

Decision Support Tool: Summary of patient identification and selection tools

	Model / Tool	Summary	Target population	Patient risk / adverse outcome	Available data Sources (electronic)	Disease specific / generic	Identification / Selection
1.	Case Smart Suite Germany (CSSG)	<p>The algorithm used is similar to that of diagnostic cost group. Inputs include ICD-10 German Modification (GM) diagnosis codes assigned in outpatient and inpatient settings, prior costs, hospital admissions and demographic data. Clinically similar ICD-10-GM codes are classified into diagnostic groups that are collapsed into diagnostic categories. This tool may be purchased for use 'off-the-shelf' by healthcare providers and insurers. Generic models for adaption in other countries are available for purchase.</p> <p>VARIABLES</p> <ul style="list-style-type: none"> • ICD-10 German Modification (GM) diagnosis codes • Prior costs • Hospital admissions • Demographic data <p>JURISDICTION / DEVELOPER / ORIGIN: Commercial developer, Verisk Health, Munich, Germany</p> <p>VALIDATED: unknown</p> <p>REFERENCES</p> <p>Freund, Gondon, Rochon et al. (2013)</p> <p>Verisk Health</p>	Adults	Hospital admission, next 12 months	Outpatient Inpatient Demographic	Generic	Identification
2.	Combined Predictive Model (CPM)	<p>A logarithm for predicting re-hospitalisation in the next 12 months intended for use by Primary Care Trusts and other NHS organisation in the UK where both primary and secondary data are available. Available for use by the NHS organisations as a stand-alone string code; requiring the local build of a user interface. Allows segmentation of an entire NHS population (all patients registered with a GP) into relative risk segments.</p> <p>The model is no longer updated or supported by the UK Department of Health; not compatible with HRG4 data</p> <p>VARIABLES</p> <ul style="list-style-type: none"> • Healthcare utilisation • Polypharmacy • Chronic disease including Asthma, COPD, Depression <p>JURISDICTION / DEVELOPER / ORIGIN: United Kingdom, Publicly developed tool (Kings Fund and Health Dialog), no longer maintained.</p> <p>VALIDATION: The model was developed on a 50% random sample of data from two Primary Care Trusts (PCTs) and validated on the other 50% random sample data.</p> <p>REFERENCES</p> <p>Kings Fund - Predicting and reducing re-admission to hospital</p> <p>Lewis (2010)</p> <p>Lewis, Vaithianathan, Wright et al. (2013)</p> <p>Lewis, Wright, Vaithianathan (2012).</p>	All	Hospital readmission, next 12 months	General Practice Outpatient Emergency Department Inpatient	Generic	Identification
3.	Community Assessment Risk Screen (CARS)	<p>The Community Assessment Risk Screen (CARS) is a simple instrument that can be used to identify elderly patients who are at higher risk for health service use and increased costs. This tool uses three variables to predict future hospitalisations: 1) pre-existing chronic disease; 2) the number of prescription medications and 3) hospitalisations or ED use in the preceding 6-12 months. The score (0-9) is accumulative depending on the number of risk factors present. Data is obtained by medical staff directly from patients and the logarithm applied. In Valencia, the tool was adapted for automatic population using administrative data.</p> <p>VARIABLES</p> <ul style="list-style-type: none"> • Pre-existing chronic disease/comorbidities (≥2 diagnoses = 2 pts) • Number of prescription medications (≥5 meds = 3pts) • Hospitalisations or Emergency Department use in preceding 6-months (if yes = 4pts) • A score of four or more indicated high risk. <p>JURISDICTION / DEVELOPER / ORIGIN: United States of America</p> <p>VALIDATION: The model was validated in a control cohort.</p>	Age ≥ 65 years	Hospital readmission, next 12 months	Patient questionnaire Administrative data	Generic	Identification Selection

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		<p>REFERENCES</p> <p>Shelton, Sager, Schraeder (2000)</p> <p>Donate-Martinez, Garces Ferrer, Rodenas Rigla. (2014)</p>					
4.	Devon Combined Predictive Model (CPM)	<p>Predicts unplanned admission to hospital or an emergency re-admission in the following 12 months. This adaption of Combined Predictive Model (CPM) added seven local factors as variables including length of registration with GP.</p> <p>VARIABLES</p> <ul style="list-style-type: none"> A total of 89 variables: 69 variables from the CPM plus local variables derived from the literature, from GPs and commissioners, and from local health data. See Chenore, Pereira Gray, Forrer, et al. (2013) – supplementary data <p>JURISDICTION / DEVELOPER / ORIGIN: Adaption of CPM tool developed by NHS Devon, UK</p> <p>VALIDATION: The whole sample of patients was randomly split into an 80% derivation (training) set and a 20% validation set.</p> <p>REFERENCES</p> <p>Chenore, Pereira Gray, Forrer, et al. (2013)</p> <p>Lewis, Vaithianathan, Wright et al. (2013)</p> <p>Lewis, Wright, Vaithianathan (2012)</p> <p>Kings Fund - Predicting and reducing re-admission to hospital</p>	All	Unplanned hospital admission or readmission, next 12 months	General Practice Outpatient Emergency Department Inpatient	Generic	Identification
5.	Early Admission Risk Likelihood Index (EARLI)	<p>Predicts the likelihood of emergency admission to hospital of older people aged 75 years within in the following 12 months. EARLI can be used as a simple triage-screening tool to help identify the most vulnerable older people, either to target interventions and support to reduce demand on hospital services or for inclusion in testing the effectiveness of difference interventions.</p> <p>VARIABLES</p> <ul style="list-style-type: none"> Do you have heart problems? Do you have leg ulcers? Can you go out of the house without help? Do you have problems with your memory and get confused? Have you been admitted to hospital as an emergency in the last 12 months? Would you say the general state of your health is good? <p>JURISDICTION / DEVELOPER / ORIGIN: United Kingdom</p> <p>VALIDATION: Both bootstrap validation (measure internal bias in model discrimination) and external validation with a split sample approach were used to determine the validity of the model.</p> <p>REFERENCES</p> <p>Lyon, Lancaster, Taylor, et al. (2007)</p>	Aged ≥ 75 years	Unplanned hospital admission or readmission, next 12 months	Patient questionnaire	Generic	Identification Selection
6.	Hospital Admission Risk Prediction (HARP) Ontario – complex	<p>Generates an individual patient risk score of hospital admission within the next 30 days, and 15 months.</p> <p>The complex model accounts for 10 factors, and performs slightly better than the simple model, but only captures those who have had an acute presentation. Predictors were determined by a thorough analysis of acute care and social data variables, using statistical techniques and expert opinion. A multiple regression analysis determined the final rank and weighting of these factors.</p> <p>The analysis and inclusion of primary care clinical variables has been identified as an area of future work.</p> <p><i>NB. There is no relationship between the HARP Ontario tools and the HARP Victoria model</i></p> <p>VARIABLES</p> <ul style="list-style-type: none"> Factors included in the Simple algorithm: Plus: <ul style="list-style-type: none"> Resource intensity level Length of stay (15 month model only) Admission via emergency department 	Adults	Hospital readmission, 30 days Hospital admission, 15 months	Inpatient	Generic	Identification

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		<ul style="list-style-type: none"> ○ Charlson comorbidity index ○ Paracentesis (30 day model only) ○ 18 Case Mix Groups with high Odds Ratio <p>JURISDICTION / DEVELOPER / ORIGIN: Health Quality Ontario, Canada</p> <p>VALIDATION: A split sample design was taken for algorithm derivation and validation for each model.</p> <p>REFERENCES</p> <p>Early Identification of People At-Risk of Hospitalization: Hospital Admission Risk Prediction (HARP)</p> <p>Health Quality Ontario - HARP</p>					
7.	Hospital Admission Risk Prediction (HARP) Ontario - simple	<p>Identifies patients at-risk of future hospitalisation. The simple model accounts for 5 factors and the top six conditions, and is a strong substitute for the HARP Complex tool in settings without access to hospital data sources - it does not require the data on such variables as hospital intervention, Charlson index of comorbidities, or resource intensity levels. In Canada the tool has been integrated into primary care EMR systems.</p> <p><i>NB. There is no relationship between the HARP Ontario tools and the HARP Victoria model</i></p> <p>VARIABLES</p> <ul style="list-style-type: none"> • Age • Place patient was discharged to • Number of acute Admissions, six months prior • Number of emergency department visits, six months prior • Top Case Mix Groups based on both prevalence and predictive strength: COPD, heart failure, IBD, GI obstruction, cirrhosis, diabetes <p>JURISDICTION / DEVELOPER / ORIGIN: Canada</p> <p>VALIDATION: A split sample design was taken for algorithm derivation and validation for each model.</p> <p>REFERENCES</p> <p>Early Identification of People At-Risk of Hospitalization: Hospital Admission Risk Prediction (HARP)</p> <p>Health Quality Ontario - HARP</p>	Adults	Hospital readmission, 30 days Hospital admission, 15 months	General Practice Inpatient	Generic	Identification Selection
8.	Hospital Admission Risk Program (HARP) Victoria	<p>A Victorian program, similar to NSW Chronic Disease Management Program (CDMP). The program aims to prevent avoidable hospital presentations and admissions. It targets the very high/high risk cohort by restricting eligibility to those who have had at least one hospital admission in the previous 12 month period. The full assessment for referred patients calculates a risk score that could be applied in primary or secondary care settings. Approximately one-third of NSW Local Health Districts are using the HARP criteria with or without the Western Health 'calculator' to stratify patients for Connecting Care in the Community.</p> <p><i>NB. There is no relationship between the HARP Ontario tools and the HARP Victoria model</i></p> <p>VARIABLES</p> <p>Chronic Disease - including renal, liver disease. Also includes psychosocial complex issues, Mental Health, Self Care capacity, Lifestyle Factors, polypharmacy >5, medications, Biomedical markers for specific conditions, Carer Stress, Cognitive Impairment, Chronic Pain, Disability, CALD, Indigenous, 'Readiness to change' - self management</p> <p>JURISDICTION / DEVELOPER / ORIGIN: Australia (Victoria)</p> <p>VALIDATION: No published information identified.</p> <p>REFERENCES</p> <p>Hospital Admission Risk Program (HARP)</p> <p>Western Health HARP Calculators</p>	Adults	Avoidable hospital presentations and admissions	Inpatient Emergency Department	Generic	Identification Selection

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9.	Health Numerics-RISC (OPTUM)	<p>The models were developed to predict the likelihood of an unplanned (emergency) inpatient admission due to a chronic condition. The initial two 12 month models (acute only; acute + GP) were redeveloped in 2013, along with two 3-month short-term models (acute only; acute + GP).</p> <p>It uses Episode Treatment Groups to combine activity from multiple settings across time, and identifies patients rising up the risk ranking, “high climbers”</p> <p>It is an off the shelf product, built for UK population. Software platform provides a customisable home page – showing individuals on a ‘watch’ list and short cuts to your own saved reports (refreshed each month)</p> <p>VARIABLES</p> <ul style="list-style-type: none"> • Demographic • Length of Stay • Inpatient unplanned chronic admissions • Outpatient attendance and specialty • Emergency Department attendance • Can include Mental Health and Social Care risk factors if available in local data <p>JURISDICTION / DEVELOPER / ORIGIN: United Kingdom</p> <p>VALIDATION: The developer carried out repeated split-sampling to verify the results.</p> <p>REFERENCES</p> <p>HealthNumerics-RISC® Predictive Models</p> <p>White Paper HealthNumerics-RISC® Predictive Models</p>	All	Unplanned hospital admission (due to chronic disease), next 12 months	General Practice Emergency Department Outpatient Inpatient	Generic	Identification
10.	Indiana Chronic Disease Management Program (ICDMP) tool	<p>Used to assign participants to different program services (nurse care managers to highest risk 20%; telephone care coordinators to remainder 80%). Algorithm based on two years or retrospective claims data 1) total net Medicaid claims in past 12 months; 2) Medicaid aid category (e.g. ‘aged’ or ‘disabled’); 3) total number of unique medications filled in the past year.</p> <p>VARIABLES</p> <ul style="list-style-type: none"> • Total net Medicaid claims costs in the past year, • Medicaid aid category (e.g., the beta-weight for the “disabled” category was higher than that for the “aged” category) • Total number of unique medications filled in the past year <p>JURISDICTION / DEVELOPER / ORIGIN: Commissioned by Indiana Medicaid to vendor Regenstrief Institute</p> <p>VALIDATION: Model was tested in a second cohort.</p> <p>REFERENCES</p> <p>Li, Holmes, Rosenman, et al. (2005)</p> <p>Rosenman, Holmes, Ackermann, et al. (2006)</p> <p>Katz, Holmes, Stump, et al. (2009)</p> <p>Rosenman, Holmes, Ackermann, et al. (2006)</p>	Adults	Utilisation and cost of health services, next 12 months	Administrative data	Disease Specific – Congestive Heart Failure (CHF) Disease Specific – Diabetes	Identification Could potentially be used for Selection
11.	Johns Hopkins University Adjusted Clinical Groups (ACG)	<p>This predictive model uses primary and hospital data to measure illness burden across a population to explain variation in health care consumption. It produces a summary of output data to quantify current morbidity, as well as predicts future risk. The Johns Hopkins ACG System is a suite of tools. The potential uses and applications of System include risk of hospitalisation and high cost.</p> <p>Uses various inputs that can be adjusted according to setting such as: age, gender, total disease burden, medical conditions, population markers, resource use and medications. Available as a stand-alone product or a part of a service delivery package and electronic medical record administration.</p> <p>There is ongoing use of the ACG System in Software package available for US or international licence (currently available Version 9). more than 12 countries worldwide. It is an off the shelf product that can be adapted to meet local data and requirements.</p> <p>VARIABLES</p> <p>Includes: chronic condition count, fragility flag, disease and treatment/medication codes, resource utilisation by setting.</p> <ul style="list-style-type: none"> • Age • Gender • Medication 	Adults	Relative total cost, next 12 months Patient in the top 5% of high cost patients, next 12 months Predicted relative pharmacy cost, next 12 months Patient in the top 5% of high	General Practice Outpatient Inpatient	Generic	Identification Selection

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		<ul style="list-style-type: none"> Selected resources use markers Special population markers Selected medical conditions Overall disease burden <p>JURISDICTION / DEVELOPER / ORIGIN: Developed at Johns Hopkins University with commercial licence rights.</p> <p>VALIDATION: validated for use in US and UK; in use in 12+ countries</p> <p>REFERENCES</p> <p>The Johns Hopkins ACG System (link not supported in NSW Health Internet Explorer)</p> <p>White Paper: Applications of the ACG System in the UK (2014)</p> <p>Cohen, Flaks-Manov, Low, et al. (2015)</p> <p>Arce, De Ormijana, Orueta, et al. (2014)</p>		cost pharmacy, next 12 months Emergency admission, next 12 months Hospital admission, next 6 months Hospital admission, next 12months More than 12 days in hospital, next 12 months			
12.	LACE	<p>An index to quantify the risk of death or unplanned re-admission within 30 days after discharge from hospital to the community. This index can be used with both primary and administrative (hospital) data. It is intended to be administered within the hospital at the point of discharge. Data inputs are length of stay (“L”); acuity of the admission (“A”); comorbidity of the patient (measured with the Charlson Comorbidity Index Score)(“C”); and emergency department use (measured as the number of visits in the six-months before admission)(“E”).</p> <p>VARIABLES</p> <ul style="list-style-type: none"> Length of stay Acuity of the admission Comorbidity of the patient (measured with the Charlson comorbidity index score) Emergency department use (measured as the number of visits in the six months before admission) <p>JURISDICTION / DEVELOPER / ORIGIN: Publicly developed in Ontario, Canada</p> <p>VALIDATION: a split-sample design was used to derive and validate the algorithm. Externally validated in random selection of 1,000,000 patients discharged from hospital over 4 year period in Ontario, Canada.</p> <p>REFERENCES</p> <p>van Walraven, Dhalla, Bell, et al. (2010)</p> <p>Dhalla, O’Brien, Morra, et al. (2014)</p> <p>Lewis, Wright, Vaithianathan. (2012)</p> <p>Tuso, Huynh, Garofalo, et al. (2013)</p>	All	Death or unplanned readmission, next 30 days	Inpatient Emergency Department	Generic	Identification Selection (discharge)
13.	Nairn Case Finder	<p>Tool originally developed for Lodgehill Clinic in Nairn (Scotland) and measures risk of an unplanned admission to hospital in the subsequent 12 months. Primary care data are taken from the country-wide GP medical records system “General Practice Administration System for Scotland” (since changed for use with current system “GP Vision”). Primary care variables include age, sex, and chronic disease status. Secondary care data were taken from the NHS Highland Patient Administration System and include outpatient attendance and unplanned admission to hospital in the previous two years. The tool was run monthly and GPs were provided with lists of at risk patients.</p> <p>VARIABLES</p> <ul style="list-style-type: none"> Primary Care data <ul style="list-style-type: none"> Age Sex Chronic disease status as recorded for the Quality and Outcomes Framework (QoF), e.g. asthma, cancer, coronary health disease, chronic obstructive pulmonary disease, epilepsy, hypertension, and mental health. Secondary Care data <ul style="list-style-type: none"> Outpatient attendance Unplanned admission to hospital in the previous 2 years. <p>JURISDICTION / DEVELOPER / ORIGIN: Public developer. NHS Highland Health Board, Scotland.</p> <p>VALIDATION: unknown</p>	All	Unplanned admission, next 12 months	General Practice Inpatient	Generic	Identification

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		<p>REFERENCES</p> <p>Baker, Leak, Ritchie, et al. (2012)</p>					
14.	Patients at Risk of Readmission (PARR)	<p>Public risk stratification tool intended to be used by Primary Care Trusts in the UK. Produces a patient 'risk score' showing a patient's likelihood of re-hospitalisation within the next 12 months. Risk scores range from 0 – 100, with 100 being the highest risk. PARR1 uses data on prior hospitalisations for certain 'reference conditions' to predict risk of re-hospitalisation while PARR2 uses data on any prior hospitalisation to predict risk of rehospitalisation. It is not possible to predict future admissions of patients with no prior admissions.</p> <p>Further iterations of PARR (including PARR-30) were developed. The tool originally did not come with an in-built user interface, although two have been developed (PARR + and PARR ++). The model is no longer updated or supported by the UK Department of Health; not compatible with HRG4 data</p> <p>VARIABLES</p> <ul style="list-style-type: none"> • Hospital utilisation (past 3 years), incl diagnostic fields, prior hospitalisation frequency and demographic characteristics (age, gender, ethnicity) • Community characteristics, incl demographic data and underlying age/sex adjusted rates of hospitalisation for conditions that are sensitive to physician practice style • Hospital of current admission <p>JURISDICTION / DEVELOPER / ORIGIN: Publicly developed tool (Kings Fund and Health Dialog). Now decommissioned</p> <p>England</p> <p>VALIDATION: The algorithm was developed using a 10% sample of (HES) data for all of England for the period indicated. The coefficients for the 21 variables were then applied against a second 10% sample to validate the findings of the algorithm from the first sample.</p> <p>REFERENCES</p> <p>Kings Fund - Predicting and reducing re-admission to hospital</p> <p>Lewis, Wright, Vaithianathan. (2012)</p> <p>Lewis, Vaithianathan, Wright et al. (2013)</p>	All	Readmission, next 12 months	Outpatient Inpatient Census	Generic	Identification
15.	Predicting emergency admission over the next year (PEONY)	<p>A population-derived algorithm to predict future emergency admissions (over next 12 months) in all individuals 40 years or older. The model can be implemented at individual patient level as well as family practice level to target case management, and does not rely on patients having had a previous admission.</p> <p>VARIABLES</p> <ul style="list-style-type: none"> • Demographics • Medications • Co-morbidities • Previous admissions • Mean length of stay <p>JURISDICTION / DEVELOPER / ORIGIN: Scotland</p> <p>VALIDATION: Validated on a random split-half test/data set</p> <p>REFERENCES</p> <p>Donnan, Dorward, Mutch, et al. (2008)</p>	Aged ≥ 40 years	Unplanned hospital admission, next 12 months	General Practice Inpatient data	Generic	Identification Selection
16.	Predictive risk stratification model (PRISM)	<p>Prism is a web based predictive risk tool commissioned by the Welsh Government that stratifies people into four levels based on their individual risk of an emergency admission to hospital in the following 12 months.</p> <p>Both absolute risk (four levels based on percentage risk score) and relative risk (four risk levels based on their risk score relative to the practice population) are measured. Care providers register for access and use Prism through a password protected website. End users can view population level trends, view patient risk data (by entering a NHS number) or filter populations by risk level or other criteria.</p> <p>It is an off the shelf product for use in Welsh GP Practices. The PRISM module runs automatically on a monthly basis and it allows populations to be re-stratified to reflect ongoing health status and health service usage</p> <p>VARIABLES</p> <ul style="list-style-type: none"> • 37 different variables, including 22 variables from GP systems, eight from hospital inpatient record, three demographic variables, data of outpatient 	All	Unplanned admission, 12 months	General Practice Outpatient Inpatient	Generic	Identification

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		<p>visits following ED visits and the Welsh Index of Multiple Deprivation</p> <p>JURISDICTION / DEVELOPER / ORIGIN: Public tool commissioned by NHS Wales Informatics Service to Kings Fund and Health Dialog.</p> <p>Wales</p> <p>VALIDATION: A research study by Swansea University called PRISMATIC is investigating the process and effects of introducing the predictive risk model (PRISM) into GP practices by comparing quality of patient care and resource use between GP practices with and without PRISM. This includes a model validation component.</p> <p>REFERENCES</p> <p>NHS Wales - PRISM</p> <p>PRISMATIC study</p> <p>PRISM Handbook</p> <p>NHS Wales - Chronic Conditions Management Demonstrators Evaluation Report</p> <p>Hutchings, Evans, Fitzsimmons, et al. (2013)</p>					
17.	Probability of Readmission (Pra)	<p>Estimates probability of hospital readmission within four years. Inputs include age, gender, poor self-rated general health, availability of an informal caregiver, having ever had coronary artery disease, having had diabetes during the previous year, a hospital admission during the previous year, more than six doctor visits during the previous year. A more recent version of the tool (PraPlus) also includes questions about medical conditions, functional ability, living circumstances, nutrition and depression. Responses to these questions give further insight to the risk of hospital readmission for elderly patients.</p> <p>Widely used in the USA. Johns Hopkins University holds exclusive rights from the University of Minnesota to sublicense the Pra and PraPlus instruments to others.</p> <p>VARIABLES</p> <ul style="list-style-type: none"> • In general would you say your health is: [excellent; very good; good; fair; poor]. • In the previous 12 months, have you stayed overnight as a patient in a hospital? • In the previous 12 months, how many times did you visit a physician or clinic? • In the previous 12 months, did you have diabetes? • Have you ever had: Coronary heart disease? Angina pectoris? A myocardial infarction? Any other heart attack? • Your sex? • Is there a friend, relative or neighbour who would take care of you for a few days, if necessary? • Your date of birth? <p>A more recent version of the tool (PraPlus) also includes questions about medical conditions, functional ability, living circumstances, nutrition and depression.</p> <p>JURISDICTION / DEVELOPER / ORIGIN: Developed at the University of Minnesota, USA</p> <p>VALIDATION: Since its derivation, the Pra score has subsequently been validated to predict one or more hospital admissions over a 1-year follow-up period and to predict other outcomes such as healthcare utilization and healthcare costs - see Wallace, et al. (2013)</p> <p>REFERENCES</p> <p>Pacala, Boulton, Boulton. (1995)</p> <p>Pacala, Boulton, Reed, et al. (1997)</p> <p>Boulton, Boulton, Morishita, et al. (2001)</p> <p>Doñate-Martínez, Garcés Ferrer, Ródenas Rigla. (2014)</p>	Aged ≥ 65 years	<p>Unplanned hospital admissions (2+), next 4 years</p> <p>Unplanned hospital admission, next 12 months</p>	Patient questionnaire Administrative data	Generic	Identification Selection
18.	Qadmissions	<p>Provides a measure of absolute risk of emergency admission to hospital during the next two years, which includes established risk factors and is designed to run off routinely collected primary care data. It does not include hospital utilisation data (e.g. length of stay, outpatient attendances). This tool is part of a suite of risk calculators.</p> <p>VARIABLES</p> <p>Incorporates 30 variables including:</p> <ul style="list-style-type: none"> • demographic variables 	Adults	Unplanned hospital admission, next 24 months	General Practice	Generic	Identification Selection

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		<ul style="list-style-type: none"> lifestyle variables chronic diseases prescribed medication; clinical values laboratory test results number of emergency admissions in the preceding year (based on information recorded on the linked hospital episodes records) <p>JURISDICTION / DEVELOPER / ORIGIN: England</p> <p>VALIDATION: two validation approaches were used: randomly allocating two-thirds of practices to the derivation dataset and one-third to the validation dataset; assembled a second validation cohort.</p> <p>REFERENCES</p> <p>Hippisley-Cox, Coupland. (2013)</p> <p>QAdmissions risk calculator</p>					
19.	Scottish Patients at Risk of Readmission and Admission (SPARRA)	<p>SPARRA scores risk of admission in the prediction year and can be accessed securely online by authorised health care professionals in NHS Scotland Boards, Community Health Partnerships and GP Practices. Three iterations of this tool have been developed. Version 1 stratified population >65 years, version 2 extended this to whole-of-population and version 3 includes new prescription data input. The algorithm is based on hospital inpatient admissions; community dispensed prescriptions; emergency department (ED) attendances; new outpatient attendances; and psychiatric inpatient admissions. Colour coded data visualisation is available.</p> <p>SPARRA Version 3 is currently in use in Scotland - a key feature of the new tool is the division of the SPARRA cohort into three sub-cohorts: frail elderly, long term conditions, and younger Emergency Department. Within the Version 3 algorithm, these sub-cohorts each have their own specific set of risk factors tailored to the characteristics of these particular populations. The update also improved the discriminatory power of the algorithm.</p> <p>VARIABLES</p> <ul style="list-style-type: none"> Developed from a patient-level dataset which combines information on an individual's: <ul style="list-style-type: none"> Hospital inpatient admissions Community dispensed prescriptions Emergency Department attendances New outpatient attendances Psychiatric inpatient admissions. <p>JURISDICTION / DEVELOPER / ORIGIN: Public developer, commissioned by Scottish Government Information Services Division from Health Dialog, UK Scotland</p> <p>VALIDATION: Logistical regression methodology used to develop and test the tool. Outcomes data for the implementation of SPARRA v3 is not publicly available.</p> <p>REFERENCES</p> <p>ISD Scotland - SPARRA</p> <p>National Health Service Scotland; Scottish Government Health Delivery Directorate (2011)</p>	All	Unplanned hospital admission, next 12 months	Pharmacy Outpatient Emergency Department Inpatient	Generic	Identification