



Advancing Care Coordination
and Telehealth Deployment

ACT Programme

Annex D to Deliverable 7

Literature review outcomes

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Building the background of the deliverable

Objectives of the review

- To define risk assessment, risk predictive modeling, stratification from population and individual based perspectives.
- To know the general European policies about risk assessment and its implications on patient management.
- To review current proposals of modelling of health risk assessment.
- To compile methodological issues regarding modeling development, validation and efficacy.
- To review current publications of stratification tools at ACT regions
- To identify gaps of current risk assessment and stratification strategies
- To identify potential sources of enhancement of risk predictive modeling towards a personalized medicine

Methods

We performed a simplified literature review (not a systematic review), by three main strategies:

1.1.1 MeSH terms in PubMed

“(stratification tools OR risk assessment OR predictive modeling tools) AND (chronic diseases OR chronicity OR chronic patients) AND (primary care OR integrated care OR patient centered medical home OR home based interventions OR telemedicine) AND Europe AND (preventive interventions OR prevention) NOT children NOT pregnancy NOT infectious diseases NOT (disease-oriented OR disease-specific OR diagnosis-specific)”

Details:

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((stratification[All Fields] AND tools[All Fields]) OR ("risk assessment"[MeSH Terms] OR ("risk"[All Fields] AND "assessment"[All Fields]) OR "risk assessment"[All Fields]) OR (predictive[All Fields] AND modeling[All Fields] AND tools[All Fields])) AND (("chronic disease"[MeSH Terms] OR ("chronic"[All Fields] AND "disease"[All Fields]) OR "chronic disease"[All Fields] OR ("chronic"[All Fields] AND "diseases"[All Fields]) OR "chronic diseases"[All Fields]) OR chronicity[All Fields] OR (chronic[All Fields] AND ("patients"[MeSH Terms] OR "patients"[All Fields]))) AND (("primary health care"[MeSH Terms] OR ("primary"[All Fields] AND "health"[All Fields] AND "care"[All Fields]) OR "primary health care"[All Fields] OR ("primary"[All Fields] AND "care"[All Fields]) OR "primary care"[All Fields] OR ("Int J Integr Care"[Journal] OR ("integrated"[All Fields] AND "care"[All Fields]) OR "integrated care"[All Fields]) OR ("patients"[MeSH Terms] OR "patients"[All Fields] OR "patient"[All Fields]) AND centered[All Fields] AND ("patient-centered care"[MeSH Terms] OR ("patient-centered"[All Fields] AND "care"[All Fields]) OR "patient-centered care"[All Fields] OR ("medical"[All Fields] AND "home"[All Fields]) OR "medical home"[All Fields])) OR (home[All Fields] AND based[All Fields] AND interventions[All Fields]) OR ("telemedicine"[MeSH Terms] OR "telemedicine"[All Fields])) AND ("europe"[MeSH Terms] OR "europe"[All Fields]) AND ((preventive[All Fields] AND interventions[All Fields]) OR ("prevention and control"[Subheading] OR ("prevention"[All Fields] AND "control"[All Fields]) OR "prevention and control"[All Fields] OR "prevention"[All Fields])) NOT ("child"[MeSH Terms] OR "child"[All Fields] OR "children"[All Fields]) NOT ("pregnancy"[MeSH Terms] OR "pregnancy"[All Fields]) NOT ("communicable diseases"[MeSH Terms] OR ("communicable"[All Fields] AND "diseases"[All Fields]) OR "communicable diseases"[All Fields]) OR ("infectious"[All Fields] AND "diseases"[All Fields]) OR "infectious diseases"[All Fields]) NOT (disease-oriented[All Fields] OR disease-specific[All Fields] OR diagnosis-specific[All Fields])
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1.1.2 Google Scholar

“Stratification tools; Predictive models; Risk stratification; EIP AHA; Healthcare services”

After a two steps process of reading the titles and abstracts, we discarded documents not related with risk assessment and stratification or not related with population or individual based risk prediction or general policies of the risk assessment and stratification.

1.1.3 Literature from key informants - ACT regions

Finally, we classified the documents according to:

- a) Papers in high impact factor journals
 - b) Specialized books of risk assessment and modeling and/or statements about risk assessment
 - c) Compilation of systematic reviews
 - d) Documents about risk assessment, risk predictive modeling, stratification from population and individual based perspectives
 - e) Documents about current aims of risk assessment
 - f) Documents about current proposals of modelling from multimorbidity and disease specific, approaches
 - g) Documents about methodological issues regarding modeling development, validation and efficacy
 - h) Documents about current publications of stratification tools at ACT regions
 - i) Documents about gaps and limitations of current risk assessment and stratification strategies
 - j) Documents about potential sources of enhancement of risk predictive modeling towards a personalized medicine
 - k) Systematic reviews about risk assessment tools
- l) IV. Finally, we reflected the findings and relevant information obtained from the documents in the main text of the deliverable.

Results

We obtained a total of 106 documents from PubMed (n=80) and Google Scholar (n=26). After this, we discarded those documents (n=72) not related with risk assessment and stratification or not related with population or individual based risk prediction or general policies of the risk assessment and stratification. Finally, we added the documents obtained from key informants from ACT regions documents (n=7). At the end, remaining documents (n=41) were classified and used for the development of the current deliverable according to the objectives mentioned above.

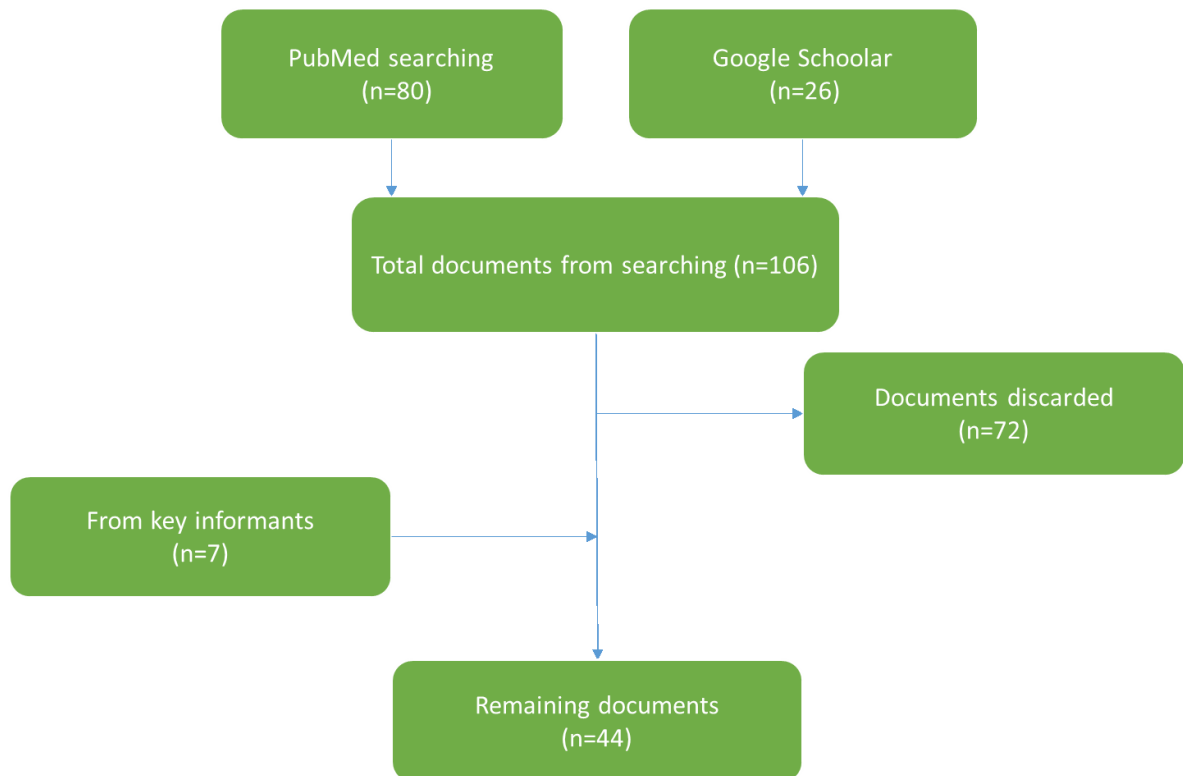


Figure 1: Flowchart of selection of documents for inclusion in this literature review and subsequent classification.

Classification results

1.1.4 High impact factor papers

- Epstein AM, Jha AK, Orav EJ. The Relationship between Hospital Admission Rates and Rehospitalizations. *N Engl J Med.* 2011;365(24):2287-2295.
- Bradley EH, Curry L, Horwitz LI, et al. Hospital strategies associated with 30-day readmission rates for patients with heart failure. *Circ Cardiovasc Qual Outcomes.* 2013;6(4):444-450. Zulman DM, Vijan S, Omenn GS, Hayward R a. The relative merits of population-based and targeted prevention strategies. *Milbank Q.* 2008;86(4):557-580.
- Kansagara D, Englander H, Salanitro A. Risk prediction models for hospital readmission: a systematic review. *Jama.* 2011;306(15):1688-1698.
- Jha AK, Orav EJ, Epstein AM. Public reporting of discharge planning and rates of readmissions. *N Engl J Med.* 2009;361(27):2637-2645.
- Wang TJ, Gona P, Larson MG, et al. Multiple biomarkers for the prediction of first major cardiovascular events and death. *N Engl J Med.* 2006;355(25):2631-2639.
- Hamel MB, Lantos JD, Spertus J a. The Concept of Risk in Comparative-Effectiveness Research. *N Engl J Med.* 2014;371(22):2129-2130.
- Rich MW, Beckham V, Wittenberg C, Leven CL, Freedland KE, Carney RM. A multidisciplinary intervention to prevent the readmission of elderly patients with congestive heart failure. *N Engl J Med.* 1995;333(18):1190-1195.



I.1.5 Specialized and statements documents

- Busse R, Blümel M, Scheller-Kreinsen D, Zentner a. Tackling Chronic Disease in Europe: Strategies, Interventions and Challenges.; 2010.
- Ellen Nolte; Martin McKee. Caring for people with chronic conditions. A Health system perspective. In: Council of the European Union. Maidenhead.; 2008:92-115.
- Kindig D, Stoddart G. What is population health? Am J Public Health 2003;93:380–3.
- Kindig D. What Are We Talking About When We Talk About Population Health? – Health Affairs Blog 2015. http://healthaffairs.org/blog/2015/04/06/what-are-we-talking-about-when-we-talk-about-population-health/?utm_source=Sailthru&utm_medium=email&utm_term=Healthcare Dive&utm_campaign=Issue: 2015-04-06 Healthcare Dive

I.1.6 Compilation of systematic reviews

- Kansagara D, Englander H, Salanitro A. Risk prediction models for hospital readmission: a systematic review. *Jama* 2011;306:1688–98.
- Wallace E, Stuart E, Vaughan N, Bennett K, Fahey T, Smith SM. Risk Prediction Models to Predict Emergency Hospital Admission in Community-dwelling Adults A Systematic Review. 2014;52(8):751-765.
- O’Caoimh R, Cornally N, Weathers E, et al. Risk prediction in the community: A systematic review of case-finding instruments that predict adverse healthcare outcomes in community-dwelling older adults. *Maturitas*. 2015.
- d. Documents about risk assessment, risk predictive modeling, stratification from population and individual based perspectives
- Aronowitz R a. The converged experience of risk and disease. *Milbank Q* 2009;87:417–42.
- Hamel MB, Lantos JD, Spertus J a. The Concept of Risk in Comparative-Effectiveness Research. *N Engl J Med* 2014;371:2129–30.
- Sampat BN, Buterbaugh K, Perl M. New evidence on the allocation of NIH funds across diseases. *Milbank Q* 2013;91:163–85.
- Musich S, Klemes A, Kubica MA. Personalized preventive care reduces healthcare expenditures among Medicare advantage beneficiarie. *Am J Manag Care* 2014;20:613–20.
- Alderwick H. Population health systems Going beyond integrated care 2015.
- Zulman DM, Vijan S, Omenn GS, Hayward R a. The relative merits of population-based and targeted prevention strategies. *Milbank Q* 2008;86:557–80.

I.1.7 Documents about current aims of risk assessment

- Hildebrandt H, Hermann C, Knittel R, Richter-Reichhelm M, Siegel A, Witzenrath W. Gesundes Kinzigtal Integrated Care: improving population health by a shared health gain approach and a shared savings contract. *Int J Integr Care* 2010;10.
- Smart A, Martin P, Parker M. Tailored medicine: whom will it fit? The ethics of patient and disease stratification. *Bioethics* 2004;18:322–42.



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- Ware JH. The limitations of risk factors as prognostic tools. *N Engl J Med* 2006;355:2615–7.
 - Wharam JF, Weiner JP. The promise and peril of healthcare forecasting. *Am J Manag Care* 2012;18.
 - McClellan K a, Avard D, Simard J, Knoppers BM. Personalized medicine and access to health care: potential for inequitable access? *Eur J Hum Genet* 2012;21:143–7.
 - Orkin FK. Risk stratification, risk adjustment, and other risks. *Anesthesiology* 2010;113:1001–3.
 - Thomas JW. Book review Risk Adjustment for Measuring Health Care Outcomes, 3rd edition. *Int J Qual Heal Care* 2004;16:181–2.
 - Smith PC, Mossialos E, Papanicolas I. Performance measurement for health system improvement: experiences, challenges and prospects. World Health Organization - Europe, European Observatory on Health Systems and Policies, Cambridge; 2009.

I.1.8 Multimorbidity and disease-specific approaches

- Zeng C, Ellis JL, Steiner JF, Shoup JA, McQuillan DB, Bayliss EA. Assessment of morbidity over time in predicting health outcomes. *Med Care* 2014;52 Suppl 3:S52–9.
- Hebert C, Shivade C, Foraker R, Wasserman J, Roth C, Mekhjian H, Lemeshow S, Embi P. Diagnosis-specific readmission risk prediction using electronic health data: a retrospective cohort study. *BMC Med Inform Decis Mak* 2014;14:65.

I.1.9 Methodological issues

- Dixon J, Smith P, Gravelle H, Martin S. A person based formula for allocating commissioning funds to general practices in England: development of a statistical model. *BMJ* 2011;6608:1–16.
- Choudhry S a, Li J, Davis D, Erdmann C, Sikka R, Sutariya B. A public-private partnership develops and externally validates a 30-day hospital readmission risk prediction model. *Online J Public Health Inform* 2013;5:219.
- Starfield B, Weiner J, Mumford L, Steinwachs D. Ambulatory care groups: a categorization of diagnoses for research and management. *Health Serv Res* 1991;26:53–74.
- van Walraven C, Dhalla IA, Bell C, Etchells E, Stiell IG, Zarnke K, Austin PC, Forster AJ. Derivation and validation of an index to predict early death or unplanned readmission after discharge from hospital to the community. *CMAJ* 2010;182:551–7.
- Hebert C, Shivade C, Foraker R, Wasserman J, Roth C, Mekhjian H, Lemeshow S, Embi P. Diagnosis-specific readmission risk prediction using electronic health data: a retrospective cohort study. *BMC Med Inform Decis Mak* 2014;14:65.
- Hamel MB, Lantos JD, Spertus J a. The Concept of Risk in Comparative-Effectiveness Research. *N Engl J Med* 2014;371:2129–30.
- Pocock SJ, Ariti C a, McMurray JJ V, Maggioni A, Køber L, Squire IB, Swedberg K, Dobson J, Poppe KK, Whalley G a, Doughty RN. Predicting survival in heart failure: a risk score based on 39 372 patients from 30 studies. *Eur Heart J* 2013;34:1404–13.



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- Royston P, Moons KGM, Altman DG, Vergouwe Y. Prognosis and prognostic research: Developing a prognostic model. *BMJ* 2009;338:b604.

1.1.10 Publications of stratification tools at ACT regions

- Basque Country:
 - Mendia J, García-Álvarez A. Desarrollo de un modelo de predicción de riesgo de hospitalizaciones no programadas en el país vasco. *Rev Esp Salud Pública* 2014;251–60.
 - Orueta JF, Mateos Del Pino M, Barrio Beraza I, Nuño Solinis R, Cuadrado Zubizarreta M, Sola Sarabia C. [Stratification of the population in the Basque Country: results in the first year of implementation]. *Aten Primaria* 2013;45:54–60.
 - Orueta JF, García-Álvarez A, Alonso-Morán E, Vallejo-Torres L, Nuño-Solinis R. Socioeconomic variation in the burden of chronic conditions and health care provision--analyzing administrative individual level data from the Basque Country, Spain. *BMC Public Health* 2013;13:870.
- Catalonia
 - López-Aguila S, Contel JC, Farré J, Campuzano JL, Rajmil L. Predictive model for emergency hospital admission and 6-month readmission. *Am J Manag Care* 2011;17:348–57.
- Groningen
 - Van Kleef RC, Van Vliet RCJ a, Van de Ven WPMM. Risk equalization in The Netherlands: an empirical evaluation. *Expert Rev Pharmacoecon Outcomes Res* 2013;13:829–39.
- Scotland
 - Scottish Patients at Risk of Readmission and Admission (SPARRA): A Report on the Development of SPARRA Version 3 2012;3.

1.1.11 Documents about gaps and limitations

- Smart A, Martin P, Parker M. Tailored medicine: whom will it fit? The ethics of patient and disease stratification. *Bioethics* 2004;18:322–42.
- Ware JH. The limitations of risk factors as prognostic tools. *N Engl J Med* 2006;355:2615–7.

1.1.12 Enhancement of risk assessment

- Zeng C, Ellis JL, Steiner JF, Shoup JA, McQuillan DB, Bayliss EA. Assessment of morbidity over time in predicting health outcomes. *Med Care* 2014;52 Suppl 3:S52–9.
- Mayo NE, Nadeau L, Levesque L, Miller S, Poissant L, Tamblyn R. Does the addition of functional status indicators to case-mix adjustment indices improve prediction of hospitalization, institutionalization, and death in the elderly? *Med Care* 2005;43:1194–202.



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- Godman B, Finlayson AE, Cheema PK, Zebedin-Brandl E, Gutiérrez-Ibarluzea I, Jones J, Malmström RE, Asola E, Baumgärtel C, Bennie M, Bishop I, Bucsis A, Campbell S, Diogene E, Ferrario A, Fürst J, Garuoliene K, Gomes M, Harris K, Haycox A, Herholz H, Hviding K, Jan S, Kalaba M, Kvalheim C, Laius O, Lööv S-A, Malinowska K, Martin A, McCullagh L, Nilsson F, Paterson K, Schwabe U, Selke G, Sermet C, Simoens S, Tomek D, Vlahovic-Palcevski V, Voncina L, Wladysiuk M, van Woerkom M, Wong-Rieger D, Zara C, Ali R, Gustafsson LL. Personalizing health care: feasibility and future implications. *BMC Med* 2013;11:179.
 - Pashayan N, Pharoah P. Population-based screening in the era of genomics. *Per Med* 2012;9:451–5.
 - Wang TJ, Gona P, Larson MG, Tofler GH, Levy D, Newton-Cheh C, Jacques PF, Rifai N, Selhub J, Robins SJ, Benjamin EJ, D'Agostino RB, Vasan RS. Multiple biomarkers for the prediction of first major cardiovascular events and death. *N Engl J Med* 2006;355:2631–9.

I.1.13 Stratification/risk assessment reviews:

- Kansagara D, Englander H, Salanitro A. Risk prediction models for hospital readmission: a systematic review. *Jama* 2011;306:1688–98.
- O’Caoimh R, Cornally N, Weathers E, O’Sullivan R, Fitzgerald C, Orfila F, Clarnette R, Paúl C, Molloy DW. Risk prediction in the community: A systematic review of case-finding instruments that predict adverse healthcare outcomes in community-dwelling older adults. *Maturitas* 2015.
- Wallace E, Stuart E, Vaughan N, Bennett K, Fahey T, Smith SM. Risk prediction models to predict emergency hospital admission in community-dwelling adults: a systematic review. *Med Care* 2014;52:751–65.