Using Predictive Models to Identify Potential Underutilization and Overutilization

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Predictive Models and Underutilization

- **Predictive models are generally used to identify groups and even individuals likely to use expensive resources in the future**

- **Predictive models should also identify individuals using significantly fewer resources than expected**

- **Early intervention can potentially prevent regression to the mean of their peers with a similar burden of illness**

Expected vs. Actual Cost Variance

- **Predictive models generate prospective and concurrent cost predictions.**

- **Concurrent cost predictions represent "expected" costs since they take into account all known diagnoses occurring in the past year.**

- **By comparing actual costs (A) with the expected costs (E), the variance can be either positive or negative.**

Underutilization (E>>A)

Problem with and Causes of Underutilization

- **Individuals whose actual costs are $10K or more below their peers with a similar burden of illness may not be accessing appropriate and needed care**
- **Barriers to care:**
  - **Financial**
  - **Transportation**
  - **Language**
  - **Inadequate communication by providers**
  - **Inadequate medical literacy**
  - **Denial of illness**
  - **Substance abuse, psychiatric illness, competing priorities**

Potential Underutilizers* by Cost Variance

Distribution of Potential Underutilizers
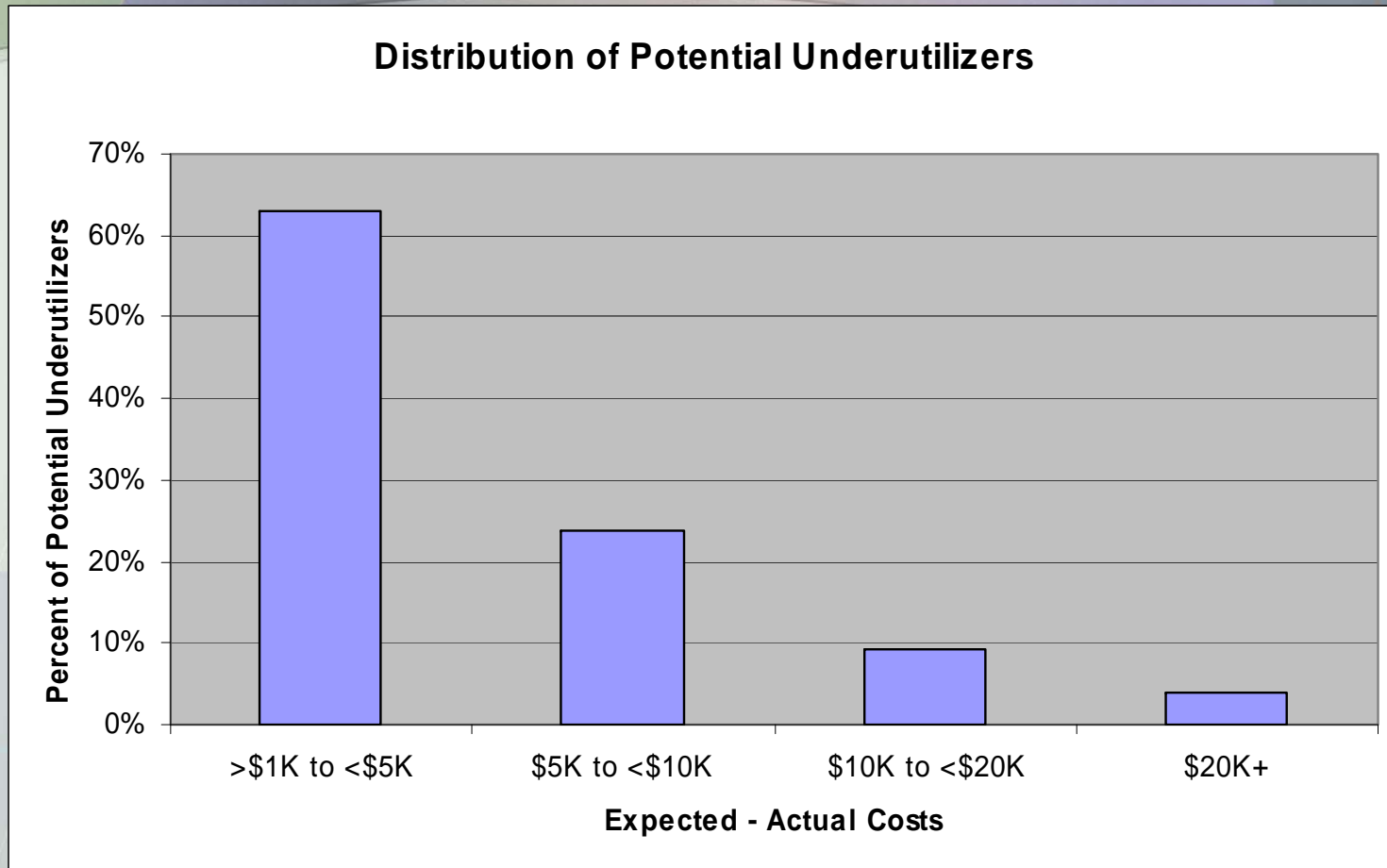
*Potential underutilizers are those E – A >$1K and represent ~20% of the total population.

High probability underutilizers (E – A >= $10K) are ~3% of the total population and ~12% of the potential underutilizers.

Distribution of High Probability Underutilizers (Expected $ – Actual $ >= $10K)

Expected $ - Actual $>= $10,000	Severity Level					
Case Mix	**1**	**2**	**3**	**4**	**5**	**6**
1 **Healthy**	<<1%					
2 **History of Acute Diagnosis**	<<1%					
3 **One Minor Chronic Disease**	0%	1%				
4 **Multiple Minor Chronic Diseases**	0%	0%	0%	0%		
5 **One Significant Chronic Disease**	<<1%	2%	5%	2%	1%	<<1%
6 **Two Significant Chronic Diseases**	4%	15%	18%	12%	5%	1%
7 **Three or More Significant Chronic Diseases**	1%	3%	5%	1%	1%	<<1%
8 **Complicated Malignancies**	2%	5%	4%	3%	<<1%	
9 **Catastrophic Conditions**	<<1%	1%	<<1%	1%	<<1%	<<1%

Note: % refers to distribution of high probability underutilizers (E – A > $10K) in Clinical Risk Group matrix

Yellow categories are those with >=5% of high probability underutilizers.

Example

- **60 year old: diabetes, asthma and hypertension.**
  - **During the last 12 months**
    - **3 PCP visits**
    - **No BP, DM meds; multiple visits for upper respiratory infections, no asthma control meds**
    - **Incomplete diabetic surveillance (no hemoglobin A1c, microalbumin test, lipid testing)**
    - **No flu shot documented**

Another Example

- **30 year old: diabetes, asthma and hypertension.**
  - **During the last 4 years, variance in expected and actual has grown incrementally from $4K to $20K**
    - **Asthma and BP only treated with appropriate meds during the last 2-3 months**
    - **Incomplete diabetic surveillance (no hemoglobin A1c, microalbumin test)**
    - **No flu shot ever documented**

More Examples

- **50 year old male: pathologic fractures of the spine noted in 2/06**
  - One MD visit in the last year
  - No blood work since diagnosis made
  - Only Rx is narcotic
- **54 year old with multiple sclerosis**
  - Seen exclusively by physician's assistant for over two years
  - No routine preventive services in 3 years
- **44 year old with hypertension, CHF**
  - One MD visit in the last 17 months

Some Causes of False Positives

- **Under-statement of actual costs**
  - **Coordination of Benefits**
  - **No pharmacy coverage under the insurer providing claims data**
  - **Incurred but not reported claims (IBNR)**

Minimizing False Positives

- **Flag those without pharmacy benefits**
- **Flag those with COB for whom the carrier being analyzed is secondary**

Other Causes of False Positives

- **Predictive model over-estimates expected costs**
  - Severity due to apparent complication (e.g. infectious disease based on antibiotic use)
  - Insufficient weight to the passage of time (e.g. pregnancy predicting subsequent likelihood of another pregnancy, cancer and HIV costs)
- **Incorrect coding creates apparent complications and model upgrades severity**

Causes of False Negatives

- **Predictive model under-estimates expected costs**
  - **Weights used are based on a generic population but the group is skewed in its average costs**
  - **Geographic cost factors in the study population are not representative of the one used in the predictive model**
- **Undercoding incorrectly suggests a lower burden of illness**

Reducing False Negatives

- **Use group specific weights whenever possible**

Overutilization
(A>>E)

The Difficulty Identifying Overutilization

- **Those with a high burden of illness are expected to have high cost**
- **To understand which high cost individuals need a closer review of appropriateness requires a benchmark**
- **The expected costs generated by predictive models can provide this benchmark.**

Identifying Overutilization

- **Increased variance between actual and expected costs helps contextualize high costs to find true outliers within high burden of illness peer groups**

- **The Clinical Risk Group case mix/severity matrix helps identify high cost individuals with a relatively low burden of illness**

Potential Overutilizers* by Cost Variance

Distribution of Overutilizers
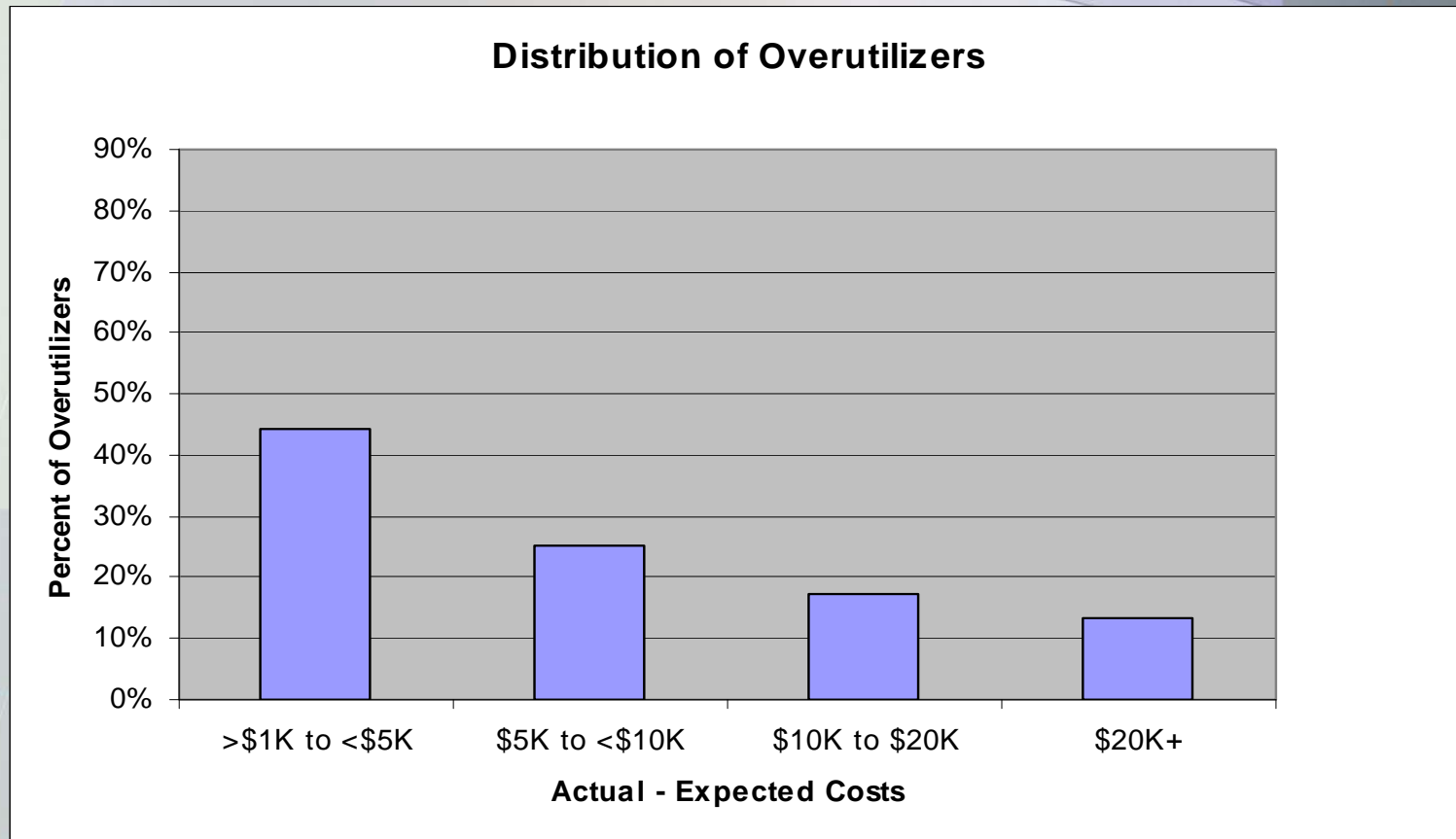
*Potential overutilizers are those A - E >$1K and represent ~20% of the total population.

High probability overutilizers (A – E >= $10K) are ~3% of the total population and ~30% of the potential overutilizers.

Distribution of High Probability Overutilizers (Actual $ – Expected $ >= $10K)

Actual $ - Expected $ >= $10,000		Severity of Illness Level					
Case Mix		1	2	3	4	5	6
1	Healthy	3%					
2	One or More Significant Acute Diseases	4%					
3	One Minor Chronic Disease	7%	3%				
4	Multiple Minor Chronic Diseases	2%	1%	4%	1%		
5	One Significant Chronic Disease	10%	7%	3%	1%	<<1%	<<1%
6	Two Significant Chronic Diseases	17%	12%	8%	5%	2%	<<1%
7	Three or More Significant Chronic Diseases	1%	<<1%	1%	<<1%	<<1%	<<1%
8	Complicated Malignancies	1%	2%	2%	1%	<<1%	
9	Catastrophic Conditions	<<1%	<<1%	<<1%	<<1%	<<1%	<<1%

Note: % refers to distribution of high probability overutilizers (A – E >$10K) in Clinical Risk Group matrix

Yellow categories are those with >=5% of high probability overutilizers

Examples

- **57 year old: diabetes, hypertension and adhesive capsulitis (frozen shoulder) with almost $20K in PT and chiropractic services during the last 12 months**

- **15 year old: 7 ER visits in the last 12 months related to episodes of skeletal trauma, genito-urinary symptoms:**

  ?sexual abuse/domestic violence

- **51 year old: with anxiety disorder and almost $20K in lab and radiology testing for neck pain, back pain, chest pain, visual symptoms, muscle pain, etc. during the last 12 months**

Some Causes of False Positives

- **Under-statement of projected costs**
  - **Undercoding, falsely lower burden of illness**
- **High actual costs related to acute, unpredictable events, e.g. trauma, pregnancy, severe acute illness or complication**

Reducing False Positives

- **Profile sources of high costs to determine if these are unpredictable, acute events**

- **High projected costs due to underlying disease burden and high actual costs related to complications from underuse of appropriate services**

Reducing False Negatives

- **Determine if under-service is an issue**
  - **Profile gaps in care**
  - **Determine if physicians visit rate is low**
- **Profile sources of high costs**

Summary

- **Predictive models generate prospective (projected) costs as well as concurrent (expected) cost estimates**

- **The variance between actual and expected costs can be used to identify potential underutilization (E>>A) as well as likely overutilization (A>>E)**

- **Awareness of causes of false positive and false negatives can help define strategies to better identify high opportunity targets for outreach by care managers**

For more information

- **Bernstein R. New Arrows in the Quiver for Targeting Care Management: High Risk vs. High Opportunity Case Identification. J Ambul Care Manage 2007; 30:39-51**

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