Appendix

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I. Key Concepts of Care Management Activities For Children with Medical Complexity

Provided below are key concepts of care management activities of children with medical complexity (CMC) described in prior studies that influence the children’s health and quality of care.

Understanding the Child’s Health

Through recurrent communication with the child, their family, and care team, it is important that clinicians in care management achieve an on-going understanding of the child’s acute and chronic health problems, healthcare needs, issues that could modify the child’s health for better or worse, important physical examination findings, health trajectory, well-being, and quality of life.

Managing Health Information

CMC can accumulate a very large amount of health information. It is important to organize, update, validate, and share the child’s health records as well as help the family and other health care team keep track of and actively use the child’s health records when making treatment decisions.

Creating Care Plans

Care managers can help coordinate care with the child’s healthcare team to create proactive care plans that will help 1) treat acute illnesses, 2) avoid chronic illness exacerbations, 3) meet all of the child’s healthcare needs; 4) manage the roles and responsibilities of the child’s health care team, and 5) optimize the child’s well-being and quality of life.

Providing Urgent Care

Through rapid response in the outpatient, community, and home settings, care managers can help make possible the ability to deliver high quality urgent care to the children by executing care plans, mitigating the illness severity of urgent health problems, and shortening acute illness duration.

Empowering Families

Care managers can help assess family values and perceptions, teach caregiving skills, assist with home caregiving activities, support physical and emotional health, address financial and social issues, and encourage shared medical-decision making.

These care management activities help to:

1) Optimize the health of CMC who are at high risk for poor health outcomes and excessive healthcare utilization;
2) Prevent altogether or address early-on health problems that otherwise would require the need for expensive health services;
3) Rapidly and effectively respond to changes in patients’ conditions to avoid use of unnecessary use of health services; and
4) Ensure efficient and successful transitions of hospitalized CMC at admission and hospital discharge.
II. Example Approaches to Conduct Care Management Activities For Children with Medical Complexity

<table>
<thead>
<tr>
<th>Community Case Management6</th>
<th>Primary Care Clinic3</th>
<th>Complex Care Clinic4</th>
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**Example of care management services provided in the community, independent of a clinical practice:**

Medicaid contracts with community care management personnel (e.g., nurse or social worker) working independently of an outpatient or community clinic to integrate with the children’s existing healthcare providers, school, hospitals, etc. to perform various care management activities. The nurses make home visits, attend clinic visits, and interact directly with hospital personnel when the children are admitted.

*Annual cost per 2 hours of care management activities per month per child = $1200.*

**Example of enhancing care management for CMC in a primary care pediatric practice:**

Within a practice, CMC are distinguished to receive special care characterized by access to a designated pediatric nurse practitioner (8 hours per week), consultation from a local parent, modifications of office routines, implementation of an individualized health plan, regularly scheduled continuing medical and nursing education, and expedited referrals and communication with specialists and hospital-based personnel.

Systems were developed to streamline the ordering of medications and supplies as well as coordinating patient appointments so that family burden was minimized. Care plans were created and maintained in Word and faxed to specialists, emergency departments, hospitals, etc.

*Annual cost per child = $500.*

**Example of care management in a consultative, outpatient clinic dedicated entirely to CMC:**

Nurse care managers (NCM) serve as a single point of contact for patients and families, PCPs, and community resources. They prepare a plan of care, facilitate communication among specialists and PCPs, attend appointments, work with community agencies and insurers to make sure that the children had all needed services. They sometimes spend up to 20 hours per patient per month.

Physicians are available 24 hours / 7 days a week. They performed detailed H&Ps, reviewed the medical record, and synthesized the child’s many problems in a comprehensive summary provided to the family, PCP, and specialists. The physicians frequently arbitrate among competing diagnoses and therapies. They see patients electively in the clinic, urgently in the ED, and occasionally at home or in the PCPs’ office. They facilitated admissions and coordinated care during the hospital stay.

*Annual cost per child = $3,500.*
Key Concepts and Evidence of Care Management for Children with Medical Complexity

III. Evidence of the Impact of Care Management on Health Care Utilization and Cost

Provided below are the results from studies on care management for CMC. The studies have a pre-post intervention study design without a control group for comparison. The studies do not distinguish the specific types of health care encounters (e.g., specific types of hospitalizations or emergency department visits) that were affected by care management activities.

<table>
<thead>
<tr>
<th>Emergency Department Care</th>
<th>Hospital Care</th>
<th>Outpatient Care</th>
<th>Post-acute And Home Nursing Care</th>
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<tbody>
<tr>
<td>• 18%-55% reduction in emergency department visits(^7,8)</td>
<td>• 26-59% reduction in the total number of admissions(^3,4,6)</td>
<td>• 72% increase in the number of outpatient encounters(^4)</td>
<td>• Impact of care management on post-acute and home nursing care is not described</td>
</tr>
<tr>
<td>• 12% reduction in emergency department expenditures(^6)</td>
<td>• 52% reduction in the total number of hosp. days(^4)</td>
<td>• 3%-17% increase in outpatient care expenditures(^6,8)</td>
<td>• Increased use of post-acute and home nursing care may occur(^18,19)</td>
</tr>
</tbody>
</table>

IV. Evidence of Potentially-Avoidable Healthcare Encounters

Emergency Department Visits (ED) Not Associated with Admission\(^6,8,17\) ED visits not associated with admission are increasingly used as a first step toward understanding which ED visits might be potentially avoided in CMC. It is believed that up to one-third of these visits could have been managed in the outpatient or community settings.

Hospital Days\(^3,4,6,8\) Although hospital admissions for some CMC may not be avoidable, the efficiency of their inpatient acute care could be improved with the receipt of high quality care management. For example, hospital days for some CMC might be reduced with increased exposure to home nursing or post-acute care.

30-day Unplanned Readmission\(^10-14\) CMC have the highest rates of unplanned readmission of all children. There is variation in readmission rates of CMC across hospitals that is unrelated to differences in casemix. The quality of their discharge and follow-up care affects their readmission risk. To exclude planned readmissions, we used a set of 2418 ICD-9-CM procedure codes that were identified by pediatric specialists as indicative of elective procedures that were scheduled in advance of admission (e.g., Nissen fundoplication).

Admissions for Ambulatory Care Sensitive Conditions (ACSC)\(^10,15,16\) Hospital admissions of CMC that are avoided entirely by outpatient care management are, by definition, sensitive to ambulatory care. The Agency for Healthcare Research and Quality developed a set of ACSCs that are being increasingly used as a first step to understanding which CMC admissions might be potentially-avoidable. Pediatric experts were involved in the development of ACSCs. ACSCs include illnesses such as upper respiratory illness and gastroenteritis.
References Cited


**Business Case and Sensitivity Analysis of Care Management for Children with Medical Complexity**

**Phase 1. Quantify the funds available for care management from the reduction of different types of potentially avoidable healthcare encounters**

**1st Step.** Set a reasonable base case and range of potential levels of reduction.

From a literature review, taking into account studies’ methods, results, and limitations, we set 10% (with a range of 0-20%) as a reasonable base case for reduction of the 4 healthcare encounters described below.

1. Emergency department visits not associated with admission
2. Hospital days (total)
3. Admissions for ambulatory care sensitive conditions
4. 30-day unplanned readmissions

**2nd Step.** Determine the cost saved from base case and range of reductions.

Using the 2011 Truven Medicaid Marketscan Database, we quantified the cost associated with the above reductions in a cohort of children with medical complexity (CMC).

**Phase 2. Assess potential investments in care management underwritten by cost savings achieved by reduction of potentially avoidable healthcare encounters**

**3rd Step.** Compare the amount of funds available per child that could underwrite budget-neutral investments in care management.

Using the 2011 Truven Medicaid Marketscan Database, we assessed the amount of saved cost per child due to potential reductions (base case and range) of different types of potentially avoidable healthcare encounters in a cohort of CMC.

**4th Step.** Determine the percentage of CMC whose care management could be served by different approaches of care management relying only on the funds derived from the reduction.

We assessed the following 4 approaches to care management, drawing on published estimated costs per patient for each approach:

1. Community Nursing Care Management
2. Care Management in a Complex Care Clinic
3. Increased use of Post-Acute Care
4. Increased use of Home Nursing Care
**Trends in Pediatric Hospital Resource Use Attributable to Children with Medical Complexity Using Medicaid from 2000 to 2009**

Data Source: Kids’ Inpatient Database, Agency for Healthcare Research and Quality

Caption: This exhibit describes the national trends in the percentage of hospitalizations, hospital bed days, and hospital charges attributable to children with medical complexity using Medicaid throughout the United States.
Variation in Healthcare Spending on Emergency Department Visits across Distinct Types of Children with Medical Complexity

**Data Source:** Truven Marketscan Medicaid Database, 2011.

**Caption:** Shapes indicate a distinct type of CMC based on their complex chronic conditions. The list of complex chronic conditions is cardiovascular, gastrointestinal, hematologic or immunologic, malignancy, metabolic, neurologic and neuromuscular, other congenital or genetic defect, premature and neonatal, renal and urologic, respiratory, technology dependence, and transplantation. Shown on the y axis is the covariance (i.e., variability) of spending for each distinct type of CMC. Shown on the x axis is the percent of total emergency department visits attributable to each distinct type of CMC.
Variation in Healthcare Spending on Ambulatory Care Sensitive Conditions across Distinct Types of Children with Medical Complexity

Data Source: Truven Marketscan Medicaid Database, 2011.

Caption: Shapes indicate a distinct type of CMC based on their complex chronic conditions. The list of complex chronic conditions is cardiovascular, gastrointestinal, hematologic or immunologic, malignancy, metabolic, neurologic and neuromuscular, other congenital or genetic defect, premature and neonatal, renal and urologic, respiratory, technology dependence, and transplantation. Shown on the y axis is the covariance (i.e., variability) of spending for each distinct type of CMC. Shown on the x axis is the percent of total admissions for ambulatory care sensitive conditions attributable to each distinct type of CMC.
Variation in Healthcare Spending on 30-day Unplanned Hospital Readmission across Distinct Types of Children with Medical Complexity

Data Source: Truven Marketscan Medicaid Database, 2011.

Caption: Shapes indicate a distinct type of CMC based on their complex chronic conditions. The list of complex chronic conditions is cardiovascular, gastrointestinal, hematologic or immunologic, malignancy, metabolic, neurologic and neuromuscular, other congenital or genetic defect, premature and neonatal, renal and urologic, respiratory, technology dependence, and transplantation. Shown on the y axis is the covariance (i.e., variability) of spending for each distinct type of CMC. Shown on the x axis is the percent of total 30-day unplanned hospital readmissions attributable to each distinct type of CMC.