UVA Hospital: Predicting Patient Discharge

John Ainsworth quietly sipped coffee outside a conference room at the University of Virginia Hospital, reviewing his notes as he prepared for the meeting inside. As Administrator of Analytics, Ainsworth led data analysis findings around efforts to improve the operational and clinical performance of the hospital. In the summer of 2018, the Board asked Ainsworth and his team to identify new opportunities to improve efficiency of care.

After interviewing hospital staff members at various points in the patient flow, Ainsworth and his team identified the discharge process as a potential source of improvement. There were several categories of patient discharge[1] that seemed particularly inefficient. If the idle time for patients between receiving care and exiting the hospital could be reduced it would substantially improve clinical operations. The team had a robust dataset based on historical information the hospital had collected for each unique patient. Ainsworth was eager to review the model his team wanted to pilot and hopefully use it to propose process changes to make the hospital's discharge process more efficient. Their predications had to be solid. As the conference room door opened, Ainsworth joined his team to see what they had.

Healthcare in the United States

The healthcare system in the United States was complicated, inefficient, and $3.6 trillion was spent on it in 2018.[2] Most individuals in the US who had health insurance coverage did so through their employer, a system dating back to a decision during World War II to exempt employer-based coverage from wage controls and income tax.[3] Employers in turn contracted with large insurance companies to provide coverage for employees. These insurance companies, which included firms like United Health, Anthem, and Cigna, operated as for-profit financial service firms. Revenues for these firms in 2018 were $226 billion, $92 billion, and $49 billion, respectively.[4] Because they were publicly traded, these companies had a fiduciary incentive to increase their profits quarter-on-quarter indefinitely.

A new wrinkle had also been slowly changing the health care market with companies being "self-insured". This meant that the employer was at risk for the entire cost of health care for its employees and used the large

[1] Discharge referred to the process by which a patient who has completed treatment at the hospital exits either to their home or to another care facility.
[2] "Historical National Health Expenditure Data", CMS, https://www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/NationalHealthExpendData/NationalHealthAccountsHistorical (accessed Sept. 1, 2021).
[3] https://www.peoplekeep.com/blog (The previous writer(s) did not indicate what article was used from this blog) ; Michael A. Morrisey, PhD, "Health Insurance, Second Edition", https://account.ache.org/iweb/upload/Morrisey2253_Chapter_1-3b5f4e08.pdf ; United States Census Bureau, "Health Insurance Coverage in the United States: 2018", https://www.census.gov/content/dam/Census/library/publications/2019/demo/p60-267.pdf (accessed Oct. 25, 2021).
[4] UnitedHealth Group Incorporated Form 10-K, 2018; Anthem, INC. Form 10-K, 2018; Cigna Corporation Form 10-K, 2018

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insurance companies to manage the plans by providing networks and processing claims. By 2018, sixty percent of companies were self-insured—spurring even more interest in cost reduction.[5]

For those without private insurance, options included self-paying or a government funded insurance provider. Each government program had conditions—people with a disability, were 65 or older, or had End-Stage Renal Disease qualified for Medicare.[6] Those with an income below a certain threshold or individuals with disabilities qualified for Medicaid.[7] Active duty and retired military qualified for Tricare.[8] In addition, the 2014 Affordable Care Act (ACA) created a government-regulated health care insurance exchange consisting of private insurance plans. Payment classes for government funded insurance were lower than for private insurance.

The hospital networks, clinics, and other facilities that furnished care to patients were called providers. Providers generated revenue through "reimbursement rates"—a predetermined fraction of the charges of medical services for which the payor would compensate the hospital. The payor being the insurer (directly or via employer self-insurance), the government program, or the patient's own funds. Hospitals primarily generated revenue through services such as surgery, medical care, technical fees from tests and procedures, and room rates. While all these responsibilities increased hospital revenue, surgical procedures had higher charges that resulted in higher revenue.[9]

Most large payors negotiated with and selected a target group of providers called "in-network" that patients could visit for health care services. These providers arranged agreements with payors on the terms of reimbursement for services provided. While these rates were not usually disclosed, estimates ranged from 30% to 60% of charges—generally government programs paid providers less than private insurers (called payment class).[10] If a hospital billed $100,000 for a surgery, for example, a payor might reimburse $30,000 to $60,000, and the hospital would be forced to absorb or write off the additional cost. Alternatively, if a patient requested care from a provider that was "out of the payor's network," that individual could be responsible for bearing an increased share of the cost.

Unlike physicians who were paid by fee for service, hospitals were paid by diagnosis related groups or DRGs. DRGs were developed in the late 60's and 70's in an effort to group similar types of patients or procedures. DRGs tracked the quality of care and utilization of services so that standards could be developed for hospital reimbursements. Once the system was adopted by the Center for Medicare and Medicaid Services (CMS) in 1983, it soon became widespread amongst all payors.[11]

Further complicating the financial sustainability of providers was bad debt. The Emergency Medical Treatment and Labor Act required hospitals to treat patients in need of emergency services, regardless of an

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[5] Gary Claxton, Anthony Damico, Gregory Foster, Michelle Long, Matthew Rae, and Heidi Whitmore, "Employer Health Benefits 2017 Annual Survery", The Kaiser Family Foundation and Health Research & Educational Trust, https://www.kff.org/report-section/ehbs-2017-section-10-plan-funding/ (accessed Oct. 22., 2021).

[6] Medicare.gov, "What's Medicare", https://www.medicare.gov/what-medicare-covers/your-medicare-coverage-choices/whats-medicare (accessed Oct. 22, 2021).

[7] Optima Health, "Healthcare and More", https://www.optimahealth.com/plans/medicaid/#:~:text=Medicaid%20is%20health%20insurance%20from,Health%20as%20your%20Medicaid%20plan (accessed Oct. 22, 2021).

[8] Tricare, "Tricare 101", https://tricare.mil/Plans/New (accessed Oct. 22, 2021).

[9] Samuel H. Steinberg, Ph.D, "How Does A Hospital Make Money?", Physicians News Digest, November 16, 2006, https://physiciansnews.com/2006/11/16/how-does-a-hospital-make-money/ (accessed Sept. 1, 2021).

[10] Tricia Neuman and Eric Lopez, "How Much More Than Medicare Do Private Insurers Pay? A Review of the Literature", https://www.kff.org/medicare/issue-brief/how-much-more-than-medicare-do-private-insurers-pay-a-review-of-the-literature/ (accessed Oct. 22, 2021).

[11] "Design and Development of the Diagnosis Related Groups (DRG)", CMS, October 2019, https://www.cms.gov/icd10m/version37-fullcode-cms/fullcode_cms/Design_and_development_of_the_Diagnosis_Related_Group_(DRGs).pdf (accessed Oct. 22, 2021).

individual's ability to pay.[12] In 2018, close to 30 million Americans lacked healthcare coverage.[13] Uninsured patients requiring emergency service, and unable to pay for the care they received, presented a unique challenge for providers.

A study from Health Affairs reported that higher percentages of Medicare affiliated patients, higher percentages of uninsured patients and larger expenditures were characteristics associated with less profitable hospitals when compared to more profitable hospitals.[14] As such, providers were squeezed between low reimbursement rates and an inability to collect. Public hospitals faced an even larger challenge as private hospitals were allowed to deny uninsured non-emergency services.[15] These dual pressures forced the managers of provider firms, such as hospital administrators, to continuously seek out more efficient ways to deliver care.

The UVA Hospital

Officially opened on April 13th, 1901, the UVA Hospital was a public, non-profit[16] teaching hospital in Charlottesville, VA. The hospital grew with the Charlottesville community and expanded over time to offer a wide range of services under the university's Medical Center network. The hospital served as a Level 1 trauma center, capable of providing the highest level of total care for patients experiencing extreme injuries or other circumstances. In addition to the hospital, the Medical Center was also comprised of a 40-bed transitional care hospital and primary/specialty care clinics in the surrounding area. The Medical Center prided itself in its history of academics and ensuring remarkable care for the patients it served.[17]

In 2018, the hospital consisted of 612 beds and a workforce of 8,119 full time employees, 889 full time faculty, and 733 residents or fellows.[18] During this time, six specialties[19] ranked in the top 50 nationwide according to the 2017–2018 U.S. News and World Report's Best Hospitals guide. "These awards reflect the ongoing collaboration of our care teams," Rick Shannon MD and executive VP for health affairs said, "to find ways to improve on our excellent, specialized care."[20]

While patient services accounted for almost half (49.2%) of the University of Virginia's total revenue and operational funding in 2018, almost 50% was attributed to patients covered by Medicare or Medicaid (see **Exhibit 1**).[21] According to the university's Financial Report, this high percentage was just one of the difficulties:

> Similar to other health systems across the country, UVA is experiencing unprecedented reimbursement challenges, increasing costs associated with pharmaceuticals and medical supplies, challenges of recruitment and retention of frontline health care workers, and a

[12] "Emergency Medical Treatment & Labor Act (EMTALA)", Centers for Medicare & Medicaid Services, https://www.cms.gov/regulations-and-guidance/legislation/emtala (accessed Sept. 1, 2021).
[13] Edward R. Berchick, Jessica C. Barnett and Rachel D. Upton, "Health Insurance Coverage in the United States: 2018", November 8, 2019, https://www.census.gov/library/publications/2019/demo/p60-267.html (accessed Sept. 2, 2021).
[14] Ge Bai and Gerard F. Anderson, "A More Detailed Understanding Of Factors Associated With Hospital Profitability", Health Affairs, May 2016, https://www.healthaffairs.org/doi/full/10.1377/hlthaff.2015.1193 (accessed Sept. 1, 2021).
[15] For more see What happens when private hospitals avoid treating uninsured patients | Healthcare Finance News (accessed Sept 1, 2021).
[16] Group organized for purposes other than generating profit and in which no part of the organization's income is distributed to its members, directors, or officers – "Non-profit organizations", Cornell Law School, https://www.law.cornell.edu/wex/non-profit_organizations (accessed Sept. 1, 2021).
[17] "University of Virginia Financial Report 2017-2018", https://evp-coo.virginia.edu/system/files/UVA_2017-18_Financial_Report_7k_FINAL_web_PDF_appligent_508.pdf (accessed Sept. 1, 2021). ; "What Is a Trauma Center? Trauma Center Levels: ER vs. Trauma Center", UPMC, May 26 2016, https://share.upmc.com/2016/05/er-vs-trauma-center-levels/ (accessed Sept. 1, 2021).
[18] "Facts & Statistics", UVA Health, https://uvahealth.com/about/facts-stats (accessed Aug. 24, 2021).
[19] The six specialties were cancer; ear, nose, and throat; orthopedics; urology; diabetes and endocrinology; cardiology and heart surgery
[20] "U.S. News & World Report Ranks UVA as No. 1 Hospital in Virginia", UVA Health, August 8, 2017, https://newsroom.uvahealth.com/2017/08/08/u-s-news-world-report-ranks-uva-no-1-hospital-virginia/ (accessed Aug. 24, 2021).
[21] "Meeting of the Health System Board for the University of Virginia Health System", University of Virginia Board of Visitors, June 6, 2018, https://bov.virginia.edu/june-6-8-2018-meeting-board (accessed Sept. 2, 2021).

growing compliance burden. As a state hospital, we also have a continued responsibility to care for the medically underserved in Virginia.[22]

The patient journey

The UVA Hospital cared for 28,539 admitted patients in 2018.[23] Managing the inventory of hospital beds at a care facility was fundamental to its operations. In order to allocate beds most effectively, UVA hospital managers paid particularly close attention to patient progression—the patient's journey that included admission to the hospital, various stages of care, and eventual discharge from the hospital. For many patients, length of care followed a "long-tailed" pattern. Patients were admitted and immediately underwent surgery or other intensive treatment. Afterwards, patients experienced a period of convalescence before discharge. The average length of patient progression was 6.33 days.[24] There were generally seven different types of discharge: Home, Home Health, Skilled Nursing Facility (SNF), Long Term Care Hospital (LTCH), Rehabilitation, Hospice, and Mortality. Patients routinely exited the UVA hospital to other medical facilities, where bed availability could be even more limited. When a hospital patient required relocation, hospital employees coordinated with various providers in their preferred location to find a destination bed. Three discharge types, SNF, LTCH, and Rehabilitation, required the most time for hospital staffers to process because of the time associated with securing a bed at a destination facility.

Unsurprisingly, the hospital's revenue followed the same pattern as patient care. Revenue from patient services exceeded $1.6 billion in 2018.[25] Since hospital reimbursements were based on fixed rates according to DRGs, patients exceeding the usual length of stay could exceed reimbursement. In Virginia, the average cost of one day spent in the hospital was $2,081. Therefore, patients staying in the hospital longer than necessary were a drain on the bottom line. When a bed was "underutilized" because of an excessive length of stay, the hospital experienced both a loss due to the cost and a missed opportunity to provide care for new patients. While this opportunity cost could be difficult to quantify, hospital administrators shared a conviction that more efficient care would lead to greater revenue per bed.

Another issue associated with long convalescence periods was patient infection. The longer a patient stayed in the hospital, the greater the risk of patient infection. If patients required additional treatment for infections deemed responsible by the hospital, reimbursements for the additional care would not be made to the hospital because payment would be based on the original DRG.

Reducing the recovery time required after major treatments was certainly not a viable option to improve operational efficiency. However, reducing the number of beds occupied by medically cleared patients waiting to relocate to a destination bed would minimize non-health related convalescence periods and increase the hospital's revenue.

Data Analysis and Improving Efficiency

As Ainsworth's team learned through the initial data collection, the search process for destination beds at other facilities for hospital patients could be extremely time-consuming. Patients requiring a transfer to another facility were not allowed to move from the hospital until a destination bed was located at the other facility. This rule resulted in longer stays for patients requiring transfer. While the hospital staffed three full-time employees, their success depended on the availability of beds in nearby facilities.

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[22] https://evp-coo.virginia.edu/system/files/UVA_2017-18_Financial_Report_7k_FINAL_web_PDF_appligent_508.pdf
[23] https://uvahealth.com/about/facts-stats
[24] https://uvahealth.com/about/facts-stats
[25] https://evp-coo.virginia.edu/system/files/UVA_2017-18_Financial_Report_7k_FINAL_web_PDF_appligent_508.pdf

This often proved difficult as the landscape of care facilities in Virginia was fragmented. The state contained less than 300 SNFs and nursing homes that qualified for Medicare and Medicaid reimbursement. Many of these facilities provided less than 100 beds.[26] Rehabilitation facilities and long-term care hospitals were similarly small and dispersed. These facilities, unlike the hospital, could deny admission to patients based on the status of insurance coverage.

Additionally, SNF, LTCH, and Rehabilitation discharge types required the hospital to complete a Uniform Assessment Instrument (UAI).[27] This paperwork, which was mandated to secure a bed at another facility, was also required for Medicaid reimbursement. UAIs were long documents that could take hours to complete. See **Exhibit 4** for an example UAI.

The discharge process at UVA Hospital operated through a ticketing system, whereby a discharge recommendation triggered the issuance of a work order for hospital staff to begin the process of finding beds at another facility and completing the UAI (see **Exhibit 5**). The team responsible for this next stage of work was primarily staffed with social workers. In some cases, a patient would be recommended for discharge and then wait for hours as the team worked on the ticket. On average, it took a social worker 4 hours to complete UAI and find a bed in another facility to discharge the patient. The average hourly compensation for social workers is $18.

Ainsworth's team believed that the discharge process was an operation that could benefit from integrating data science into the workflow. The team envisioned training a classification model with the collected data to predict discharge type for incoming patients. Before doctors provided discharge recommendations, the model could be deployed on data from incoming patients to indicate which patients likely required a transfer—giving the staff a head start for tracking down available destination beds and filling out UAI.

Predicting patient discharge pilot

In order to provide discharge predictions before doctors made their recommendations, Ainsworth's team had to first build a predictive model using the available information. As Ainsworth settled into a chair at the head of the table, he was eager to see what his team had come up with that would give hospital staff a head start on finding a new bed and fill out UAI for a patient. Were they able to use machine learning to predict the type of discharge a given patient would undergo to decrease length of stay and ultimately increase revenue at the hospital?

Your task:

Using the data and the starter notebook, your task is to predict whether a given patient needs a transfer. Then, you conduct cost-benefit analysis to compare the estimated cost in the following scenarios:

- Scenario A: No predictive model- wait for the discharge ticket to be triggered and then find a transfer bed and fill out UAI. This is the status quo. The cost associated with this scenario is already calculated in the notebook (i.e., Scenario 1 in the notebook).

[26] "Virginia Skilled Nursing Home Facilities", SeniorCare.com, https://www.seniorcare.com/nursing-homes/va/ (accessed Aug. 24, 2021).
[27] "Uniform Assessment Instrument", Department for Aging and Rehabilitative Services Adult Protective Services Division, December 2015, https://dss.virginia.gov/files/division/licensing/alf/intro_page/current_providers/manuals/uai_users_manual.pdf (accessed Aug. 24, 2021).

- Scenario B: Use a cost-sensitive predictive model to predict who needs to be transferred before the discharge ticket is triggered. Assume that the predictions are made at least 4 hours before the discharge ticket is triggered. Then, calculate the cost associated with this scenario.

Finally, deduct the cost in scenario B from the cost in scenario A. This value is the total saving of your cost-sensitive model. This value (the maximum savings) is the evaluation metric for the leaderboard. Enter the savings amount in leaderboardhq using the link provided below:

Team Number	**Link**
Team 1:	https://leaderboardhq.com/addscore/qrfoujdr/s8sgq5ed
Team 2:	https://leaderboardhq.com/addscore/qrfoujdr/ln1d20ff
Team 3:	https://leaderboardhq.com/addscore/qrfoujdr/ubfeiyfn
Team 4:	https://leaderboardhq.com/addscore/qrfoujdr/4hkmzxli
Team 5:	https://leaderboardhq.com/addscore/qrfoujdr/pth24ax2
Team 6:	https://leaderboardhq.com/addscore/qrfoujdr/8h2xc846
Team 7:	https://leaderboardhq.com/addscore/qrfoujdr/e2hpc7kb
Team 8:	https://leaderboardhq.com/addscore/qrfoujdr/9woqtvvi
Team 9:	https://leaderboardhq.com/addscore/qrfoujdr/n39umthb
Team 10:	https://leaderboardhq.com/addscore/qrfoujdr/mjd33pc7
Team 11:	https://leaderboardhq.com/addscore/qrfoujdr/wcqy0773
Team 12:	https://leaderboardhq.com/addscore/qrfoujdr/rxk986aj

Rules:

1- Please use trainInput solely for training your models and testInput solely for testing them.

2- The confusion matrix in your solution should be based on testInput. Therefore, the costs are calculated based on the confusion matrix for testInput.

3- The evaluation metric is the total saving (higher is better).

4- You can see the entire leaderboard here: https://leaderboardhq.com/qrfoujdr

Exhibit 1

UVA Hospital: Predicting Patient Discharge

University of Virginia Medical Center Net Revenue By Payor FY March 31, 2018
(in thousands)

	Actual	Budget	%Variance	Prior Year
Medicare	342,675	341,747	0.3%	337,133
Medicaid	232,931	239,802	-2.9%	231,448
Commercial Insurance	187,287	188,319	-0.5%	189,534
Anthem	249,810	247,332	1.0%	221,069
Aetna	82,141	85,668	-4.1%	83,720
Other	107,134	109,041	-1.7%	96,661
Total Paying Patient Revenue	1,201,978	1,211,909	-0.8%	1,159,565

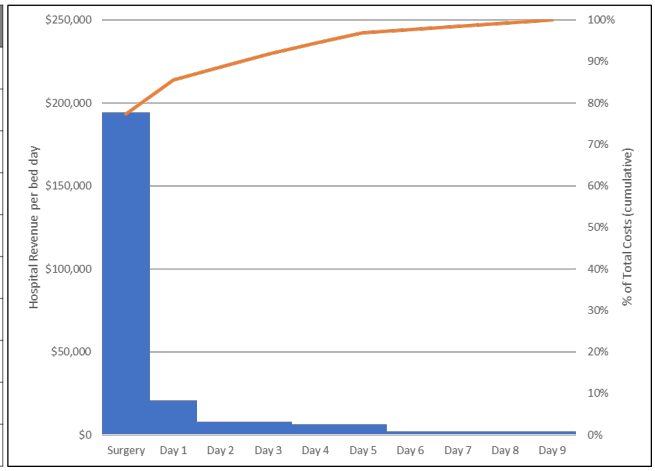
Source: https://bov.virginia.edu/june-6-8-2018-meeting-board

Exhibit 2

UVA Hospital: Predicting Patient Discharge

University of Virginia Hospital Heart Surgery Patient Revenue Over Time

Treatment Description (Illustrative)	Day	UVA Hospital Median Price	Cumulative Cost
CORONARY BYPASS W/O CARDIAC CATH	Surgery	$194,036	77%
CHEST PAIN	Day 1	$20,606	85%
ICU ROOM & BED	Day 2	$8,010	89%
ICU ROOM & BED	Day 3	$8,010	92%
INTERMEDIATE ROOM AND CARE	Day 4	$6,272	94%
INTERMEDIATE ROOM AND CARE	Day 5	$6,272	97%
SEMI-PRIVATE ROOM AND CARE	Day 6	$1,980	98%
SEMI-PRIVATE ROOM AND CARE	Day 7	$1,980	98%
SEMI-PRIVATE ROOM AND CARE	Day 8	$1,980	99%
SEMI-PRIVATE ROOM AND CARE	Day 9	$1,980	100%

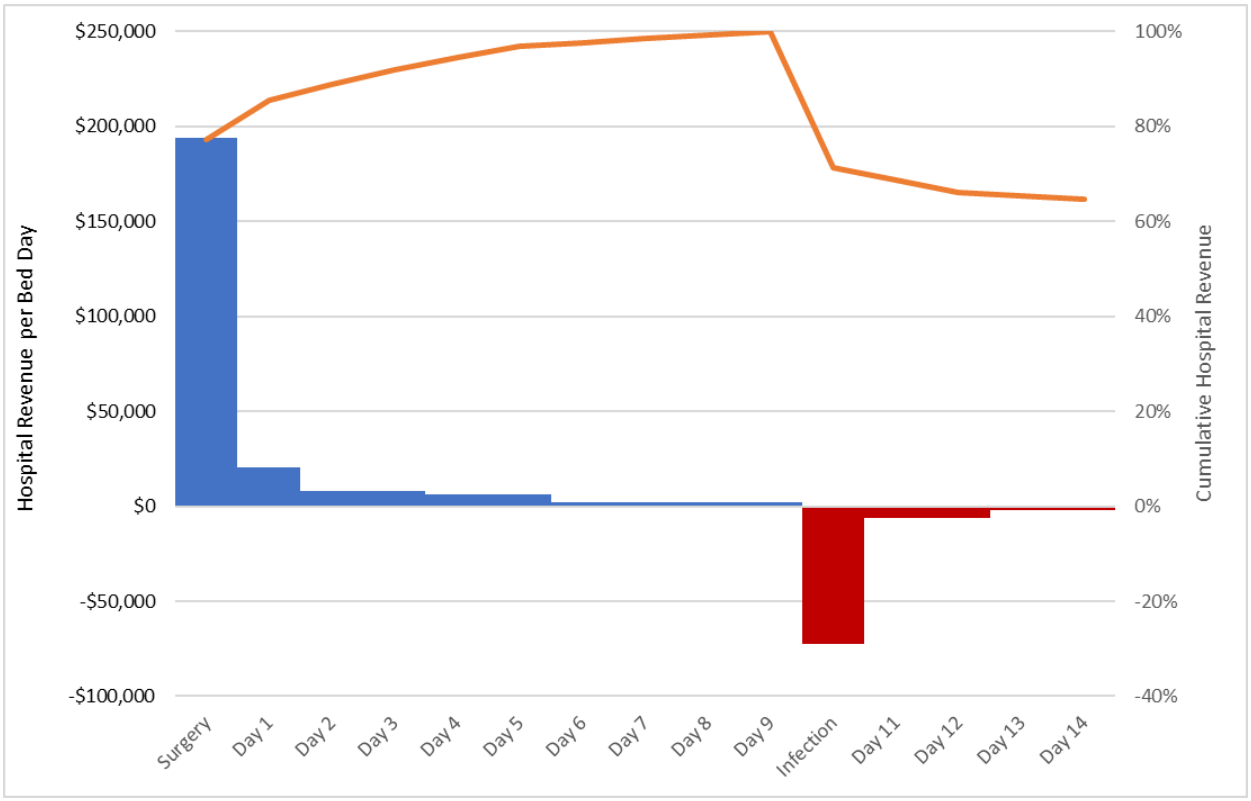


Data Source: Costs are average prices as listed at https://uvahealth.com/services/billing-insurance/common-prices

Exhibit 3

UVA Hospital: Predicting Patient Discharge

University of Virginia Hospital Heart Surgery Patient with Infection Revenue Over Time



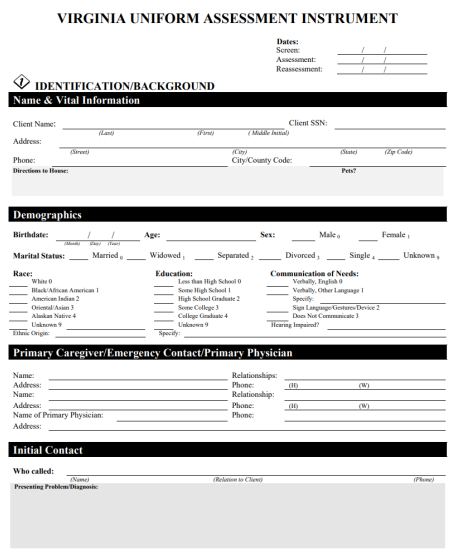
Data Source: Costs are average prices as listed at https://uvahealth.com/services/billing-insurance/common-prices

Note: Costs indicative of the *price* of a respiratory infection; actual loss incurred may differ by margin

Exhibit 4

UVA Hospital: Predicting Patient Discharge

Virginia Universal Assessment Instrument



VIRGINIA UNIFORM ASSESSMENT INSTRUMENT

Dates:
Screen: ___/___/___
Assessment: ___/___/___
Reassessment: ___/___/___

I. IDENTIFICATION/BACKGROUND

Name & Vital Information

Client Name: _____ Client SSN: _____
(Last) (First) (Middle Initial)
Address: _____
(Street) (City) (State) (Zip Code)
Phone: _____ City/County Code: _____
Directions to House: Pets?

Demographics

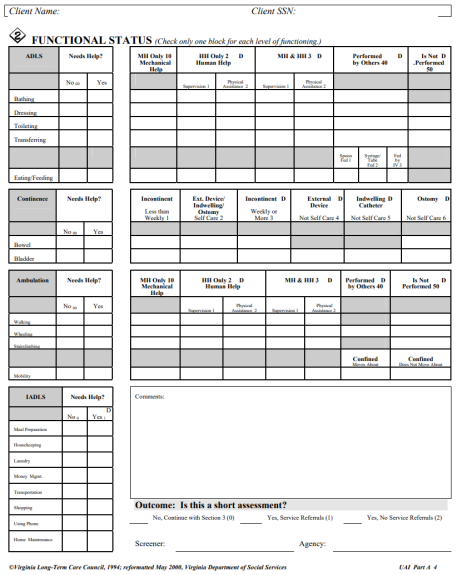
Birthdate: ___/___/___ Age: _____ Sex: ____ Male 0 ____ Female 1
(Month) (Day) (Year)
Marital Status: ____ Married 0 ____ Widowed 1 ____ Separated 2 ____ Divorced 3 ____ Single 4 ____ Unknown 9
Race:
____ White 0
____ Black/African American 1
____ American Indian 2
____ Oriental/Asian 3
____ Alaskan Native 4
____ Unknown 9
Ethnic Origin: _____
Education:
____ Less than High School 0
____ Some High School 1
____ High School Graduate 2
____ Some College 3
____ College Graduate 4
____ Unknown 9
Communication of Needs:
____ Verbally, English 0
____ Verbally, Other Language 1
Specify: _____
____ Sign Language/Gestures/Device 2
____ Does Not Communicate 3
Hearing Impaired? _____
Specify: _____

Primary Caregiver/Emergency Contact/Primary Physician

Name: _____ Relationships: _____
Address: _____ Phone: _____ (H) _____ (W)
Name: _____ Relationship: _____
Address: _____ Phone: _____ (H) _____ (W)
Name of Primary Physician: _____ Phone: _____
Address: _____

Initial Contact

Who called: _____
(Name) (Relation to Client) (Phone)
Presenting Problem/Diagnosis:



Client Name: Client SSN:

II. FUNCTIONAL STATUS (Check only one block for each level of functioning.)

ADLS	Needs Help? No 0	Yes 1	MH Only 10 Mechanical Help	HH Only 2 Human Help D Supervision 1	Physical Assistance 2	MH & HH 3 D Supervision 1	Physical Assistance 2	Performed by Others 40 D	Is Not Performed 50 D
Bathing									
Dressing									
Toileting									
Transferring									
								Spoon Fed 1	Syringe/ Tube Fed 2	Ind Oral Int 3
Eating/Feeding									

Continence	Needs Help? No 0	Yes 1	Incontinent Less than Weekly 1	Ext. Device/ Indwelling/ Ostomy Self Care 2	Incontinent D Weekly or More 3	External D Device Not Self Care 4	Indwelling D Catheter Not Self Care 5	Ostomy D Not Self Care 6
Bowel								
Bladder								

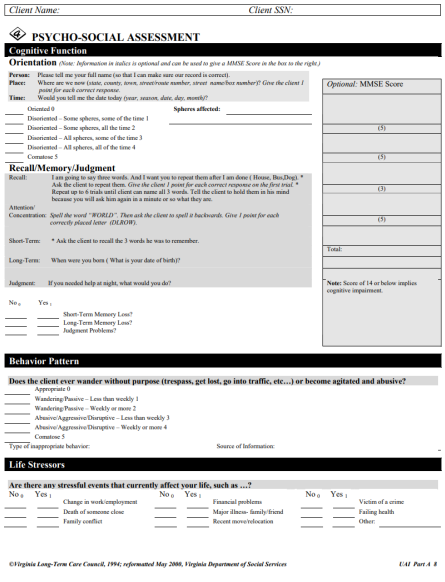
Ambulation	Needs Help? No 0	Yes 1	MH Only 10 Mechanical Help	HH Only 2 D Human Help Supervision 1	Physical Assistance 2	MH & HH 3 D Supervision 1	Physical Assistance 2	Performed D by Others 40	Is Not D Performed 50
Walking									
Wheeling									
Ambulating									
								Confined Above Desk	Confined Does Not Move About
Mobility									

IADLS	Needs Help? No 0	Yes 1	D
Meal Preparation			
Housekeeping			
Laundry			
Money Mgmt.			
Transportation			
Shopping			
Using Phone			
Home Maintenance			

Comments:

Outcome: Is this a short assessment?
____ No, Continue with Section 3 (0) ____ Yes, Service Referrals (1) ____ Yes, No Service Referrals (2)

Screener: _____ Agency: _____



Client Name: Client SSN:

III. PSYCHO-SOCIAL ASSESSMENT

Cognitive Function

Orientation (Note: Information in italics is optional and can be used to give a MMSE Score in the box to the right.)

Person: Please tell me your full name (so that I can make sure our record is correct).
Place: Where are we now (state, county, town, street/route number, street name/box number)? Give the client 1 point for each correct response.
Time: Would you tell me the date today (year, season, date, day, month)?

____ Oriented 0
____ Disoriented – Some spheres, some of the time 1
____ Disoriented – Some spheres, all the time 2
____ Disoriented – All spheres, some of the time 3
____ Disoriented – All spheres, all of the time 4
____ Comatose 5

Spheres affected: _____

Recall/Memory/Judgment

Recall: I am going to say three words. And I want you to repeat them after I am done (House, Bus,Dog). * Ask the client to repeat them. Give the client 1 point for each correct response on the first trial. * Repeat up to 6 trials until client can name all 3 words. Tell the client to hold them in his mind because you will ask him again in a minute or so what they are.

Attention/ Concentration: Spell the word "WORLD". Then ask the client to spell it backwards. Give 1 point for each correctly placed letter. (DLROW).

Short-Term: * Ask the client to recall the 3 words he was to remember.

Long-Term: When were you born (What is your date of birth)?

Judgment: If you needed help at night, what would you do?

Optional: MMSE Score
(5)
(5)
(3)
(5)
Total:

Note: Score of 14 or below implies cognitive impairment.

No 0 Yes 1
____ ____ Short-Term Memory Loss?
____ ____ Long-Term Memory Loss?
____ ____ Judgment Problems?

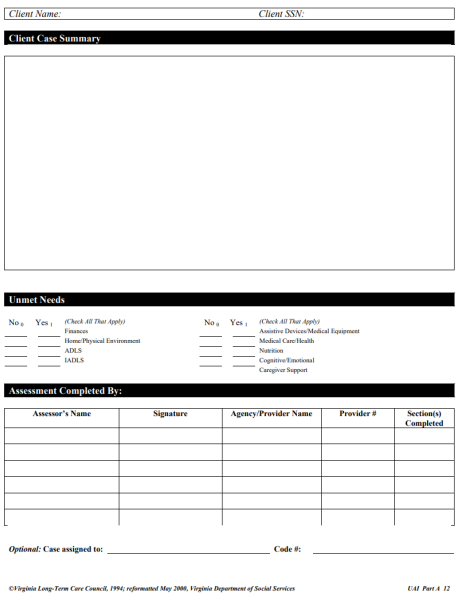
Behavior Pattern

Does the client ever wander without purpose (trespass, get lost, go into traffic, etc…) or become agitated and abusive?
____ Appropriate 0
____ Wandering/Passive – Less than weekly 1
____ Wandering/Passive – Weekly or more 2
____ Abusive/Aggressive/Disruptive – Less than weekly 3
____ Abusive/Aggressive/Disruptive – Weekly or more 4
____ Comatose 5
Type of inappropriate behavior: Source of Information:

Life Stressors

Are there any stressful events that currently affect your life, such as …?

No 0 Yes 1
____ ____ Change in work/employment
____ ____ Death of someone close
____ ____ Family conflict
____ ____ Financial problems
____ ____ Major illness- family/friend
____ ____ Recent move/relocation
____ ____ Victim of a crime
____ ____ Failing health
____ ____ Other: _____



Client Name: Client SSN:

Client Case Summary

Unmet Needs

No 0 Yes 1 (Check All That Apply)
____ ____ Finances
____ ____ Home/Physical Environment
____ ____ ADLS
____ ____ IADLS
____ ____ Assistive Devices/Medical Equipment
____ ____ Medical Care/Health
____ ____ Nutrition
____ ____ Cognitive/Emotional
____ ____ Caregiver Support

Assessment Completed By:

Assessor's Name	Signature	Agency/Provider Name	Provider #	Section(s) Completed

Optional: Case assigned to: _____ Code #: _____

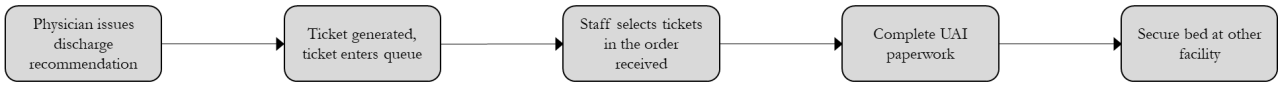
Data Source: https://www.dss.virginia.gov/files/division/dfs/as/as_intro_page/forms/032-02-0168-01-eng.pdf

Exhibit 5

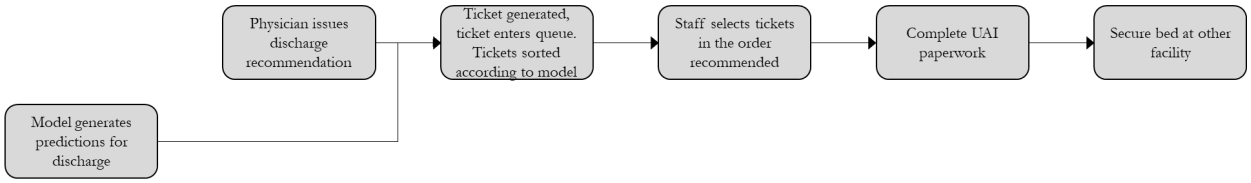
UVA Hospital: Predicting Patient Discharge

Process Flows

Incumbent Process:



Future State Process:



Data Source: Case writer interviews