits in the first two years of life were counted among the eligible study population. A hypospadias-related physician visit was defined as a claim with a type of service of professional office visit or professional consultation (TOS_CD= PROF.OFFVIS or PROF.CONSUL) with a primary hypospadias diagnosis code. The per person number of office visits were calculated and reported overall and by birth year, race, and region.

2.5.2 Corrective Procedures

Hypospadias-related corrective procedures in the first two years of life were counted among the eligible study population. A hypospadias-related corrective procedure was defined as a claim with a hypospadias-related ICD-9-CM procedure code, ICD-10-CM procedure code, or CPT/HCPCS procedure code (Appendix C), with any accompanying hypospadias diagnosis code in the confinement and medical files. Multiple procedures occurring on a single service date were considered to be part of a single surgical episode.

We conducted three analyses related to corrective procedures in the first two years of life where the hypospadias patient was the unit of measurement. These analyses included: 1) percent of hypospadias patients with any corrective procedures, 2) percent of hypospadias patients with 0, 1, or 2+ procedures, and 3) total corrective procedures per hypospadias patient.

The results were reported overall and by birth year, race, and region. We additionally conducted an analysis where the corrective procedure was the unit of measurement. This analysis characterized all hypospadias-related corrective procedures occurring in the first two years of life among the study population in terms of age in months of the enrollee when the procedure occurred (0-<6, 6-<12, 12-<18, or 18-<24), enrollee race, enrollee region, and site of service (inpatient or ambulatory). Inpatient procedures were defined as those with a claim located in the confinement files or a medical file claim with a place of service of inpatient hospital (POS=21). All others were considered ambulatory procedures.

2.5.3 Preoperative Androgen Stimulation

The prevalence of androgen stimulation prior to a hypospadias-related corrective procedure was calculated among the eligible study population that underwent at least one hypospadias-related corrective procedure in their first two years of life. Preoperative androgen stimulation was defined as a claim occurring ≤ 3 months before the service date of the corrective procedure and that met one of the three following conditions: 1) was located in the medical files and had a procedure code for a qualifying testosterone injection (Appendix D), 2) was located in the medical or confinement files and had a qualifying National Drug Code (NDC) for an androgen (Appendix E), or 3) was located in the pharmacy files and had a generic name containing "testosterone" or "androgen." The prevalence of preoperative androgen stimulation was calculated overall and by birth year, race, and region.

2.6 Treatment Outcomes of Hypospadias

2.6.1 Repeat Corrective Procedures

Among the eligible study population who also underwent an initial hypospadias-related corrective procedure, the prevalence of repeat procedures within 18 months of the initial procedure was calculated. To be eligible for this analysis, hypospadias patients did not necessarily have to be enrolled from birth through two years of age, rather they had to be enrolled from birth through at least 18 months following an initial hypospadias procedure. A repeat hypospadias

corrective procedure was defined as a claim in the confinement and medical files with a hypospadias-related ICD-9-CM procedure code, ICD-10-CM procedure code, or CPT/HCPCS procedure code (Appendix C), with any accompanying hypospadias diagnosis code, that occurred within 18 months of an initial hypospadias-related procedure. The percentage of repeat corrective procedures among those with an initial procedure and the total number of repeat procedures per person among those with a repeat procedure was reported overall and by birth year, age at first procedure, race, region, site of service of the initial procedure, and whether or not the initial procedure was preceded by preoperative androgen stimulation.

2.6.2 Postoperative Complications

The prevalence of complications due to urethral fistula, stricture, or diverticulum within 18 months of a hypospadias corrective procedure was calculated among the eligible study population who underwent an initial hypospadias corrective procedure. As described in section 2.6.1, to be eligible for this analysis, hypospadias patients had to be enrolled from birth through at least 18 months following an initial hypospadias procedure; they did not necessarily have to be enrolled from birth through two years of age. A postoperative complication was defined as a claim occurring within 18 months of a hypospadias corrective procedure that met at least one of the following criteria (Appendix F): 1) had a hypospadias complication CPT procedure code, 2) had a urethral fistula code in any diagnosis or procedure field, 3) had a urethral stricture code in any diagnosis or procedure field, or 4) had a urethral diverticulum code in any diagnosis or procedure field. The percentage of postoperative complications due to urethral fistula, stricture, or diverticulum among those with any hypospadias procedure was reported overall and by birth year, age at procedure, race, region, site of service of the initial procedure, and whether or not the initial procedure was preceded by preoperative androgen stimulation.

2.6.3 Postoperative Rehospitalization

The prevalence of rehospitalization within 18 months of a hypospadias corrective procedure was calculated among the eligible study population who underwent an initial hypospadias corrective procedure. As described in section 2.6.1, to be eligible for this analysis, hypospadias patients had to be enrolled from birth through at least 18 months following an initial hypospadias procedure; they did not necessarily have to be enrolled from birth through two years of age. A postoperative rehospitalization was defined as a claim occurring within 18 months of a hypospadias corrective procedure that met both of the following criteria: 1) came from the confinement files or came from the medical files and listed an inpatient hospital as the place of service (POS=21), and 2) had a hypospadias-related diagnosis or procedure code in any diagnosis or procedure field (Appendices A and C). The percentage of postoperative rehospitalizations among those with any hypospadias procedure was reported overall and by birth year, age at procedure, race, region, site of service of the initial procedure, and whether or not the initial procedure was preceded by preoperative androgen stimulation.

2.7 Expenditures related to Hypospadias

Insurer expenditures were estimated for hypospadias-related services among hypospadias patients in their first three years of life. The objective of this analysis was to estimate the per person costs of hypospadias in the first three years of life. Consequently, for claims to be eligible for this analysis, the enrollee had to be continuously and fully enrolled in private insurance from birth through three years of age.

We first estimated the total insurer expenditures in the first three years of life for services with a primary diagnosis of hypospadias. We also estimated the total insurer expenditures for hypospadias corrective procedures in the first three years of life. These claims were required to have both a hypospadias procedural code and a hypospadias diagnosis code in any diagnosis field (not only primary). Finally, we estimated the total insurer expenditures for repeat hypospadias corrective procedures occurring within 18 months of an initial procedure. For claims to be eligible for this

analysis, the enrollee had to be continuously and fully enrolled in private insurance from birth through 18 months post initial procedure (not necessarily three full years as with the other two expenditure analyses). Given that we were calculating total insurer expenditures, denied claims were not included in the expenditure analyses.

These insurer expenditures were aggregated overall and by race, region, and birth year. Age at first procedure, site of first procedure, and use of preoperative androgen stimulation were also examined when estimating the repeat procedure expenditures. In addition, expenditure estimates were derived separately for inpatient hospital stays, hospital-based outpatient services, physician office services, and all other services. Per person per follow-up period (three years or 18 months) expenditures were calculated by dividing the total expenditures by the number of hypospadias patients followed.

The payment made by the insurer in the CDM was an amount after standardization across plans and providers. In CDM, all expenditures were re-calculated using specific pricing algorithms to account for differences in pricing across health plans and provider contracts. We also converted all dollar amounts to 2015 dollar-equivalent values based on the adjusting methods suggested by CDM.

To derive an estimated paid amount, we used the algorithm below in which the standardized price serves as an estimate of the allowed amount:

Estimated paid amount = Standardized amount - Coinsurance amount - Copay amount - Deductible amount

2.8 Time to Event Analyses

We conducted three time to event analyses among eligible hypospadias patients from the study population: 1) time from birth to first hypospadias corrective procedure, 2) time from initial procedure to repeat procedure, and 3) time from initial procedure to rehospitalization.

Among the eligible study population of hypospadias patients who were enrolled from birth through two

years of age, we assessed the cumulative probability of a hypospadias-related corrective procedure at 6, 9, 12, 18, and 24 months of age. We also calculated the median time of first procedure, defined as the time at which half of the hypospadias patient population had experienced an initial hypospadias corrective procedure. These were examined in the population overall and by birth year, race, region, and site of first procedure. We also conducted a log-rank test to determine if the survival distributions differed across the various categories of these groups.

Among the eligible study population of hypospadias patients who had undergone an initial hypospadias corrective procedure and were enrolled from birth through 18 months following the initial procedure, we assessed the cumulative probability of a repeat procedure and of rehospitalization at 3, 6, 9, 12, and 18 months post procedure. We also calculated the median time to repeat procedure and median time to rehospitalization, defined as the time at which half of the population experienced a repeat procedure or rehospitalization. These were examined in the population overall and by birth year, race, region, site of first procedure, and preoperative androgen stimulation at first procedure. We also conducted a log-rank test to determine if the survival distributions differed across the various categories of these groups.

3.0 Results

3.1 Prevalence

The overall population in the CDM file did decline over the time period studied, albeit modestly (Table 1.1). In 2005-2006 there were 70,909 males continuously enrolled from birth through two years of age, and this declined to 54,036 by the years 2013-2014. However, the Race and Region distributions remained stable over this time period. The majority of the population was White, and most of the population resided in the Southern region of the United States.

Over the time period of the study, the claims-based prevalence of hypospadias remained fairly static, with a slight increase in prevalence from 1.2% in 2005-2006 up to 1.4% in 2013-2014 (Table 3.1). However, when the Race and Region sub-groups were examined, there

was no meaningful change in the distribution of hypospadias among these cohorts. Overall, approximately 1% of the boys in the study period were affected by hypospadias; the White and Black subgroups were most commonly affected, with a hypospadias prevalence of just over 1%. In contrast, the Asian and Hispanic groups were affected to a lesser extent, with a prevalence of just under 1%. The prevalence was also similar among the different geographic regions. These prevalences are higher than what has been reported elsewhere⁶. Given that we examined claims-based prevalence, the prevalence we observed may represent evaluation and management visits where the presence of hypospadias was assessed but not confirmed.

3.2 Health Utilization

3.2.1 Ambulatory Evaluation & Management Visits

Hypospadias is typically diagnosed at, or shortly after, birth. As such, there will be a physician office visit early in the male child's life for the evaluation and management of this condition. Over the time period studied, there was no increase or decrease in the number of physician office visits per person in the first two years of life among male children with hypospadias (Table 4.1). In 2005-2006 and 2013-2014, there were 1.3 visits per person among males with hypospadias. The office visits per person were similar among the different Race subgroups. When the years are looked at in aggregate, the Northeast Region had 1.6 visits per person, which was the greatest among the four geographic regions.

3.2.2 Surgical Procedures

Hypospadias is primarily treated through surgical intervention, which reconstructs the child's urethra and urethral opening. Among males with hypospadias, the prevalence of surgical procedures to correct hypospadias did not change over the time period studied (Table 4.2). Interestingly, 58.0% and 57.2% of male children diagnosed with hypospadias underwent reconstruction in 2005-2006 and 2013-2014, respectively. These percentages are helpful to place some context to the greater than expected prevalence

of hypospadias. It may be that hypospadias was the reason for an evaluation and management visit, but that hypospadias was not confirmed in that visit so therefore no surgical procedure was performed. The percent of children undergoing a corrective procedure was similar among the different Race sub-groups, and also among the Region sub-groups.

Depending on the severity of the hypospadias and the outcome of the initial procedure, a certain subset of patients undergoing an initial hypospadias correction procedure will require a repeat procedure. In some cases these repeat procedures are planned, staged approaches to a complex variant of hypospadias. In other cases, they may represent a complication from the primary surgical procedure, such as a urethral fistula. Over the time period studied, the percent of patients who underwent more than one corrective procedure was between 4.0% and 6.9% (Table 4.3). These data may be particularly helpful in the counseling of patients undergoing a primary hypospadias repair as to the likelihood of their needing a follow-up procedure.

The total number of corrective procedures per person among males with a diagnosis of hypospadias was stable throughout the time period studied, ranging from 0.7 in 2005-2006 to 0.6 in 2013-2014 (Table 4.4). Furthermore, the fact that these values were less than one was also consistent with the finding that not all children in our population who were diagnosed with hypospadias underwent surgical correction of hypospadias. Similar to the prior analyses, there were no meaningful differences in the Race or Region sub-groups.

The timing of the corrective procedure for hypospadias is important; it should not be at too early an age, as the anesthetic risk is greater. However, it should still be at a young enough age, which will minimize any psychological trauma associated with the surgery. The largest cohort of children underwent surgical correction between 6 and 12 months of age (Table 4.5). This time period serves to optimize the aforementioned concerns. The second largest cohort underwent surgery at a time between 12 and 18 months, and the third largest cohort underwent surgery between birth and 6 months. This distribution

did not meaningfully change over the 10-year time period studied.

There have been reports advocating the use of preoperative androgen stimulation prior to hypospadias surgery. Administration of this agent may improve surgical results for certain patients. An analysis of the prevalence of preoperative androgen stimulation found that it is seldom utilized; overall, it is administered to approximately 4% of individuals diagnosed with hypospadias undergoing a corrective procedure (Table 4.6). Overall, it appeared to be least commonly employed in the West as compared to the Northeast, South, and Midwest.

An analysis of the time to first hypospadias procedure within the first two years of life further confirms the commonly utilized timing of surgical intervention (Table 4.7). Most children who have surgery to correct hypospadias will undergo that procedure by 18 months of age. Over the time period studied, this timing of surgical intervention remained relatively stable. Whites and Blacks underwent surgery earlier in life compared to Hispanic and Asian children. Indeed, by 24 months of age, less than half of the Asian children in the study population had experienced a corrective procedure. There did not appear to be Regional differences.

The child's age when he underwent the primary corrective procedure does have some correlation with the occurrence of a repeat procedure (Table 5.1). For example, the proportion of children undergoing a repeat procedure was greatest when the primary procedure was performed between 18 and 24 months. These children may have undergone their primary corrective procedure at a later age due to a more severe variant of hypospadias. For such patients, a delay in the primary procedure may allow additional phallic growth that will provide some technical advantages during the procedure. Patients who underwent preoperative androgen stimulation also experienced elevated rates of repeat surgeries, suggesting that this cohort had a more severe variant of hypospadias that necessitated androgen therapy to promote phallic growth.

When the repeat corrective procedures are analyzed per person, the average number of corrective procedures per person is similar among the different age cohorts (Table 5.2). Race and region subgroups were also not appreciably different from one another. However, the average number of corrective procedures was greater for those children who underwent their first procedure in an inpatient setting compared to an ambulatory setting; the overall data demonstrated that those with an ambulatory procedure had 1.2 repeat procedures per person on average, compared to 1.8 among those with an inpatient procedure.

At present, our understanding of complication rates following hypospadias are limited. Our understanding is generally informed by reports from single-institution series, which are oftentimes centers of excellence for this condition. The claims-based prevalence of postoperative complications due to urethral fistula, stricture, or diverticulum is, therefore, particularly instructive (Table 5.3). Overall prevalence of complications was approximately 14-18% for those children who underwent hypospadias corrective surgery between birth and 24 months of age. Complication prevalence was lowest among Whites and Blacks, and greatest among Hispanics and Asians. Interestingly, there was a Regional difference, as the prevalence of complications in the Northeast was greater than in the other regions. If the primary surgery was performed in an inpatient setting, complications were more common; this may be due to the fact that children with a more severe variant of hypospadias were more likely to undergo an inpatient procedure as opposed to an outpatient procedure. The same reasoning also likely explains why children who received preoperative androgen stimulation experienced a greater prevalence of complications (35.0% versus 15.2%).

Certain patients who undergo hypospadias repair may require rehospitalization following their initial surgery. Prevalence of rehospitalization was lowest among those who underwent their primary surgery between 6-12 months of age (Table 5.4). Prevalence was greater for those who underwent surgery at 0-6 and 12-18 months of age. Prevalence of rehospitalization was

also high among those aged more than 30 months at their first procedure; however, very few eligible participants fell into this category, indicating that these estimates may be unreliable. Prevalence of rehospitalization was greatest for those aged 18-24 months. For this older age cohort, patient selection may affect these findings; such patients may have had more severe variants of hypospadias. For the youngest cohort, there may have been challenges in managing a complicated hypospadias repair as an outpatient in such a young child, which yielded a higher prevalence of rehospitalization.

The cumulative probability of a child undergoing a repeat hypospadias-related corrective procedure was similar over the years studied (Table 5.5). The cumulative probability was also similar among the different Race and Region subgroups, although Whites and those living in the Midwest did have the lowest probability of a repeat procedure after 18 months compared to the other groups. However, having undergone the primary procedure in an inpatient setting, and receiving preoperative androgen stimulation therapy, were both associated with greater probabilities of a repeat procedure. As seen in Table 5.6, rehospitalization events were low, which makes comparisons among the subgroups difficult.

3.3 Insurer Expenditure on Health Utilization

There is a cost associated with the treatment of patients with hypospadias. In the CDM population, \$16,918,936 was spent in total by a private insurer from 2004-2016 on services with a primary diagnosis of hypospadias (Table 5.7), and \$12,422,803 was spent on hypospadias-related corrective procedures with any hypospadias diagnosis (Table 5.8). For children with hypospadias in each birth year, between one and two million dollars was spent by a private insurer on claims with a primary diagnosis of hypospadias on around 300 hypospadias patients in the first three years of life (Table 5.7). Over the three-year follow-up period, this amounted to between four and six thousand dollars per person. The greatest proportion of expenditures were made in the South, as the number of individuals was greatest in that Region, although the highest per person costs occurred in the West. These per person costs may be lower than

expected, but the costs reported herein only represent insurer covered expenses associated with the hypospadias condition.

The vast majority of the expenditures on corrective procedures were made in the hospital-based outpatient setting (Table 5.8). That this location received the greatest proportion of expenditures is expected, as this location is where hypospadias surgeries were most commonly performed. Interestingly, when the total insurer expenditures on repeat procedures were examined, the greatest per person per 18 month expenditure was for those who underwent their first corrective surgery between 18 and 24 months of age, where it was \$2,375 (Table 5.9). The younger cohorts all had per person expenditures of \$800-\$1000. The Hispanic sub-group also accounted for a larger expenditure than the other Race sub-groups. Additionally, the children who received preoperative androgen stimulation had a greater per person per 18 month expenditure, which was expected given that those receiving preoperative androgen stimulation are often the more severe hypospadias cases.

4.0 Conclusion

Hypospadias remains one of the most commonly encountered congenital abnormalities of the male genitalia. Overall, the prevalence of this disorder was stable over the years assessed herein. It is notable, though, that the prevalence reported in this report is higher than that which has been reported elsewhere⁶. Although these data may represent a true increase in the medical condition, it is more probable that they represent an artifact of the claims-based dataset, whereby some children may have had a visit coded for hypospadias, although it was ultimately assessed at that visit that hypospadias was not present.

Hypospadias remains a primarily surgically treated condition, with over half of children receiving this diagnosis undergoing surgical therapy within two years of birth. Just over 5% of children undergoing an initial hypospadias repair will subsequently undergo another surgical procedure. Interestingly, although most children will undergo their repair prior to one year of

age, those that undergo repair after the one year time point will experience an increased risk of complication and subsequent surgery. This may be due to a selection bias, as those patients undergoing a surgical procedure later in life may have a more severe variant of hypospadias. Preoperative androgen stimulation may be used prior to surgical repair. This, too, was associated with an increased rate of complication and secondary surgical procedure, but again there may be a patient selection bias present. Despite these potential limitations, this compendium has provided one of the most comprehensive examinations of hypospadias to date, reminding us that this conditions is an important healthcare issue in the pediatric population.

5.0 References

1. Schnack TH, Zdravkovic S, Myrup C, et al. Familial aggregation of hypospadias: a cohort study. *Am J Epidemiol* 2008; **167**(3): 251-6.
2. Spinoit AF, Poelaert F, Groen LA, Van Laecke E, Hoebeke P. Hypospadias repair at a tertiary care center: long-term followup is mandatory to determine the real complication rate. *J Urol* 2013; **189**(6): 2276-81.
3. Wood HM, Kay R, Angermeier KW, Ross JH. Timing of the presentation of urethrocutaneous fistulas after hypospadias repair in pediatric patients. *J Urol* 2008; **180**(4 Suppl): 1753-6.
4. Facts about Hypospadias. 2017. <https://www.cdc.gov/ncbddd/birthdefects/hypospadias.html> (accessed July 16, 2018).
5. Ward JB, Pierce C, Lim J, Matlaga BR, Feinstein L. Determining infant age from administrative claims data without birth date: A validation study. 34th International Conference on Pharmacoepidemiology & Therapeutic Risk Management; 2018; Prague, Czech Republic; 2018.
6. Springer A, van den Heijkant M, Baumann S. Worldwide prevalence of hypospadias. *J Pediatr Urol* 2016; **12**(3): 152 e1-7.

Appendix A. Diagnostic codes to identify claims of hypospadias

Code Type	Code	Description
ICD-9 diagnosis codes	752.61	Hypospadias
ICD-10 diagnosis codes	Q54.0	Hypospadias, balanic
	Q54.1	Hypospadias, penile
	Q54.2	Hypospadias, penoscrotal
	Q54.3	Hypospadias, perineal
	Q54.8	Other hypospadias
	Q54.9	Hypospadias, unspecified

Appendix B. U.S. states by Census Bureau Regions

Region	States
Northeast	Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont, New Jersey, New York, Pennsylvania
Midwest	Illinois, Indiana, Michigan, Ohio, Wisconsin, Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, South Dakota
South	Delaware, District of Columbia, Florida, Georgia, Maryland, North Carolina, South Carolina, Virginia, West Virginia, Alabama, Kentucky, Mississippi, Tennessee, Arkansas, Louisiana, Oklahoma, Texas
West	Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, Wyoming, Alaska, California, Hawaii, Oregon, Washington

Appendix C. Procedural codes for identifying hypospadias corrective procedures

Code Type	Code	Description
ICD-9 procedure codes	58.45	Repair of hypospadias and epispadias
ICD-10 procedure codes	0TSD0ZZ	Reposition Urethra, Open Approach
	0TSD4ZZ	Reposition Urethra, Percutaneous Endoscopic Approach
CPT procedure codes	54300	Plastic operation on penis for straightening of chordee (eg, hypospadias), with or without mobilization of urethra
	54304	Plastic operation on penis for correction of chordee or for first stage hypospadias repair with or without transplantation of prepuce and/or skin flaps
	54308	Urethroplasty for second stage hypospadias repair (including urinary diversion); less than 3 cm
	54312	Urethroplasty for second stage hypospadias repair (including urinary diversion); greater than 3 cm
	54316	Urethroplasty for second stage hypospadias repair (including urinary diversion) with free skin graft obtained from site other than genitalia
	54318	Urethroplasty for third stage hypospadias repair to release penis from scrotum (eg, third stage Cecil repair)
	54322	One stage distal hypospadias repair (with or without chordee or circumcision); with simple meatal advancement (eg, Magpi, V-flap)
	54324	One stage distal hypospadias repair (with or without chordee or circumcision); with urethroplasty by local skin flaps (eg, flip-flap, prepuccial flap)
	54326	One stage distal hypospadias repair (with or without chordee or circumcision); with urethroplasty by local skin flaps and mobilization of urethra
	54328	One stage distal hypospadias repair (with or without chordee or circumcision); with extensive dissection to correct chordee and urethroplasty with local skin flaps, skin graft patch, and/or island flap
	54332	One stage proximal penile or penoscrotal hypospadias repair requiring extensive dissection to correct chordee and urethroplasty by use of skin graft tube and/or island flap
54336	One stage perineal hypospadias repair requiring extensive dissection to correct chordee and urethroplasty by use of skin graft tube and/or island flap	

Code Type	Code	Description
CPT procedure codes (continued)	54340	Repair of hypospadias complications (ie, fistula, stricture, diverticula); by closure, incision, or excision, simple
	54344	Repair of hypospadias complications (ie, fistula, stricture, diverticula); requiring mobilization of skin flaps and urethroplasty with flap or patch graft
	54348	Repair of hypospadias complications (ie, fistula, stricture, diverticula); requiring extensive dissection and urethroplasty with, flap, patch or tubed graft (includes urinary diversion)
	54352	Repair of hypospadias cripple requiring extensive dissection and excision of previously constructed structures including re-release of chordee and reconstruction of urethra and penis by use of local skin as grafts and island flaps and skin brought in as flaps or grafts
	54360	Plastic operation on penis to correct angulation

Appendix D. CPT/HCPCS Procedural Codes for Preoperative Androgen Stimulation

Code	Description
J3121	Injection, testosterone enanthate, 1 mg
J3120	Injection, testosterone enanthate, up to 100 mg
J3130	Injection, testosterone enanthate, up to 200 mg
J1090	Injection, testosterone cypionate, up to 50 mg
J1071	Injection, testosterone cypionate, 1 mg
J1070	Injection, testosterone cypionate, up to 100 mg
J1080	Injection, testosterone cypionate, 1 cc, 200 mg
J3140	Injection, testosterone suspension, up to 50 mg
J3150	Injection, testosterone propionate, up to 100 mg
J1060	Injection, testosterone cypionate and estradiol cypionate, up to 1 ml

Appendix E. National Drug Codes (NDC) for Androgens Included in Preoperative Androgen Stimulation Definition

Product Name	NDC code
ANDRO 100	00456100410
ANDRO L.A. 200	00456060410
ANDRO-CYP 100	00588507670
ANDRO-CYP 200	00588507770
ANDRODERM	52544046954, 52544046960, 52544047030, 52544047054, 54868370400, 54868603200
ANDROGEL	00051842501, 00051842530, 00051845001, 00051845030, 00051848833, 00051848888, 16590071930, 21695011230, 35356037605, 54569533800, 54569533900, 54868479200, 54868481000, 54868581400, 68115080930
ANDROID	00187090201
ANDROID-10	00187031106
ANDROID-25	00187049906
ANDRONATE	00418655141, 00418656141
DELATEST	00217680608
DELATESTRYL	54396032816, 54396032840, 54569462000, 54569541600, 54868501600, 67979050140
DEP ANDRO 100	00456101910
DEP ANDRO 200	00456060310
DEP ANDROGYN	00456102010
DEPO-TESTOSTERONE	00009034702, 00009041701, 00009041702, 00403300918, 00403304918, 35356005810, 54569141100, 54569530100, 54868021600, 54868021601, 54868079600, 55045302902, 55175500701, 63874106101, 00314081570, 00314083570
DEPOTESTOGEN	00314087570
DUO SPAN	00684020210

Product Name	NDC code
DUO-CYP	00588504770
DUO-SPAN II	00684010210
DUOGEN L.A.	00298630561, 00298663561
DURA-DUMONE	43797002212
DURATEST-100	59441058710
DURATEST-200	59441058810
DURATESTTRIN	59441058910
DURATHATE-200	59441059010
EVERONE	00314065070, 00314065270
FIRST-TESTOSTERONE	65628002001
FIRST-TESTOSTERONE MC	65628002101
FORTESTA	63481018316
HISTERONE-100	59441060210
HISTERONE-50	43797002012
MEDITEST	52349011510
METESTONE	00181061200, 00181061300
METHITEST	00115703701, 00115703801
METHYLTESTOSTERONE	00115398201, 00115398203, 00115398403, 00115398603, 00182018501, 00182058201, 00182058301, 00302412001, 00302412010, 00302412101, 00349209401, 00349211201, 00349239601, 00364017001, 00364017101, 00364017201, 00463612201, 00463612210, 00463612301, 00463612310, 00463612401, 00463612410, 00527107801, 00527107810, 00527114001, 00527114010, 00536463001, 00536463401, 00536463410, 00536463801, 00536463810, 00677008501, 00677008601, 00677008701, 00814478514, 00814478814, 00814479014, 00839142506, 00839142516, 00839142906, 00839142916, 00839508806,

Product Name	NDC code
	00839508816, 00904080760, 00904080860, 00904080960, 00904080960, 00904080980, 00904080980, 51432028403, 51432028603, 51432028803, 54569083300, 54569084100
ORETON METHYL	00085097006, 00187031206
PRIMOTEST FORTE	52083053010
SHOTEST	47649012705, 47649012805, 47649012905
STRIANT	55056306001
T-CYPIONATE	25332003910
T-E CYPIONATE	25332005110
TEST-ESTRO-CYPIONATE	00536947070
TESTA-C	00298683561
TESTAMONE-100	00217681208
TESTASPAN	00684015210
TESTEX	00418085110
TESTIM	16590085330, 54569559500, 54868498900, 66887000105
TESTODERM	17314283603, 17314460803, 17314460903, 54569394400, 54569394500
TESTODERM TTS	17314471703
TESTOLIN	00418078110, 00418079141
TESTONE L.A.	00298621561, 00298679761
TESTOPEL PELLETS	10116100101, 10116100102, 10116100103, 43773100102, 43773100103, 43773100104
TESTOSTERONE	00182071463, 00223058010, 00223858130, 00223859010, 00223859130, 00223860010, 00223860130, 00314008310, 00314077170, 00364660754, 00364660756, 00402008310, 00402008330, 00402008410, 00402008430, 00536890070, 00536950070, 00536950075, 00574091610, 00588506370, 00677031021, 00684012610, 00781309270, 00781309370, 00814768840, 00904087410, 00904087510, 00904087610, 25332003010, 51432077510, 54569220500, 54569300300

Product Name	NDC code
TESTOSTERONE CYPIONATE	00182071263, 00182071363, 00223863510, 00223863610, 00364660954, 00364661054, 00402025510, 00402025610, 00403301018, 00536948070, 00536949070, 00574082001, 00574082010, 00591322379, 00677098021, 00703612101, 00703612501, 00781307370, 00781307470, 00781307471, 00781309670, 00781309770, 00814773340, 23490634301, 49072071110, 54569213100, 54569302500, 54868361800, 54868361801, 54868366900, 55175501801
TESTOSTERONE ENANTHATE	00223860810, 00223860910, 00364661654, 00364661754, 00402035510, 00402035610, 00536167070, 00574082105, 00591322126, 00677031321, 00781310570, 00814770540, 00904245510, 51309042910, 54569301200
TESTOSTERONE PROPIONATE	00182119763, 00223866010, 00223866130, 00314077270, 00364668654, 00402038310, 00402038330, 00463107310, 00574091910, 00588506870, 00677030921, 00719338187, 00781310270, 00904086810, 00904086830, 49072071710, 51309043310, 54569236300
TESTRED	00187090101, 58016096700, 58016096730, 58016096760, 58016096790
TESTRED CYPIONATE 200	00187020010
TESTRIN-P.A.	00418043141
TESTRO AQ	00463106910
TESTRO-L.A.	00463107010
VALERTEST NO. 1	00314078670
VIGOREX	12539010601, 12539012701, 12539012710
VIRILON	00076030103, 00076030104
VIRILON IM	00076030110

Appendix F. Definition of Postoperative Complication due to Urethral Fistula, Stricture, or Diverticulum

Any claim that occurs within 18 months of a hypospadias procedure in the confinement or medical files with at least one of the following:

- A hypospadias complication CPT procedure code of: 54340, 54344, or 54348
- A urethral fistula code in any diagnosis/procedure field. Possible codes include:
 - o ICD-9 diagnosis: 599.1
 - o ICD-10 diagnosis: N36.0
- A urethral stricture code in any diagnosis/procedure field. Possible codes include:
 - o ICD-9 diagnosis: 598.xx
 - o ICD-10 diagnosis: N35.xxx, N99.1xx
 - o ICD-9 procedure: 58.5
 - o ICD-10 procedure: 0TND0ZZ, 0TND3ZZ, 0TND4ZZ, 0TND7ZZ, 0TND8ZZ, 0TNDXZZ
 - o CPT procedure code: 52281, 53601, 53600, 53620, 53621, 53605,
- A urethral diverticulum code in any diagnosis/procedure field. Possible codes include:
 - o ICD-9 diagnosis: 599.2
 - o ICD-10 diagnosis: N36.1
 - o CPT procedure code: 53235

Table 1.1: Total number of males continuously enrolled in private insurance from birth through 2 years of age, by birth year, 2004-2016

Demographic Characteristics		Overall		2005-2006		2007-2008		2009-2010		2011-2012		2013-2014	
		N	%	N	%	N	%	N	%	N	%	N	%
Overall		316,152	100.0	70,909	100.0	69,939	100.0	63,056	100.0	58,212	100.0	54,036	100.0
Race	White	213,884	67.7	47,045	66.3	46,908	67.1	42,870	68.0	39,958	68.6	37,103	68.7
	Black	23,431	7.4	4,507	6.4	5,525	7.9	5,227	8.3	4,317	7.4	3,855	7.1
	Hispanic	34,593	10.9	7,922	11.2	7,743	11.1	6,796	10.8	6,155	10.6	5,977	11.1
	Asian	21,626	6.8	4,428	6.2	4,733	6.8	4,358	6.9	4,228	7.3	3,879	7.2
	Unknown	22,618	7.2	7,007	9.9	5,030	7.2	3,805	6.0	3,554	6.1	3,222	6.0
Region	Northeast	33,859	10.7	7,009	9.9	7,391	10.6	7,024	11.1	6,411	11.0	6,024	11.1
	Midwest	81,249	25.7	17,213	24.3	16,667	23.8	15,795	25.0	16,219	27.9	15,355	28.4
	South	129,712	41.0	28,880	40.7	30,129	43.1	27,214	43.2	23,095	39.7	20,394	37.7
	West	71,332	22.6	17,807	25.1	15,752	22.5	13,023	20.7	12,487	21.5	12,263	22.7

Source: De-identified Optum® Clinformatics® Data Mart, 2004-2016

NOTE: Enrollees with full enrollment in commercial health plan from birth through 2 years of age.

Table 2.1: Total number of males experiencing a hypospadias-related corrective procedure (CP) and continuously enrolled in private insurance from birth through 18 months post-operation, overall and by year of procedure, 2004-2016

Demographic Characteristics		Overall		2004-2005		2006-2007		2008-2009		2010-2011		2012-2013		2014-2015	
		N	%	N	%	N	%	N	%	N	%	N	%	N	%
Overall		2,356	100.0	276	100.0	441	100.0	501	100.0	446	100.0	379	100.0	313	100.0
Age at first procedure (months)	0 to <6	453	19.2	62	22.5	75	17.0	92	18.4	88	19.7	77	20.3	59	18.8
	6 to <12	1,463	62.1	184	66.7	278	63.0	310	61.9	262	58.7	229	60.4	200	63.9
	12 to <18	331	14.0	27	9.8	73	16.6	78	15.6	67	15.0	47	12.4	39	12.5
	18 to <24	64	2.7	3	1.1	12	2.7	12	2.4	20	4.5	11	2.9	6	1.9
	24 to <30	16	0.7	0	0	2	0.5	3	0.6	3	0.7	4	1.1	4	1.3
	30 to <36	8	0.3	0	0	0	0	1	0.2	2	0.4	4	1.1	1	0.3
	36+	21	0.9	0	0	1	0.2	5	1.0	4	0.9	7	1.8	4	1.3
Race	White	1,774	75.3	210	76.1	321	72.8	373	74.5	334	74.9	289	76.3	247	78.9
	Black	181	7.7	13	4.7	34	7.7	37	7.4	37	8.3	33	8.7	27	8.6
	Hispanic	152	6.5	17	6.2	31	7.0	37	7.4	27	6.1	21	5.5	19	6.1
	Asian	89	3.8	4	1.4	19	4.3	19	3.8	21	4.7	18	4.7	8	2.6
	Unknown	160	6.8	32	11.6	36	8.2	35	7.0	27	6.1	18	4.7	12	3.8
Region	Northeast	283	12.0	33	12.0	48	10.9	71	14.2	53	11.9	49	12.9	29	9.3
	Midwest	605	25.7	72	26.1	118	26.8	131	26.1	104	23.3	98	25.9	82	26.2
	South	977	41.5	122	44.2	179	40.6	213	42.5	193	43.3	151	39.8	119	38.0
	West	491	20.8	49	17.8	96	21.8	86	17.2	96	21.5	81	21.4	83	26.5
Site of first procedure	Inpatient	80	3.4	13	4.7	13	2.9	14	2.8	17	3.8	14	3.7	9	2.9
	Ambulatory	2,276	96.6	263	95.3	428	97.1	487	97.2	429	96.2	365	96.3	304	97.1
Preoperative androgen stimulation	No	2,256	95.8	269	97.5	430	97.5	482	96.2	413	92.6	366	96.6	296	94.6
	Yes	100	4.2	7	2.5	11	2.5	19	3.8	33	7.4	13	3.4	17	5.4

CP: corrective procedure

Source: De-identified Optum[®] Clinformatics[®] Data Mart, 2004-2016

NOTE: Enrollees with full enrollment in commercial health plan from birth through 2 years of age.

Table 3.1: Claim-based prevalence of hypospadias among male newborns continuously enrolled in private insurance from birth through 2 years of age, overall and by birth year, 2005-2016

Demographic Characteristics	Overall			2005-2006			2007-2008			2009-2010			2011-2012			2013-2014		
	Total N	N with hypospadias	%	Total N	N with hypospadias	%	Total N	N with hypospadias	%	Total N	N with hypospadias	%	Total N	N with hypospadias	%	Total N	N with hypospadias	%
Overall	316,152	4,152	1.3	70,909	858	1.2	69,939	936	1.3	63,056	827	1.3	58,212	792	1.4	54,036	739	1.4
Race																		
White	213,884	3,086	1.4	47,045	627	1.3	46,908	706	1.5	42,870	612	1.4	39,958	574	1.4	37,103	567	1.5
Black	23,431	310	1.3	4,507	53	1.2	5,525	68	1.2	5,227	68	1.3	4,317	68	1.6	3,855	53	1.4
Hispanic	34,593	303	0.9	7,922	61	0.8	7,743	62	0.8	6,796	62	0.9	6,155	56	0.9	5,977	62	1.0
Asian	21,626	194	0.9	4,428	41	0.9	4,733	40	0.8	4,358	39	0.9	4,228	46	1.1	3,879	28	0.7
Unknown	22,618	259	1.1	7,007	76	1.1	5,030	60	1.2	3,805	46	1.2	3,554	48	1.4	3,222	29	0.9
Region																		
Northeast	33,859	507	1.5	7,009	100	1.4	7,391	128	1.7	7,024	106	1.5	6,411	102	1.6	6,024	71	1.2
Midwest	81,249	1,085	1.3	17,213	239	1.4	16,667	226	1.4	15,795	206	1.3	16,219	200	1.2	15,355	214	1.4
South	129,712	1,724	1.3	28,880	336	1.2	30,129	411	1.4	27,214	365	1.3	23,095	325	1.4	20,394	287	1.4
West	71,332	836	1.2	17,807	183	1.0	15,752	171	1.1	13,023	150	1.2	12,487	165	1.3	12,263	167	1.4

Source: De-identified Optum[®] Clinformatics[®] Data Mart, 2004-2016

NOTE: Male enrollees with full enrollment in commercial health plan from birth through 2 years of age.

Table 4.1: Total hypospadias physician office visits per person in the first 2 years of life among males with hypospadias and enrolled in private insurance from birth through 2 years of age, overall and by birth year, 2005-2016

Demographic Characteristics		Overall			2005-2006			2007-2008			2009-2010			2011-2012			2013-2014		
		Total N	N visits	Visits per person	Total N	N visits	Visits per person	Total N	N visits	Visits per person	Total N	N visits	Visits per person	Total N	N visits	Visits per person	Total N	N visits	Visits per person
Overall		4,152	5,516	1.3	858	1,147	1.3	936	1,285	1.4	827	1,135	1.4	792	1,023	1.3	739	926	1.3
Race	White	3,086	4,045	1.3	627	826	1.3	706	955	1.4	612	836	1.4	574	722	1.3	567	706	1.2
	Black	310	425	1.4	53	74	1.4	68	87	1.3	68	97	1.4	68	95	1.4	53	72	1.4
	Hispanic	303	413	1.4	61	95	1.6	62	95	1.5	62	80	1.3	56	64	1.1	62	79	1.3
	Asian	194	255	1.3	41	51	1.2	40	54	1.4	39	55	1.4	46	60	1.3	28	35	1.3
	Unknown	259	378	1.5	76	101	1.3	60	94	1.6	46	67	1.5	48	82	1.7	29	34	1.2
Region	Northeast	507	787	1.6	100	174	1.7	128	168	1.3	106	166	1.6	102	181	1.8	71	98	1.4
	Midwest	1,085	1,296	1.2	239	267	1.1	226	295	1.3	206	260	1.3	200	203	1.0	214	271	1.3
	South	1,724	2,379	1.4	336	485	1.4	411	588	1.4	365	491	1.3	325	443	1.4	287	372	1.3
	West	836	1,054	1.3	183	221	1.2	171	234	1.4	150	218	1.5	165	196	1.2	167	185	1.1

Source: De-identified Optum[®] Clinformatics[®] Data Mart, 2004-2016

NOTE: Enrollees with full enrollment in commercial health plan from birth through 2 years of age.

Table 4.2: Claim-based prevalence of any corrective procedure among males with hypospadias aged 0 to 2 years and enrolled in private insurance from birth through 2 years of age, overall and by birth year, 2005-2016

Demographic Characteristics		Overall			2005-2006			2007-2008			2009-2010			2011-2012			2013-2014		
		Total N	N with surgery	%	Total N	N with surgery	%	Total N	N with surgery	%	Total N	N with surgery	%	Total N	N with surgery	%	Total N	N with surgery	%
Overall		4,152	2,350	56.6	858	498	58.0	936	540	57.7	827	472	57.1	792	417	52.7	739	423	57.2
Race	White	3,086	1,761	57.1	627	357	56.9	706	413	58.5	612	352	57.5	574	309	53.8	567	330	58.2
	Black	310	189	61.0	53	33	62.3	68	36	52.9	68	43	63.2	68	46	67.6	53	31	58.5
	Hispanic	303	157	51.8	61	40	65.6	62	34	54.8	62	30	48.4	56	21	37.5	62	32	51.6
	Asian	194	90	46.4	41	20	48.8	40	19	47.5	39	19	48.7	46	18	39.1	28	14	50.0
	Unknown	259	153	59.1	76	48	63.2	60	38	63.3	46	28	60.9	48	23	47.9	29	16	55.2
Region	Northeast	507	285	56.2	100	59	59.0	128	69	53.9	106	59	55.7	102	62	60.8	71	36	50.7
	Midwest	1,085	624	57.5	239	137	57.3	226	144	63.7	206	122	59.2	200	98	49.0	214	123	57.5
	South	1,724	958	55.6	336	203	60.4	411	229	55.7	365	196	53.7	325	170	52.3	287	160	55.7
	West	836	483	57.8	183	99	54.1	171	98	57.3	150	95	63.3	165	87	52.7	167	104	62.3

Source: De-identified Optum[®] Clinformatics[®] Data Mart, 2004-2016

NOTE: Enrollees with full enrollment in commercial health plan from birth through 2 years of age.

Table 4.3: Claim-based prevalence of 0, 1, or 2+ corrective procedures among males with hypospadias aged 0 to 2 years and enrolled in private insurance from birth through 2 years of age, overall and by birth year, 2005-2016

		Overall			2005-2006			2007-2008			2009-2010			2011-2012			2013-2014		
		0	1	2+	0	1	2+	0	1	2+	0	1	2+	0	1	2+	0	1	2+
		%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
Overall		43.4	51.0	5.6	42.0	52.0	6.1	42.3	51.9	5.8	42.9	50.2	6.9	47.3	48.6	4.0	42.8	52.2	5.0
Race	White	42.9	51.7	5.4	43.1	50.9	6.1	41.5	52.7	5.8	42.5	51.3	6.2	46.2	50.3	3.5	41.8	52.9	5.3
	Black	39.0	54.5	6.5	37.7	52.8	9.4	47.1	47.1	5.9	36.8	52.9	10.3	32.4	63.2	4.4	41.5	56.6	1.9
	Hispanic	48.2	45.5	6.3	34.4	59.0	6.6	45.2	50.0	4.8	51.6	38.7	9.7	62.5	32.1	5.4	48.4	46.8	4.8
	Asian	53.6	42.3	4.1	51.2	41.5	7.3	52.5	45.0	2.5	51.3	46.2	2.6	60.9	34.8	4.3	50.0	46.4	3.6
	Unknown	40.9	52.1	6.9	36.8	60.5	2.6	36.7	55.0	8.3	39.1	50.0	10.9	52.1	39.6	8.3	44.8	48.3	6.9
Region	Northeast	43.8	51.1	5.1	41.0	51.0	8.0	46.1	51.6	2.3	44.3	50.0	5.7	39.2	55.9	4.9	49.3	45.1	5.6
	Midwest	42.5	53.5	4.0	42.7	52.7	4.6	36.3	59.7	4.0	40.8	54.9	4.4	51.0	46.5	2.5	42.5	53.3	4.2
	South	44.4	49.4	6.1	39.6	52.7	7.7	44.3	49.9	5.8	46.3	46.3	7.4	47.7	48.6	3.7	44.3	49.8	5.9
	West	42.2	51.0	6.8	45.9	50.3	3.8	42.7	46.8	10.5	36.7	53.3	10.0	47.3	46.7	6.1	37.7	58.1	4.2

Source: De-identified Optum® Clinformatics® Data Mart, 2004-2016

NOTE: Enrollees with full enrollment in commercial health plan from birth through 2 years of age.

Table 4.4: Total corrective procedures (CP) per person in the first 2 years of life among males with hypospadias and enrolled in private insurance from birth through 2 years of age, overall and by birth year, 2005-2016

Demographic Characteristics		Overall			2005-2006			2007-2008			2009-2010			2011-2012			2013-2014		
		Total N	CP N	CP per person	Total N	CP N	CP per person	Total N	CP N	CP per person	Total N	CP N	CP per person	Total N	CP N	CP per person	Total N	CP N	CP per person
Overall		4,152	2,625	0.6	858	561	0.7	936	604	0.6	827	538	0.7	792	456	0.6	739	466	0.6
Race	White	3,086	1,961	0.6	627	406	0.6	706	462	0.7	612	395	0.6	574	333	0.6	567	365	0.6
	Black	310	213	0.7	53	38	0.7	68	41	0.6	68	53	0.8	68	49	0.7	53	32	0.6
	Hispanic	303	177	0.6	61	44	0.7	62	37	0.6	62	36	0.6	56	24	0.4	62	36	0.6
	Asian	194	99	0.5	41	23	0.6	40	20	0.5	39	21	0.5	46	20	0.4	28	15	0.5
	Unknown	259	175	0.7	76	50	0.7	60	44	0.7	46	33	0.7	48	30	0.6	29	18	0.6
Region	Northeast	507	314	0.6	100	70	0.7	128	72	0.6	106	65	0.6	102	67	0.7	71	40	0.6
	Midwest	1,085	672	0.6	239	150	0.6	226	155	0.7	206	131	0.6	200	104	0.5	214	132	0.6
	South	1,724	1,083	0.6	336	235	0.7	411	256	0.6	365	226	0.6	325	185	0.6	287	181	0.6
	West	836	556	0.7	183	106	0.6	171	121	0.7	150	116	0.8	165	100	0.6	167	113	0.7

CP: corrective procedure

Source: De-identified Optum® Clinformatics® Data Mart, 2004-2016

NOTE: Enrollees with full enrollment in commercial health plan from birth through 2 years of age.

Table 4.5: Descriptive characteristics of all hypospadias corrective procedures occurring among males aged 0 to 2 years and enrolled in private insurance from birth through 2 years of age, overall and by year, 2005-2016

Demographic Characteristics		Overall		2005-2006		2007-2008		2009-2010		2011-2012		2013-2014		2015-2016	
		N procedures	%	N procedures	%	N procedures	%	N procedures	%	N procedures	%	N procedures	%	N procedures	%
Overall		2,909	100.0	536	100.0	603	100.0	554	100.0	522	100.0	432	100.0	195	100.0
Age (months)	0 to <6	457	15.7	80	14.9	99	16.4	72	13.0	103	19.7	68	15.7	18	9.2
	6 to <12	1,658	57.0	315	58.8	338	56.1	312	56.3	276	52.9	267	61.8	100	51.3
	12 to <18	579	19.9	113	21.1	129	21.4	124	22.4	99	19.0	65	15.0	49	25.1
	18 to <24	215	7.4	28	5.2	37	6.1	46	8.3	44	8.4	32	7.4	28	14.4
Race	White	2,171	74.6	400	74.6	449	74.5	412	74.4	371	71.1	342	79.2	145	74.4
	Black	224	7.7	28	5.2	47	7.8	42	7.6	58	11.1	31	7.2	16	8.2
	Hispanic	196	6.7	40	7.5	39	6.5	36	6.5	37	7.1	24	5.6	19	9.7
	Asian	109	3.7	17	3.2	20	3.3	24	4.3	26	5.0	13	3.0	7	3.6
	Unknown	209	7.2	51	9.5	48	8.0	40	7.2	30	5.7	22	5.1	8	4.1
Region	Northeast	346	11.9	63	11.8	75	12.4	65	11.7	70	13.4	51	11.8	15	7.7
	Midwest	748	25.7	136	25.4	165	27.4	140	25.3	111	21.3	126	29.2	50	25.6
	South	1,210	41.6	233	43.5	255	42.3	224	40.4	234	44.8	155	35.9	80	41.0
	West	605	20.8	104	19.4	108	17.9	125	22.6	107	20.5	100	23.1	50	25.6
Site of service	Inpatient	128	4.4	28	5.2	25	4.1	15	2.7	31	5.9	18	4.2	7	3.6
	Ambulatory	2,781	95.6	508	94.8	578	95.9	539	97.3	491	94.1	414	95.8	188	96.4

Source: De-identified Optum[®] Clinformatics[®] Data Mart, 2004-2016

NOTE: Enrollees with full enrollment in commercial health plan from birth through 2 years of age.

Table 4.6: Claim-based prevalence of preoperative androgen stimulation (PAS) among males undergoing a hypospadias corrective procedure in the first 2 years of life and enrolled in private insurance from birth through 2 years of age, overall and by birth year, 2005-2016

	Overall			2005-2006			2007-2008			2009-2010			2011-2012			2013-2014		
	Total N	N with PAS	%	Total N	N with PAS	%	Total N	N with PAS	%	Total N	N with PAS	%	Total N	N with PAS	%	Total N	N with PAS	%
Overall	2,350	100	4.3	498	14	2.8	540	16	3.0	472	39	8.3	417	14	3.4	423	17	4.0
Race																		
White	1,761	66	3.7	357	9	2.5	413	7	1.7	352	27	7.7	309	9	2.9	330	14	4.2
Black	189	6	3.2	33	0	0.0	36	2	5.6	43	3	7.0	46	0	0.0	31	1	3.2
Hispanic	157	11	7.0	40	2	5.0	34	2	5.9	30	2	6.7	21	3	14.3	32	2	6.3
Asian	90	6	6.7	20	1	5.0	19	3	15.8	19	2	10.5	18	0	0.0	14	0	0.0
Unknown	153	11	7.2	48	2	4.2	38	2	5.3	28	5	17.9	23	2	8.7	16	0	0.0
Region																		
Northeast	285	7	2.5	59	1	1.7	69	2	2.9	59	3	5.1	62	0	0.0	36	1	2.8
Midwest	624	27	4.3	137	3	2.2	144	4	2.8	122	12	9.8	98	4	4.1	123	4	3.3
South	958	44	4.6	203	6	3.0	229	7	3.1	196	13	6.6	170	7	4.1	160	11	6.9
West	483	22	4.6	99	4	4.0	98	3	3.1	95	11	11.6	87	3	3.4	104	1	1.0

Source: De-identified Optum® Clinformatics® Data Mart, 2004-2016

NOTE: Enrollees with full enrollment in commercial health plan from birth through 2 years of age.

Table 4.7: Cumulative probability of a hypospadias-related corrective procedure among males with hypospadias enrolled in private insurance from birth through 2 years of age, 2004-2016

Demographic Characteristics		Total N	Cumulative Probability (%)				
			6 months	9 months	12 months	18 months	24 months
Overall		4,596	9.5	33.5	44.4	54.2	56.7
Race	White	3,407	9.5	34.5	45.4	55.1	57.2
	Black	332	12.3	35.2	48.2	57.5	60.2
	Hispanic	337	8.9	25.2	36.5	47.2	51.3
	Asian	212	6.6	29.7	34.9	41.5	46.2
	Unknown	308	8.8	32.5	45.1	56.8	59.7
Region	Northeast	559	7.2	35.2	44.4	53.0	56.0
	Midwest	1,199	8.3	32.1	43.7	55.7	58.0
	South	1,925	10.9	32.4	43.8	53.2	55.5
	West	913	9.5	36.6	46.8	54.8	57.8
Site of first procedure	Inpatient	85	29.4	56.5	74.1	90.6	100
	Ambulatory	2,520	16.3	59.2	78.5	95.7	100
	No procedure	1,991	0.0	0.0	0.0	0.0	0.0

Source: De-identified Optum® Clinformatics® Data Mart, 2004-2016

NOTE: Enrollees with full enrollment in commercial health plan from birth through 2 years of age.

Table 5.1: Claim-based prevalence of any repeat hypospadias corrective procedure (CP) among males with a first hypospadias procedure and enrolled in private insurance from birth through 18 months post-operation, overall and by year of initial procedure, 2004-2016

		Overall			2004-2007			2008-2011			2012-2015		
		Total N	N with repeat CP	%	Total N	N with repeat CP	%	Total N	N with repeat CP	%	Total N	N with repeat CP	%
Overall		2,356	281	11.9	717	95	13.2	947	111	11.7	692	75	10.8
Age at first procedure (months)	0 to <6	453	64	14.1	137	22	16.1	180	23	12.8	136	19	14.0
	6 to <12	1,463	149	10.2	462	52	11.3	572	62	10.8	429	35	8.2
	12 to <18	331	53	16.0	100	20	20.0	145	19	13.1	86	14	16.3
	18 to <24	64	13	20.3	15	0	0.0	32	7	21.9	17	6	35.3
	24 to <30	16	1	6.3	2	0	0.0	6	0	0.0	8	1	12.5
	30 to <36	8	0	0.0	0	0	0	3	0	0.0	5	0	0.0
	36+	21	1	4.8	1	1	100.0	9	0	0.0	11	0	0.0
Race	White	1,774	202	11.4	531	69	13.0	707	79	11.2	536	54	10.1
	Black	181	24	13.3	47	7	14.9	74	11	14.9	60	6	10.0
	Hispanic	152	22	14.5	48	8	16.7	64	9	14.1	40	5	12.5
	Asian	89	12	13.5	23	5	21.7	40	3	7.5	26	4	15.4
	Unknown	160	21	13.1	68	6	8.8	62	9	14.5	30	6	20.0
Region	Northeast	283	33	11.7	81	13	16.0	124	10	8.1	78	10	12.8
	Midwest	605	52	8.6	190	16	8.4	235	20	8.5	180	16	8.9
	South	977	129	13.2	301	51	16.9	406	47	11.6	270	31	11.5
	West	491	67	13.6	145	15	10.3	182	34	18.7	164	18	11.0
Site of first procedure	Inpatient	80	30	37.5	26	8	30.8	31	14	45.2	23	8	34.8
	Ambulatory	2,276	251	11.0	691	87	12.6	916	97	10.6	669	67	10.0
Preoperative androgen stimulation	No	2,256	242	10.7	699	87	12.4	895	91	10.2	662	64	9.7
	Yes	100	39	39.0	18	8	44.4	52	20	38.5	30	11	36.7

CP: corrective procedure

Source: De-identified Optum[®] Clinformatics[®] Data Mart, 2004-2016

NOTE: Enrollees with full enrollment in commercial health plan from birth through 18 months post operation.

Table 5.2: Total repeat hypospadias corrective procedures (CP) per person among males with a repeat hypospadias procedure and enrolled in private insurance from birth through 18 months post-operation, overall and by year of initial procedure, 2004-2016

		Overall			2004-2007			2008-2011			2012-2015		
		Total N	N repeat CP	CP per person	Total N	N repeat CP	CP per person	Total N	N repeat CP	CP per person	Total N	N repeat CP	CP per person
Overall		279	350	1.3	95	121	1.3	110	136	1.2	74	93	1.3
Age at first procedure (months)	0 to <6	64	86	1.3	22	32	1.5	23	27	1.2	19	27	1.4
	6 to <12	149	184	1.2	52	64	1.2	62	78	1.3	35	42	1.2
	12 to <18	52	62	1.2	20	24	1.2	18	22	1.2	14	16	1.1
	18 to <24	12	16	1.3	0	0	0	7	9	1.3	5	7	1.4
	24 to <30	1	1	1.0	0	0	0	0	0	0	1	1	1.0
	36+	1	1	1.0	1	1	1.0	0	0	0	0	0	0
Race	White	201	255	1.3	69	91	1.3	79	98	1.2	53	66	1.2
	Black	24	29	1.2	7	8	1.1	11	14	1.3	6	7	1.2
	Hispanic	22	29	1.3	8	11	1.4	9	11	1.2	5	7	1.4
	Asian	12	13	1.1	5	5	1.0	3	4	1.3	4	4	1.0
	Unknown	20	24	1.2	6	6	1.0	8	9	1.1	6	9	1.5
Region	Northeast	33	38	1.2	13	17	1.3	10	11	1.1	10	10	1.0
	Midwest	52	62	1.2	16	22	1.4	20	23	1.2	16	17	1.1
	South	128	167	1.3	51	65	1.3	47	58	1.2	30	44	1.5
	West	66	83	1.3	15	17	1.1	33	44	1.3	18	22	1.2
Site of first procedure	Inpatient	28	50	1.8	8	12	1.5	13	26	2.0	7	12	1.7
	Ambulatory	251	300	1.2	87	109	1.3	97	110	1.1	67	81	1.2
Preoperative androgen stimulation	No	241	299	1.2	87	112	1.3	90	108	1.2	64	79	1.2
	Yes	38	51	1.3	8	9	1.1	20	28	1.4	10	14	1.4

CP: corrective procedure

Source: De-identified Optum® Clinformatics® Data Mart, 2004-2016

NOTE: Enrollees with full enrollment in commercial health plan from birth through 18 months post operation.

Table 5.3: Claim-based prevalence of postoperative complications due to urethral fistula, stricture, or diverticulum among males undergoing a hypospadias procedure and enrolled in private insurance from birth through 18 months post-operation, overall and by year of initial procedure, 2004-2016

Demographic Characteristics		Overall			2004-2007			2008-2011			2012-2015		
		Total N	N with complications	%	Total N	N with complications	%	Total N	N with complications	%	Total N	N with complications	%
Overall		2,356	377	16.0	717	126	17.6	947	136	14.4	692	115	16.6
Age at first procedure (months)	0 to <6	453	70	15.5	137	18	13.1	180	31	17.2	136	21	15.4
	6 to <12	1,463	225	15.4	462	83	18.0	572	76	13.3	429	66	15.4
	12 to <18	331	61	18.4	100	21	21.0	145	21	14.5	86	19	22.1
	18 to <24	64	13	20.3	15	3	20.0	32	6	18.8	17	4	23.5
	24 to <30	16	2	12.5	2	1	50.0	6	0	0	8	1	12.5
	30 to <36	8	2	25.0	0	0	0	3	0	0	5	2	40.0
	36+	21	4	19.0	1	0	0	9	2	22.2	11	2	18.2
Race/ethnicity	White	1,774	280	15.8	531	91	17.1	707	103	14.6	536	86	16.0
	Black	181	22	12.2	47	8	17.0	74	8	10.8	60	6	10.0
	Hispanic	152	37	24.3	48	13	27.1	64	11	17.2	40	13	32.5
	Asian	89	20	22.5	23	5	21.7	40	9	22.5	26	6	23.1
	Unknown	160	18	11.3	68	9	13.2	62	5	8.1	30	4	13.3
Region	Northeast	283	80	28.3	81	25	30.9	124	33	26.6	78	22	28.2
	Midwest	605	82	13.6	190	33	17.4	235	25	10.6	180	24	13.3
	South	977	144	14.7	301	49	16.3	406	51	12.6	270	44	16.3
	West	491	71	14.5	145	19	13.1	182	27	14.8	164	25	15.2
Site of first procedure	Inpatient	80	23	28.8	26	6	23.1	31	10	32.3	23	7	30.4
	Ambulatory	2,276	354	15.6	691	120	17.4	916	126	13.8	669	108	16.1
Preoperative androgen stimulation	Yes	100	35	35.0	18	5	27.8	52	15	28.8	30	15	50.0
	No	2,256	342	15.2	699	121	17.3	895	121	13.5	662	100	15.1

Source: De-identified Optum® Clinformatics® Data Mart, 2004-2016

NOTE: Enrollees with full enrollment in commercial health plan from birth through 18 months post operation.

Table 5.4: Claim-based prevalence of postoperative rehospitalization among males undergoing a hypospadias procedure and enrolled in private insurance from birth through 18 months post-operation, overall and by year of initial procedure, 2004-2016

Demographic Characteristics		Overall			2004-2007			2008-2011			2012-2015		
		Total N	N with rehospitalization	%	Total N	N with rehospitalization	%	Total N	N with rehospitalization	%	Total N	N with rehospitalization	%
Overall		2,356	142	6.0	717	47	6.6	947	56	5.9	692	39	5.6
Age at first procedure (months)	0 to <6	453	36	7.9	137	16	11.7	180	11	6.1	136	9	6.6
	6 to <12	1,463	74	5.1	462	20	4.3	572	33	5.8	429	21	4.9
	12 to <18	331	24	7.3	100	9	9.0	145	8	5.5	86	7	8.1
	18 to <24	64	6	9.4	15	1	6.7	32	3	9.4	17	2	11.8
	24 to <30	16	1	6.3	2	1	50.0	6	0	0	8	0	0
	30 to <36	8	0	0	0	0	0	3	0	0	5	0	0
	36+	21	1	4.8	1	0	0	9	1	11.1	11	0	0
Race/ethnicity	White	1,774	108	6.1	531	36	6.8	707	44	6.2	536	28	5.2
	Black	181	7	3.9	47	1	2.1	74	1	1.4	60	5	8.3
	Hispanic	152	15	9.9	48	6	12.5	64	5	7.8	40	4	10.0
	Asian	89	3	3.4	23	1	4.3	40	1	2.5	26	1	3.8
	Unknown	160	9	5.6	68	3	4.4	62	5	8.1	30	1	3.3
Region	Northeast	283	16	5.7	81	5	6.2	124	4	3.2	78	7	9.0
	Midwest	605	29	4.8	190	8	4.2	235	13	5.5	180	8	4.4
	South	977	66	6.8	301	25	8.3	406	25	6.2	270	16	5.9
	West	491	31	6.3	145	9	6.2	182	14	7.7	164	8	4.9
Site of first procedure	Inpatient	116	110	94.8	39	37	94.9	44	42	95.5	33	31	93.9
	Ambulatory	2,240	32	1.4	678	10	1.5	903	14	1.6	659	8	1.2
Preoperative androgen stimulation	Yes	100	20	20.0	18	0	0	52	11	21.2	30	9	30.0
	No	2,256	122	5.4	699	47	6.7	895	45	5.0	662	30	4.5

Source: De-identified Optum[®] Clinformatics[®] Data Mart, 2004-2016

NOTE: Enrollees with full enrollment in commercial health plan from birth through 18 months post operation.

Table 5.5: Cumulative probability of a repeat hypospadias-related corrective procedure among males with a first hypospadias procedure and enrolled in private insurance from birth through 18 months post-operation, 2004-2016

Demographic Characteristics		Total N	Cumulative Probability (%)			
			6 months	9 months	12 months	18 months
Overall		2,356	4.3	8.8	10.4	11.9
Race	White	1,774	4.1	8.3	9.8	11.4
	Black	181	6.1	11.0	11.6	13.3
	Hispanic	152	3.3	11.2	13.8	14.5
	Asian	89	3.4	6.7	12.4	13.5
	Unknown	160	6.9	11.3	12.5	13.1
Region	Northeast	283	2.8	6.0	9.5	11.7
	Midwest	605	3.0	6.3	7.4	8.6
	South	977	5.6	10.3	11.6	13.2
	West	491	4.3	10.6	12.4	13.6
Site of first procedure	Inpatient	80	23.8	31.3	35.0	37.5
	Ambulatory	2,276	3.6	8.0	9.6	11.0
Preoperative androgen stimulation	Yes	100	11.0	32.0	37.0	39.0
	No	2,256	4.0	7.8	9.3	10.7

Source: De-identified Optum[®] Clinformatics[®] Data Mart, 2004-2016

NOTE: Enrollees with full enrollment in commercial health plan from birth through 18 months post initial procedure.

Table 5.6: Cumulative probability of re-hospitalization after a hypospadias procedure among males with a first hypospadias procedure and enrolled in private insurance from birth through 18 months post-operation, 2004-2016

Demographic Characteristics		Total N	Cumulative Probability (%)			
			6 months	9 months	12 months	18 months
Overall		2,356	1.4	2.2	2.4	2.7
Race	White	1,774	1.5	2.3	2.4	2.6
	Black	181	0.0	0.0	0.6	1.1
	Hispanic	152	3.9	4.6	5.9	6.6
	Asian	89	0.0	1.1	1.1	2.2
	Unknown	160	1.3	1.3	1.3	1.3
Region	Northeast	283	0.7	1.4	1.8	2.1
	Midwest	605	1.3	1.7	1.7	2.3
	South	977	1.9	2.7	3.0	3.1
	West	491	1.0	2.2	2.4	2.6
Site of first procedure	Inpatient	116	20.7	24.1	25.9	26.7
	Ambulatory	2,240	0.4	1.0	1.2	1.4
Preoperative androgen stimulation	Yes	100	6.0	11.0	14.0	14.0
	No	2,256	1.2	1.8	1.9	2.2

Source: De-identified Optum[®] Clinformatics[®] Data Mart, 2004-2016

NOTE: Enrollees with full enrollment in commercial health plan from birth through 18 months post initial procedure.

Table 5.7: Total insurer expenditures on hypospadias patients in first three years of life for services with a primary diagnosis of hypospadias, overall and by place of service, 2004-2016

Demographic Characteristics		N	All places of service		Inpatient hospital stays		Hospital-based outpatient services		All other services	
			Total \$	PPP3Y	Total \$	PPP3Y	Total \$	PPP3Y	Total \$	PPP3Y
Overall		3,115	\$16,918,936	\$5,431	\$1,203,470	\$386	\$15,138,095	\$4,860	\$584,027	\$187
Race	White	2,324	\$12,277,196	\$5,283	\$1,000,305	\$430	\$10,866,246	\$4,676	\$415,903	\$179
	Black	222	\$1,186,237	\$5,343	\$41,477	\$187	\$1,101,120	\$4,960	\$44,148	\$199
	Hispanic	224	\$1,361,993	\$6,080	\$85,042	\$380	\$1,214,766	\$5,423	\$62,268	\$278
	Asian	139	\$872,675	\$6,278	\$13,460	\$97	\$838,900	\$6,035	\$20,350	\$146
	Other/Unknown	206	\$1,220,835	\$5,926	\$63,186	\$307	\$1,117,063	\$5,423	\$41,359	\$201
Region	Northeast	401	\$2,191,827	\$5,466	\$158,435	\$395	\$1,935,724	\$4,827	\$98,258	\$245
	Midwest	812	\$3,589,657	\$4,421	\$162,878	\$201	\$3,311,621	\$4,078	\$118,394	\$146
	South	1,301	\$6,839,361	\$5,257	\$771,236	\$593	\$5,848,391	\$4,495	\$221,581	\$170
	West	601	\$4,298,092	\$7,152	\$110,921	\$185	\$4,042,358	\$6,726	\$145,795	\$243
Birth year	2004	311	\$1,510,908	\$4,858	\$142,994	\$460	\$1,312,757	\$4,221	\$55,164	\$177
	2005	300	\$1,845,501	\$6,152	\$211,241	\$704	\$1,557,948	\$5,193	\$76,327	\$254
	2006	323	\$1,676,561	\$5,191	\$47,973	\$149	\$1,553,590	\$4,810	\$75,320	\$233
	2007	350	\$1,876,397	\$5,361	\$64,622	\$185	\$1,740,276	\$4,972	\$71,979	\$206
	2008	369	\$1,751,355	\$4,746	\$13,369	\$36	\$1,671,478	\$4,530	\$67,166	\$182
	2009	312	\$1,673,680	\$5,364	\$98,134	\$315	\$1,530,804	\$4,906	\$45,643	\$146
	2010	318	\$1,821,667	\$5,729	\$138,864	\$437	\$1,619,977	\$5,094	\$62,932	\$198
	2011	310	\$1,860,963	\$6,003	\$75,683	\$244	\$1,742,470	\$5,621	\$44,021	\$142
	2012	258	\$1,263,327	\$4,897	\$101,432	\$393	\$1,127,257	\$4,369	\$36,562	\$142
	2013	264	\$1,638,578	\$6,207	\$309,157	\$1,171	\$1,281,537	\$4,854	\$48,915	\$185

PPP3Y: Expenditures per person per 3-year follow-up period

Source: De-identified Optum[®] Clinformatics[®] Data Mart, 2004-2016

NOTE: Among males with hypospadias who are continuously and fully enrolled in private insurance from birth through 3 years of age.

Table 5.8: Total insurer expenditures for hypospadias corrective procedures within the first three years of life of hypospadias patients, overall and by place of service, 2004-2016

Demographic Characteristics		N	All places of service		Inpatient hospital stays		Hospital-based outpatient services		All other services	
			Total\$	PPP3Y	Total \$	PPP3Y	Total \$	PPP3Y	Total \$	PPP3Y
Overall		1,718	\$12,422,803	\$7,231	\$1,187,547	\$691	\$11,175,815	\$6,505	\$60,895	\$35
Race	White	1,296	\$9,118,939	\$7,036	\$1,065,706	\$822	\$8,014,887	\$6,184	\$39,218	\$30
	Black	134	\$841,837	\$6,282	\$47,007	\$351	\$784,824	\$5,857	\$10,006	\$75
	Hispanic	110	\$960,344	\$8,730	\$23,263	\$211	\$932,295	\$8,475	\$4,786	\$44
	Asian	62	\$600,002	\$9,677	\$8,889	\$143	\$590,734	\$9,528	\$379	\$6
	Other/Unknown	116	\$901,680	\$7,773	\$42,681	\$368	\$853,074	\$7,354	\$6,507	\$56
Region	Northeast	221	\$1,594,330	\$7,214	\$124,799	\$565	\$1,450,840	\$6,565	\$18,691	\$85
	Midwest	460	\$2,799,102	\$6,085	\$272,978	\$593	\$2,517,200	\$5,472	\$10,359	\$23
	South	691	\$5,179,011	\$7,495	\$721,218	\$1,044	\$4,445,831	\$6,434	\$11,961	\$17
	West	346	\$2,850,360	\$8,238	\$68,551	\$198	\$2,761,944	\$7,982	\$19,885	\$57
Birth year	2004	170	\$1,370,037	\$8,059	\$249,426	\$1,467	\$1,118,115	\$6,577	\$2,515	\$15
	2005	172	\$1,391,102	\$8,088	\$129,955	\$756	\$1,240,640	\$7,213	\$20,508	\$119
	2006	174	\$1,288,297	\$7,404	\$123,597	\$710	\$1,161,447	\$6,675	\$3,254	\$19
	2007	203	\$1,379,339	\$6,795	\$42,789	\$211	\$1,332,066	\$6,562	\$4,484	\$22
	2008	204	\$1,392,708	\$6,827	\$17,822	\$87	\$1,370,615	\$6,719	\$4,270	\$21
	2009	168	\$1,205,776	\$7,177	\$74,737	\$445	\$1,130,475	\$6,729	\$1,146	\$7
	2010	185	\$1,282,308	\$6,931	\$119,344	\$645	\$1,156,556	\$6,252	\$6,408	\$35
	2011	169	\$1,208,230	\$7,149	\$69,590	\$412	\$1,135,436	\$6,719	\$3,204	\$19
	2012	135	\$819,154	\$6,068	\$77,554	\$574	\$740,098	\$5,482	\$2,356	\$17
	2013	138	\$1,085,853	\$7,869	\$282,734	\$2,049	\$790,369	\$5,727	\$12,751	\$92

PPP3Y: Expenditures per person per 3-year follow-up period

Source: De-identified Optum[®] Clinformatics[®] Data Mart, 2004-2016

NOTE: Among males with hypospadias who are continuously and fully enrolled in private insurance from birth through 3 years of age.

Table 5.9: Total insurer expenditures for repeat hypospadias corrective procedures within 18 months of initial procedure, 2004-2016

Demographic Characteristics		N	Overall	
			Total \$	PPP18M
Overall		2,165	\$2,018,904	\$933
Age at first procedure (months)	0 to <6	405	\$417,250	\$1,030
	6 to <12	1,331	\$1,122,450	\$843
	12 to <18	320	\$320,560	\$1,002
	18 to <24	64	\$152,018	\$2,375
	24 to <30	16	\$5,855	\$366
	30 to <36	8	\$0	\$0
	36+	21	\$773	\$37
Race	White	1,621	\$1,477,991	\$912
	Black	166	\$108,718	\$655
	Hispanic	141	\$217,453	\$1,542
	Asian	85	\$87,922	\$1,034
	Other/Unknown	152	\$126,820	\$834
Region	Northeast	265	\$208,299	\$786
	Midwest	563	\$289,349	\$514
	South	901	\$987,934	\$1,096
	West	436	\$533,322	\$1,223
Birth year	2004	214	\$179,234	\$838
	2005	220	\$260,526	\$1,184
	2006	234	\$208,899	\$893
	2007	256	\$190,442	\$744
	2008	245	\$142,890	\$583
	2009	224	\$304,212	\$1,358
	2010	219	\$168,488	\$769
	2011	213	\$201,208	\$945
	2012	176	\$156,761	\$891
	2013	164	\$206,244	\$1,258
Preoperative androgen stimulation	Yes	39	\$307,486	\$7,884
	No	2,126	\$1,711,418	\$805

PPP18M: Expenditures per person per 18-month follow-up period

Source: De-identified Optum[®] Clinformatics[®] Data Mart, 2004-2016

NOTE: Among males with hypospadias who are continuously and fully enrolled in private insurance from birth through 3 years of age.