

Author(s), country	Key points of the article
Aldridge and Kelly[1], United States	The majority of decedents were in the high-cost group, however the majority of high-cost patients were not in their last year of life. Not only is this group small (11%), the window of time for a significant impact on costs is limited by the patients' life expectancy. Findings confirm the need to focus on those with serious chronic illnesses, functional debility, and persistently high costs.
Ash et al.[2], United States	Diagnosis-based risk models are at least as powerful as prior cost for identifying people who will be expensive. Combined cost and diagnostic data were even more powerful and more operationally useful, especially because the diagnostic information identifies the medical problems that may be managed to achieve better outcomes and lower costs.
Bayliss et al.[3], United States	Self-reported health status, functional limitations, medication use, presence of 0-4 chronic conditions, self-reported ED use during the prior year, lack of prior insurance, age, gender, and deductible-based insurance product were predictive for high costs.
Beaulieu et al.[4], United States	High-cost patients are only modestly concentrated in specific hospitals and markets. The hospitals and markets that disproportionately care for high-cost beneficiaries were markedly different than those that cared for fewer such patients: these hospitals were either academic teaching or for-profit institutions operating in urban settings and serve a greater proportion of low-income patients. Concentrated markets had a greater supply of specialists and a lower supply of long-term care beds. Spending in the last 6 months of life was also significantly higher in high-cost concentration HRRs.
Boscardin et al.[5], United States	In addition to demographic characteristics and health service use, self-report of the presence of specific health conditions were predictive for high costs.
Buck et al.[6], United States	Mental health/substance abuse service users constitute 11% of all Medicaid enrollees, but make up nearly a third of high-cost enrollees. Their use of non-mental health/substance abuse services is more important than their use of MH/SA services in determining their high-cost status. Adults account for two third of this high-cost MH/SA group, and they most frequently qualify for Medicaid through disability-related eligibility categories.
Bynum et al.[7], United States	High combined Medicare and Medicaid spending are found in two distinct groups of high-cost dual eligibles: older beneficiaries who are nearing their end of life, and younger beneficiaries with sustained need for functional supports. High-cost dual eligibles often use costly inpatient settings, including acute care hospitals and inpatient long-term care services, in addition to nursing homes. 57% of high-cost dual eligibles reside in the community, not in long term care.
Chang et al.[8], United States	Consistent high-cost users had higher total and pharmacy costs, and more chronic and psychosocial conditions than episodic high-cost users.
Charlson et al. [9], United States	The comorbidity index was significantly correlated with the top 5% and top 10% of costs for the pooled sample, as well as for adults and children separately. Comorbidity can be used to identify beneficiaries most likely to incur high costs.
Charlson et al. [10], United States	Prior year costs, prior year comorbidity, prior year DCG, and prior year hospitalizations were all evaluated as predictors of upper 5% and upper 10% of subsequent (2010) costs in separate models controlling for age, gender and mental health diagnosis. In adults, the comorbidity index was equivalent to DCG and prior cost in predicting the top 5% and 10% of cost, while prior hospitalization had much lower ability to identify such patients.
Chechulin et al. [11], Canada	Age was a strong predictor of high costs, and as the material and social deprivation index increases, the risk of becoming high-cost increased. Males were more likely to incur high costs, and degree of rurality was also linked to high costs. Current and past healthcare utilization were the strongest predictors for high use. Several influential were significantly associated with high costs.
Cohen et al.[12], United States	Prior year expenditures, frequency of prescribed medication purchases, the number of office based provider visits, activity limitations and health status were the most significant predictors for high costs. Other measures that were significantly related to high costs were age, gender, marital status, family income, living alone, and the presence of an infectious or respiratory condition. Predictive capacity of models did not suffer when restricted to a single year of prior information.
Coughlin et al.[13], United States	20% of dual eligibles account for more than 60% of combined Medicaid and Medicare spending on the dual population. Subgroups were found among these high-cost population. Fewer than 1% of dual eligibles were in high-cost categories for both Medicare and Medicaid. Dual eligibles are a highly diverse group in terms of their spending. Being a dual eligible is not necessarily synonymous with high spending.
Coughlin and Long [14], United States	A high degree of spending persistence was observed: 57.9% of those in the top-10% remained in the top-10% in the two subsequent years. Two distinct high-cost groups were identified, those with persistently high costs and those with episodically high costs, each with different services driving their costs.
Crawford et al.[15], United States	The following predictive factors, listed in descending order according to the magnitude of their importance statistics, were related to high costs: total medical costs, physician costs, prescription drug costs, number of unique diagnoses, age, number of prescription drug claims, number of unique procedures, hypertension symptoms, CAD symptoms, inpatient costs, and diabetes symptoms.

DeLia[16], United States	One fourth of extreme spenders remained in that category in the three subsequent years. Almost all were blind, disabled and aged, the majority have a developmental disability, central nervous system diagnosis, or psychiatric diagnosis. Persistently high spenders were also more likely to be men, >40 years old, living in a nursing facility, or having a higher CDPS score.
de Oliveira et al.[17], Canada	Mental health high-cost patients incurred 30% higher costs than other high-cost populations. They were younger, lived in poorer neighborhoods, and had different health care utilization patterns.
Figueroa et al.[18], United States	Characteristics and likelihood of high costs vary by major type of insurance. Nearly 1 in 5 Medicaid insured patients was likely to be high-cost (top-10%), these patients were more likely to be medically complex, with more chronic diseases and mental health health/substance abuse problems. Additionally, patterns of spending varied by major type of insurance.
Figueroa et al.[19], United States	About 5% of total health care spending incurred by Medicare beneficiaries was potentially preventable, and most of this spending was incurred by high-cost patients. Large variations existed across high-cost subgroups. The high-cost frail elderly group accounted for nearly half of all potentially preventable spending after admissions for ACSCs or potentially avoidable ED visits. This spending was particularly high for heart failure, pneumonia, chronic obstructive pulmonary disease or asthma, and urinary tract infections.
Fitzpatrick et al.[20], Canada	Future high costs status was most strongly associated with food insecurity, personal income, and non-homeownership. Living in highly deprived or low ethnic concentration neighborhoods also increased the odds of becoming an HCU.
Fleishmann et al.[21], United States	Medical condition information substantially improved prediction of high expenditures beyond gender and age, with the DCG risk score providing the greatest improvement in prediction. The count of chronic conditions, self-reported health status, and functional limitations were significantly associated with future high expenditures, controlling for DCG score.
Ganguli et al.[22], United States	Complex medical issues, physical disability/frailty, and mental illness/substance was linked with increased costs, while socioeconomic status, social network, activation, and trust in clinicians and the health system appeared to increase or decrease costs depending on context. Trust seemed to modify the interaction between patient activation and cost.
Graven et al.[23], United States	Among the top-10%, 5.6%, 1.9%, and 3.8% was attributable to spending on preventable services for Medicaid, commercial, and Medicare Advantage patients, respectively. In the third year of spending among persistently high-cost patients in Medicaid, commercial and Medicaid advantage programs, cost were decreased by 11%, 25.6% and 30.6% respectively.
Guilcher et al.[24], Canada	This study provides a novel methodological approach to categorize high-cost health system users into meaningful person-centered episodes. The most common clinical grouping categories to start a person-centered episode of care were Planned Surgical, Unplanned Medical and Post-Acute Admission Events. Inpatient acute and inpatient rehabilitation accounted for the largest proportions of costs.
Guo et al.[25], United States	High-cost patients not only utilized more costly services, and more units of service per recipient, but also had higher per-unit costs for each of the service categories. The following groups had the highest odds of being a high-cost users: dying, disabled, urban resident, and male.
Hartmann et al.[26], Germany	Several predictors were related to high costs, including insurance status (dependent coverage in particular), prior expenditures, home nursing, chronic diseases and multimorbidity, mental and behavioral disorders, musculoskeletal disorders, respiratory system disorders, cardiovascular diseases, and metabolic diseases.
Hensel et al.[27], Canada	Seventeen percent of the most costly users had a prior diagnosis of a psychotic, major mood, or substance use disorder, and nearly 40% when anxiety and other disorders were included. The rate of mental illness and addiction rose incrementally across increasing user cost categories.
Hirth et al.[28], United States	Individuals' positions within the spending distribution vary over time, but considerable persistence exists, particularly clear at the lower end of the spending distribution, but also at the top persistence is considerable. Many characteristics retained predictive power for future spending, including age, gender and a variety of medical conditions.
Hunter et al.[29], United States	Approximately half of high-cost patients had at least one psychiatric diagnosis, and of these 49% had two or more psychiatric diagnoses. Utilization and costs of mental health and medical-surgical care differed among various groups of high-cost patients with mental health conditions.
Hwang et al.[30], United States	Persistent high users had higher overall disease burden due to multiple chronic conditions and incurred significantly higher expenses in medication and professional services.
Izad Shenasa et al.[31], United States	Data mining techniques, including neural networks and decision trees, were used to identify non-trivial attributes of high-cost patients. Identified attributes were overall health perception, age, history of blood cholesterol check, history of physical/ sensory/ mental limitations, and history of colonic prevention measures.
Joynt et al.[32], United States	High-cost beneficiaries were segmented into clinically relevant groups, including frail elders, those with disabilities or ESRD under the age 65, beneficiaries with chronic illnesses, and those who were relatively healthy at baseline. Frail elders were most likely to incur high costs, nearly half of the frail beneficiaries incurred high costs, and they comprised 40% of the high-cost population. Overall patterns of spending were relatively similar across high-cost segments, with inpatient spending contributing the largest share in general.

Joynt et al.[33], United States	Approximately 10% of the costs for high-cost Medicare patients were deemed potentially preventable. The percentage was slightly higher for the persistently high-cost cohort. Hospital referral regions with a higher primary care or physician supply had higher annual preventable costs per capita.
Krause et al.[34], United States	Silent-members are members of a medical health plan who submit no claims for healthcare services in a benefit year despite 12 months of continuous-enrollment. This study found that silent members who seek care in subsequent years have a greater probability of becoming high-expenditure claimants than those with low-expenditure experience.
Ku et al.[35], Taiwan	Of the top-10%, 39% remained high-cost in the year thereafter. NHI expenditure percentiles, and all chronic conditions significantly predicted future expenditures.
Lauffenburger et al.[36], United States	High-cost patients had higher mean comorbidity scores (measured using four risk adjustment measures). Trajectory modeling may be a useful way to predict costly patients that could be implementable by payers to improve cost-containment efforts.
Lee et al., [37]United States	Five distinct phenotypes of high-cost patients with diverse drivers of cost were identified. Besides, “hot-spotters” (those with four or more admissions) were quantified. They accounted for 9% of high-cost patients and 19% of that population’s costs. The majority of “hot-spotters” were in the cluster of patients who had ‘frequent care’.
Leininger et al.[38], United States	Self reported health measures were meaningful predictors of high costs, this included individual conditions, behavioral variables, prescription drug use, previous year utilization, and access to care measures.
Lieberman et al.[39], United States	This paper explored the potential of two alternative approaches for reducing the rate of growth in Medicare spending. Viewed from a budgetary perspective, concentration in Medicare spending suggests the importance of focusing on high-spending patients. Spending per beneficiary correlated strongly with inpatient use. The prevalence of serious chronic conditions is higher among high-spending beneficiaries. A high-cost patient was five times more likely to die. However, only one fifth died at the end of the year.
Meenan[40], United States	This study evaluated a variety of risk models to predict high-cost patients. To predict top-1% and top-0.5%, ACGs, DCGs, GRAM, and Prior-expense were very comparable in overall discrimination (AUCs, 0.83– 0.86). DCGs captured the most “high-cost” dollars among enrollees with asthma, diabetes, and depression; predictive performance among demographic groups (Medicaid members, members over 64, and children under 13) varied across models.
Monheit[41], United States	A sizeable minority of high expenditure cases exhibits persistently high expenditures in the short run. However, when all persons in a top expenditure percentile are considered, health expenditures do begin to regress to the mean over time as a majority of high spenders move to lower positions throughout the expenditure distribution.
Powers and Chaguturu[42], United States	Little is known about variation in clinical characteristics and care-utilization patterns among payer-defined groups. The costliest 1% of Medicare patients had an average of 8 co-occurring chronic conditions. In Medicaid, high-cost patients also had several co-occurring chronic conditions (five on average) but there was a striking prevalence of mental health disorders. In commercial populations, high-cost patients had fewer chronic conditions and were more likely to have disease risk factors than end-stage sequelae. Drivers of high costs in this population included catastrophic injuries, neurologic events, and need for specialty pharmaceuticals.
Pritchard et al.[43], United States	Spending pattern for high-cost patients differs considerably from the general population. The absolute expenditures for each place of service were increased, and the share of spending on inpatient services is significantly higher in high-cost patients, while the share of expenditures attributed to major outpatient places of service and pharmacy are lower. Common health conditions, such as back disorders and osteoarthritis, contribute a large share of expenditures, but other conditions such as chronic renal failure, graft rejection, and some cancers accounted for disproportionately higher expenditures in high-cost patients.
Rais et al.[44], Canada	Males are more costly than females. Seniors accounted for the majority of high-cost users and costs, but the average costs per patient decreased with age. Of the different clinical conditions, circulatory system conditions incurred the most costs.
Reid et al.[45], Canada	High-cost users are overwhelmingly characterized by multiple and complex health problems. This relatively small group accounted for a disproportionate share of primary care and specialist encounters as well as inpatient days.
Reschovsky et al.[46], United States	Among high-cost patients, health was the predominant predictor of costs, with most physician and practice and many market factors (including provider supply) insignificant or only weakly associated with high costs. Beneficiaries whose usual physician was a medical specialist or reported inadequate office visit time, medical specialist supply, provider for-profit status, care fragmentation, and Medicare fees were associated with higher costs.
Riley [47], United States	Annual expenditures became less concentrated over time, although the year-to-year persistence of person-level high costs remained strong. There was an increase in the prevalence of chronic conditions among high-cost beneficiaries. Spending concentration in Medicare decreased over time, perhaps due to 1) trends in longevity and medical expenses (increasing life expectancy has had the effect of spreading the same level of healthcare costs over a greater number of years; as age of death increases, lifetime Medicare costs increase only slightly), 2) expensive technologies

	are increasingly used on less sick patients, or 3) trends in disability.
Robst[48], United States	High costs were very persistent, as a high percentage of individuals were high-cost cases for multiple years. In addition, individuals receiving ICF-mental retardation services were very likely to have persistent high costs. Individuals with 1 or more inpatient stays in the base year were less likely to remain high cost in the future. Most high-cost cases had multiple diagnoses.
Rosella et al.[49], Canada	High-cost patients tended to be older with multiple comorbidities and were more likely to be white, female and have lower household income. Risky behaviors were not overwhelmingly drivers of short term high-cost, but this is likely an artifact.
Snider et al.[50], United States	A logistic model was used to capture the effect of BMI on the risk of high future medical spending. Individuals in all obesity classes have higher risk of high medical spending in the following year compared to normal weight patients (BMI \leq 25).
Tamang et al.[51], Denmark	Cost bloomers (those who move from the lower to the upper percentile in one year) represented the majority of high-cost patients. They were younger, had less comorbidity, lower mortality and fewer chronic conditions. Diverse population health data, in conjunction with modern statistical learning methods for analyzing large data sets, can improve prediction of future high-cost patients over standard diagnosis-based tools, especially for cost-bloom prediction task.
Wammes et al.[52], Netherlands	Expensive treatments, most cost-incurring condition and age proved to be informative variables for studying high-cost patients. Expensive care use (expensive drugs, ICU treatment, dialysis, transplant care and DRG >€30 000) contributed to high costs in one third of top 1% beneficiaries and in less than 10% of top 2%-5% beneficiaries. High-cost beneficiaries were overwhelmingly treated for diseases of circulatory system, neoplasms and mental disorders. More than 50% of high-cost beneficiaries were 65 years of age or younger, and average costs decreased sharply with higher age within the top 1% population.
Wodchis et al.[53], Canada	High health care costs were related to a diverse set of patient health care needs and were incurred in a wide array of healthcare settings. Analyses showed moderate stability in health care costs for individuals over a 3-year period. High-cost spending patterns and conditions varied across age groups.
Zhao et al.[54], United States	This study evaluated three models to predict high-cost patients, including a DCG-model, a prior cost model, and a prior plus DCG-model (combo model). The DCG-model and combo model outperformed the prior cost model.
Zulman et al.[55], United States	Multisystem morbidity is common in high-cost patients, approximately two-thirds have chronic conditions affecting three or more body systems. While some patients with cancer or mental illness may benefit from disease specific interventions, the majority most likely require programs that address their heterogeneous health needs.

References

1. Aldridge, M.D. and A.S. Kelley, *The Myth Regarding the High Cost of End-of-Life Care*. American journal of public health, 2015. **105**(12): p. 2411-2415.
2. Ash, A.S., et al., *Finding future high-cost cases: comparing prior cost versus diagnosis-based methods*. Health Serv Res, 2001. **36**(6 Pt 2): p. 194-206.
3. Bayliss, E.A., et al., *Applying Sequential Analytic Methods to Self-Reported Information to Anticipate Care Needs*. EGEMS (Wash DC), 2016. **4**(1): p. 1258.
4. Beaulieu, N.D., et al., *Concentration of high-cost patients in hospitals and markets*. Am J Manag Care, 2017. **23**(4): p. 233-238.
5. Boscardin, C.K., et al., *Predicting cost of care using self-reported health status data*. BMC health services research, 2015. **15**: p. 406.
6. Buck, J.A., J.L. Teich, and K. Miller, *Use of mental health and substance abuse services among high-cost Medicaid enrollees*. Adm Policy Ment Health, 2003. **31**(1): p. 3-14.
7. Bynum, J.P.W., et al., *High-Cost Dual Eligibles' Service Use Demonstrates The Need For Supportive And Palliative Models Of Care*. Health Aff (Millwood), 2017. **36**(7): p. 1309-1317.
8. Chang, H.Y., et al., *Identifying Consistent High-cost Users in a Health Plan: Comparison of Alternative Prediction Models*. Med Care, 2016. **54**(9): p. 852-9.
9. Charlson, M.E., et al., *Medicaid managed care: how to target efforts to reduce costs*. BMC health services research, 2014. **14**: p. 461.
10. Charlson, M., et al., *The Charlson comorbidity index can be used prospectively to identify patients who will incur high future costs*. PLoS One, 2014. **9**(12): p. e112479.
11. Chechulin, Y., et al., *Predicting patients with high risk of becoming high-cost healthcare users in Ontario (Canada)*. Healthc Policy, 2014. **9**(3): p. 68-79.

12. Cohen, S.B., T. Ezzati-Rice, and W. Yu, *The utility of extended longitudinal profiles in predicting future health care expenditures*. *Med Care*, 2006. **44**(5 Suppl): p. 145-53.
13. Coughlin, T.A., T.A. Waidmann, and L. Phadera, *Among dual eligibles, identifying the highest-cost individuals could help in crafting more targeted and effective responses*. *Health Aff (Millwood)*, 2012. **31**(5): p. 1083-91.
14. Coughlin, T.A. and S.K. Long, *Health care spending and service use among high-cost Medicaid beneficiaries, 2002-2004*. *Inquiry*, 2009. **46**(4): p. 405-17.
15. Crawford, A.G., et al., *Comparative effectiveness of total population versus disease-specific neural network models in predicting medical costs*. *Dis Manag*, 2005. **8**(5): p. 277-87.
16. DeLia, D., *Mortality, Disenrollment, and Spending Persistence in Medicaid and CHIP*. *Med Care*, 2017. **55**(3): p. 220-228.
17. de Oliveira, C., et al., *Patients With High Mental Health Costs Incur Over 30 Percent More Costs Than Other High-Cost Patients*. *Health Aff (Millwood)*, 2016. **35**(1): p. 36-43.
18. Figueroa, J.F., et al., *Characteristics and spending patterns of high cost, non-elderly adults in Massachusetts*. *Healthc (Amst)*, 2017.
19. Figueroa, J.F., et al., *Concentration of Potentially Preventable Spending Among High-Cost Medicare Subpopulations: An Observational Study*. *Ann Intern Med*, 2017.
20. Fitzpatrick, T., et al., *Looking Beyond Income and Education: Socioeconomic Status Gradients Among Future High-Cost Users of Health Care*. *Am J Prev Med*, 2015. **49**(2): p. 161-71.
21. Fleishman, J.A. and J.W. Cohen, *Using information on clinical conditions to predict high-cost patients*. *Health Serv Res*, 2010. **45**(2): p. 532-52.
22. Ganguli, I., R. Thompson, and T.G. Ferris, *What can five high cost patients teach us about health care spending?* *Journal of General Internal Medicine*, 2016. **1**: p. S469.
23. Graven, P.F., et al., *Preventable acute care spending for high-cost patients across payer types*. *Journal of Health Care Finance*, 2016. **42**(3).
24. Guilcher, S.J., et al., *Who Are the High-Cost Users? A Method for Person-Centred Attribution of Health Care Spending*. *PLoS One*, 2016. **11**(3): p. e0149179.
25. Guo, J.J., et al., *Characteristics and risk factors associated with high-cost medicaid recipients*. *Manag Care Interface*, 2004. **17**(10): p. 20-27.
26. Hartmann, J., et al., *Analysing predictors for future high-cost patients using German SHI data to identify starting points for prevention*. *Eur J Public Health*, 2016. **26**(4): p. 549-55.
27. Hensel, J.M., et al., *Rates of Mental Illness and Addiction among High-Cost Users of Medical Services in Ontario*. *Can J Psychiatry*, 2016. **61**(6): p. 358-66.
28. Hirth, R.A., et al., *New Evidence on the Persistence of Health Spending*. *Medical Care Research and Review*, 2015. **72**(3): p. 277-297.
29. Hunter, G., et al., *Health Care Utilization Patterns Among High-Cost VA Patients With Mental Health Conditions*. *Psychiatr Serv*, 2015. **66**(9): p. 952-8.
30. Hwang, W., et al., *Persistent high utilization in a privately insured population*. *Am J Manag Care*, 2015. **21**(4): p. 309-16.
31. Izad Shenaz, S.A., et al., *Identifying high-cost patients using data mining techniques and a small set of non-trivial attributes*. *Comput Biol Med*, 2014. **53**: p. 9-18.
32. Joynt, K.E., et al., *Segmenting high-cost Medicare patients into potentially actionable cohorts*. *Healthc (Amst)*, 2017. **5**(1-2): p. 62-67.
33. Joynt, K.E., et al., *Contribution of preventable acute care spending to total spending for high-cost Medicare patients*. *JAMA*, 2013. **309**(24): p. 2572-8.
34. Krause, T.M., et al., *Future expenditure risk of silent members: a statistical analysis*. *BMC Health Serv Res*, 2016. **16**: p. 319.
35. Ku, L.J., M.J. Chiou, and L.F. Liu, *Variations in the persistence of health expenditures and the implications for the design of capitation payments in Taiwan*. *J Health Serv Res Policy*, 2015. **20**(3): p. 146-53.
36. Lauffenburger, J.C., et al., *Longitudinal Patterns of Spending Enhance the Ability to Predict Costly Patients: A Novel Approach to Identify Patients for Cost Containment*. *Med Care*, 2017. **55**(1): p. 64-73.

37. Lee, N.S., et al., *High-Cost Patients: Hot-Spotters Don't Explain the Half of It*. J Gen Intern Med, 2017. **32**(1): p. 28-34.
38. Leininger, L.J., et al., *Predicting high-need cases among new Medicaid enrollees*. The American journal of managed care, 2014. **20**(9): p. e399-e407.
39. Lieberman, S.M., et al., *Reducing the growth of Medicare spending: geographic versus patient-based strategies*. Health Aff (Millwood), 2003. **Suppl Web Exclusives**: p. W3-603-13.
40. Meenan, R.T., et al., *Using risk-adjustment models to identify high-cost risks*. Med Care, 2003. **41**(11): p. 1301-12.
41. Monheit, A.C., *Persistence in health expenditures in the short run: prevalence and consequences*. Med Care, 2003. **41**(7 Suppl): p. III53-III64.
42. Powers, B.W. and S.K. Chaguturu, *ACOs and High-Cost Patients*. N Engl J Med, 2016. **374**(3): p. 203-5.
43. Pritchard, D., et al., *What Contributes Most to High Health Care Costs? Health Care Spending in High Resource Patients*. J Manag Care Spec Pharm, 2016. **22**(2): p. 102-9.
44. Rais, S., et al., *High-cost users of Ontario's healthcare services*. Healthc Policy, 2013. **9**(1): p. 44-51.
45. Reid, R., et al., *Conspicuous consumption: characterizing high users of physician services in one Canadian province*. J Health Serv Res Policy, 2003. **8**(4): p. 215-24.
46. Reschovsky, J.D., et al., *Following the money: factors associated with the cost of treating high-cost Medicare beneficiaries*. Health Serv Res, 2011. **46**(4): p. 997-1021.
47. Riley, G.F., *Long-term trends in the concentration of Medicare spending*. Health Aff (Millwood), 2007. **26**(3): p. 808-16.
48. Robst, J., *Developing Models to Predict Persistent High-Cost Cases in Florida Medicaid*. Popul Health Manag, 2015. **18**(6): p. 467-76.
49. Rosella, L.C., et al., *High-cost health care users in Ontario, Canada: demographic, socio-economic, and health status characteristics*. BMC Health Serv Res, 2014. **14**: p. 532.
50. Snider, J.T., et al., *Identifying patients at risk for high medical costs and good candidates for obesity intervention*. Am J Health Promot, 2014. **28**(4): p. 218-27.
51. Tamang, S., et al., *Predicting patient 'cost blooms' in Denmark: a longitudinal population-based study*. BMJ Open, 2017. **7**(1): p. e011580.
52. Wammes, J.J.G., et al., *Characteristics and healthcare utilisation patterns of high-cost beneficiaries in the Netherlands: a cross-sectional claims database study*. BMJ Open, 2017. **7**(11): p. e017775.
53. Wodchis, W.P., P.C. Austin, and D.A. Henry, *A 3-year study of high-cost users of health care*. Cmaj, 2016. **188**(3): p. 182-8.
54. Zhao, Y., et al., *Identifying future high-cost cases through predictive modeling*. Disease Management and Health Outcomes, 2003. **11**(6): p. 389-397.
55. Zulman, D.M., et al., *Multimorbidity and healthcare utilisation among high-cost patients in the US Veterans Affairs Health Care System*. BMJ Open, 2015. **5**(4): p. e007771.