Supplemental Appendix 1. Search equations

PubMed/MEDLINE

("decision support systems, clinical"[mh] OR "decision making, computer-assisted"[mh] OR "clinical decision support"[tw] OR CDSS[tw] OR CCDSS[tw])

AND (integrat*[tw] OR implement*[tw] OR "health knowledge, attitudes, practice"[mh] OR "professional competence" [mh] OR "attitude to computers"[mh] OR "attitude of health personnel"[mh] OR attitude[tw] OR satisfaction[tw] OR feedback*[tw] OR drawback*[tw] OR imped*[tw] OR facilitat*[tw] OR adherence[tw] OR hinder*[tw] OR barrier*[tw] OR perception*[tw] OR opinion*[tw] OR compliance[tw] OR acceptability[tw] OR acceptance[tw] OR insight*[tw])

AND ("primary health care"[mh] OR "physicians, family"[mh] OR "family practice"[mh] OR "primary care nursing"[mh] OR "physicians, primary care"[mh] OR "primary care"[tw] OR "primary healthcare"[tw] OR "primary health care"[tw] OR "family physician*"[tw] OR "general practice*"[tw] OR "general practitioner*"[tw] OR gp[tw] OR gps[tw] OR "primary care nursing"[tw] OR "community setting*"[tw])

Filtres : french, english, journal article

EMBASE

('decision support system'/exp OR 'decision support system' OR 'clinical decision support system'/exp OR 'clinical decision support system')

AND ('barriers' OR 'adherence' OR 'health personnel attitude'/exp OR 'health personnel attitude' OR 'satisfaction'/exp OR satisfaction OR barrier* OR opinion OR adherence OR acceptability)

AND ('primary health care'/exp OR 'primary health care' OR 'family medicine'/exp OR 'family medicine' OR 'general practice'/exp OR 'general practice' OR 'general practitioner'/exp OR 'general practitioner')

PsycInfo, CINAHL (EBSCO)

S1 ;"decision support system" OR CDSS OR CCDSS OR "decision making, computer assisted"

S2 ;integrat* OR implement* OR attitude* OR satisfaction OR feedback* OR drawback* OR imped* OR facilitat* OR "adherence" OR hinder* OR barrier* OR perception* OR opinion* OR compliance OR acceptability OR acceptance OR insight*

S3 ;"primary health care" OR "family practice" OR "primary nursing" OR "primary care" OR "primary healthcare" OR "primary health care" OR "family physician*" OR "general practice" OR "general practitioner*" OR gp OR "primary nurse*" OR "primary nursing" OR "community setting*"

S4 ; S1 AND S2 AND S3

The Cochrane Library

("decision support systems, clinical" OR "decision making, computer-assisted" OR "clinical decision support" OR CDSS OR CCDSS):ti,ab,kw

AND ("health knowledge, attitudes, practice" OR "professional competence" OR "attitude to computers" OR "attitude of health personnel" OR attitude? OR satisfaction OR feedback? OR drawback? OR imped* OR facilitat*

OR adherence OR hinder? OR barrier? OR perception? OR opinion? OR compliance OR acceptability OR acceptance OR insight):ti,ab,kw

AND ("primary health care" OR "physicians, family" OR "family practice" OR "primary care nursing" OR "physicians, primary care" OR "primary care" OR "primary healthcare" OR "primary health care" OR "family physician?" OR "general practice?" OR "general practitioner?" OR gp? OR "primary care nursing" OR "community setting?"):ti,ab,kw"

Supplemental Table 1. CDSS features extracted from the included studies, with pre-defined categories

Features extracted	
Background information	
CDSS name	
Country of development	
Country of use	
Supported language(s)	
Commercialisation status	Yes **/** Ongoing / No / Not anymore / Unknown
Developed in collaboration with PCPs	Yes / No / Unknown
Targets	
Users	Primary care physicians / Other specialists / Primary care residents / Nurses / Other PCPs (non-physicians)
Care procedures	Prevention (iatrogenesis) / Prevention (disease, test ordering) / Diagnosis / Therapeutics / Management of chronic disease(s)
Health issue(s)	
Knowledge base	
Knowledge-based CDSS	Yes / No / Unknown
Updates of the knowledge base	Yes / No / Unknown
Cites the strength of evidence	Yes / No / Unknown
Provides links to the sources of the recommendations	Yes / No / Unknown
Provides educational materials to assist patients in shared decision-making	Yes / No / Unknown
Interface	
EHR integration	Fully integrated / Partially integrated / Not integrated
Data entry by the PCP	Yes, during consultations / Yes, outside and/or during consultations / No
Data entry by the patient	Yes, before the consultation / No
Duplication of data entry	Yes / No
Active/Passive	

Push/Pull

Interruptive or not

Requires reason to override   Yes / No / Unknown

PCPs trained to the CDSS   Yes / No/ Unknown

Supplemental Appendix 2. Tables of detailed features of included CDSSs

Supplemental Appendix 2A. Background information

Study		CDSS Name	Country of development	Country of use	Supported language(s)	Commercialization	Developed in collaboration with PCPs
1	Abimbola et al. 2019	HealthTracker	Australia	Australia	English	Ongoing	Yes
2	afKlercker et al. 1998	Unknown	Sweden	Sweden	Swedish	Unknown	Yes
3	Alagiakrishnan et al. 2016	SMART CDS	Canada	Canada	English	Unknown	Yes
4	Arts et al. 2018	Unknown	The Netherlands	The Netherlands	English	Unknown	Yes
5	Ash et al. 2011	Unknown	United States of America	United States of America	English	Yes	Yes
6	Bandong et al. 2019	My Whiplash Navigator	Australia	Australia	English	Yes	Yes
7	Bessat et al. 2019	Registre Electronique des Consultations (REC)	Switzerland	Burkina Faso	French	Yes	Yes
8	Bindels et al. 2003	GRIF Automated Feedback System	The Netherlands	The Netherlands	Dutch	Unknown	Unknown
9	Curry et al. 2011	Decision Support Server	Canada	Canada	English	Not commercialized	Unknown
10	Dixon et al. 2013	Unknown	United States of America	United States of America	English	Not commercialized	Yes
11	Doerr et al. 2014	My Family	United States of America	United States of America	English	Yes	Yes
12	Edelman et al. 2014	The Pregnancy and Health Profile (PHP)	United States of America	United States of America	English	Yes	Yes
13	Feldstein et al. 2013	Patient Panel-Support Tool (PST)	United States of America	United States of America	English	Unknown	Yes
14	Guenter et al. 2019	McMaster Pain Assistant (MPA)	Canada	Canada	English	Not anymore	Yes
15	Helldèn et al. 2015	The renal button	Sweden	Sweden	English	Unknown	Yes
16	Heselmans et al. 2020, Koskela et al. 2016	EBMeDS	Finland	Finland, Estonia, Belgium, Italy	Finnish, Swedish, English, Estonian, French, Dutch, Italian, German (Russian being translated)	Yes	Yes
17	Jensen et al. 2019	eIMCI	South Africa	South Africa	English	Yes	Yes
18	Jenssen et al. 2016	Unknown	United States of America	United States of America	English	Not commercialized	Yes

#	Reference	System	Country (dev)	Country (use)	Language	Commercialized	Column
19	Kempe et al. 2017	Immunization information systems	United States of America	United States of America	English	Unknown	Unknown
20	LamShinCheung et al. 2020	eAMS (Electronic Asthma Management System)	Canada	Canada	English	Ongoing	Yes
21	Lemke et al. 2020	The Genetic and Wellness Assessment	United States of America	United States of America	English	Yes	Unknown
22	Litvin et al. 2012	ABX-TRIP CDSS	United States of America	United States of America	English	Not commercialized	Yes
23	Litvin et al. 2016	Unknown	United States of America	United States of America	English	Not commercialized	Yes
24	Lugtenberg et al. 2015 (2 articles)	NHGDoc	The Netherlands	The Netherlands	Dutch	Yes	No
25	Maia et al. 2016	Unknown	Brazil	Brazil	Portuguese	Not commercialized	Yes
26	Marcolino et al. 2021	Unknown	Brazil	Brazil	Portuguese	Yes	Yes
27	Minian et al. 2021	Unknown	Canada	Canada	English	Not commercialized	Yes
28	Montini et al. 2013	Unknown	United States of America	United States of America	English	Not commercialized	Yes
29	Pannebakker et al. 2019	Unknown	England	England	English	Unknown	Yes
30	Peiris et al. 2014	Unknown	Australia	Australia	English	Not commercialized	Yes
31	Praveen et al. 2014	Unknown	Inde + Australia + England + United States of America	Inde + Indonesia + Thailand	English, Telugu, Hindi, Bahasa, Thai	Ongoing	Yes
32	Price et al. 2017	Unknown	Canada	Canada	English	Yes	Yes
33	Richardson et al. 2019	Unknown	United States of America	United States of America	English	Not commercialized	Unknown
34	Rieckert et al. 2018 and 2019 (2 articles)	PRIMA-eDS tool	Finland	Germany + Austria + Italy + England	German, Italian, English	Yes	Yes
35	Rousseau et al. 2003	Unknown	England	England	English	Not commercialized	Unknown
36	Rubin et al. 2006	Unknown	United States of America	United States of America	English	Unknown	Yes
37	Silveira et al. 2019	TeleHAS	Brazil	Brazil	Portuguese	Not commercialized	Yes
38	Sukums et al. 2015	The QUALMAT eCDSS	Germany	Ghana + Tanzania + Burkina Faso	Unknown	Unknown	Yes
39	Toth-Pal et al. 2008	Evibase	Sweden	Sweden	Swedish	Not anymore	Yes
40	Trafton et al. 2010	ATHENA-OT	United States of America	United States of America	English	Not commercialized	Yes

41	Trinkley et al. 2021	Unknown	United States of America	United States of America	English		Not commercialized	Yes
42	Wan et al. 2012	Unknown	Australia	Australia	English		Not commercialized	Yes
43	Williams et al. 2016	Pediatric Cardiovascular Risk Reduction CDS Tool	United States of America	United States of America	English		Unknown	Unknown
44	Wilson et al. 2007	EMPOWER	Australia	Australia	English		Not commercialized	Yes
45	Zheng et al. 2005	Clinical Reminder System (CRS)	United States of America	United States of America	English		Not commercialized	Yes

Supplemental Appendix 2B. CDSS targets

Study		CDSS Name	Users	Care procedures	Health issues
1	Abimbola et al. 2019	HealthTracker	Primary care physicians	Prevention (disease, test ordering)	Treatment of cardiovascular risk
2	afKlercker et al. 1998	Unknown	Primary care physicians, nurses	Diagnosis	Ear, nose, and throat diseases
3	Alagiakrishnan et al. 2016	SMART CDS	Primary care physicians, other specialists	Prevention (iatrogenesis)	Giving rapid recommendations on the adaption of medication to renal function from the patient's EHR
4	Arts et al. 2018	Unknown	Primary care physicians	Global management of chronic disease(s)	Atrial fibrillation, diabetes, hypertension, medication prescriptions relating to care of older adults
5	Ash et al. 2011	Unknown	Primary care physicians, Nurses, Other PCPs (non-physicians)	Diagnosis, therapeutics (prescribing, vaccination)	Drug-drug, drug-condition, and drug-allergy interaction checking; patient care plan dashboard that includes alerts and reminders; nearly 3000 condition specific point-and-click templates for documentation
6	Bandong et al. 2019	My Whiplash Navigator	Primary care physicians, primary care residents, other PCPs (non-physicians), patients	Therapeutics (prescribing, vaccination)	Whiplash-associated disorders
7	Bessat et al. 2019	Registre Electronique des Consultations (REC)	Nurses, other PCPs (non-physicians)	Diagnosis, therapeutics (prescribing, vaccination)	Assessment, classification, and treatment of children under the age of 5 year
8	Bindels et al. 2003	GRIF Automated Feedback System	Primary care physicians	Prevention (disease, test ordering)	Comments on the appropriateness of diagnostic tests ordered by general practitioners based on recommendations from accepted national and regional practice guidelines
9	Curry et al. 2011	Decision Support Server	Primary care physicians	Prevention (disease, test ordering)	Diagnostic imaging prescriptions
10	Dixon et al. 2013	Unknown	Primary care physicians, other specialists	Prevention (disease, test ordering), global management of chronic disease(s)	Hypertension, diabetes, coronary artery disease
11	Doerr et al. 2014	My Family	Primary care physicians, other specialists, nurses	Prevention (disease, test ordering)	Cancer risk management
12	Edelman et al. 2014	The Pregnancy and Health Profile (PHP)	Primary care physicians, other specialists, nurses	Prevention (disease, test ordering)	Prenatal genetic screening and clinical decision support
13	Feldstein et al. 2013	Patient Panel-Support Tool (PST)	Primary care physicians, nurses, other PCPs (non-physicians)	Prevention (iatrogenesis, disease, test ordering), global management of chronic disease(s)	Graphically displays care gaps (e.g., for screening, medication use, monitoring, risk-factor control, immunizations)
14	Guenter et al. 2019	McMaster Pain Assistant (MPA)	Primary care physicians, nurses, primary care residents	Diagnosis, therapeutics (prescribing, vaccination)	Neuropathic pain
15	Helldèn et al. 2015	The renal button	Primary care physicians	Prevention (iatrogenesis)	Giving rapid recommendations on the adaption of medication to renal function from the patient's EHR
16	Heselmans et al. 2020, Koskela et al. 2016	EBMeDS	Primary care physicians, nurses	Prevention (iatrogenesis, disease, test ordering), therapeutics (prescribing,	Guideline assistant, drug interaction and contraindication reminders, drug choice suggestions (indications), reminders of drug restrictions and dosing in renal malfunction, reminders of drug

				vaccination), global management of chronic disease(s)	restrictions during pregnancy and lactation, other rules related to > 1000 international guidelines, form assistant to help with duplication of data collection
17	Jensen et al. 2019	eIMCI	Nurses	Prevention (disease, test ordering), therapeutics (prescribing, vaccination)	Management of childhood illness
18	Jenssen et al. 2016	Unknown	Nurses, other specialists	Prevention (disease, test ordering), Therapeutics (prescribing, vaccination)	Smoking cessation
19	Kempe et al. 2017	Immunization information systems	Primary care physicians, other specialists	Prevention (disease, test ordering)	Management of vaccination
20	LamShinCheung et al. 2020	eAMS (Electronic Asthma Management System)	Primary care physicians, nurses, primary care residents	Therapeutics (prescribing, vaccination), global management of chronic disease(s)	Asthma
21	Lemke et al. 2020	The Genetic and Wellness Assessment	Primary care physicians, other specialists	Prevention (disease, test ordering)	Identifying patients who have an increased probability of an inherited condition (related to cancer, cardiology, neurology, and endocrinology), and facilitating appropriate follow-up and care
22	Litvin et al. 2012	ABX-TRIP CDSS	Primary care physicians, nurses, other PCPs (non-physicians)	Prevention (disease, test ordering), diagnosis, therapeutics (prescribing)	Management of acute respiratory infections
23	Litvin et al. 2016	Unknown	Primary care physicians, nurses, other PCPs (non-physicians)	Prevention (disease, test ordering)	Identification and management of chronic kidney disease
24	Lugtenberg et al. 2015 (2 articles)	NHGDoc	Primary care physicians, nurses	Prevention (disease, test ordering, iatrogenesis) therapeutics (prescribing, vaccination), global management of chronic disease(s)	Cardiovascular risk management, asthma/COPD, diabetes mellitus type II, thyroid disorders, viral hepatitis and other liver diseases, atrial fibrillation, and subfertility
25	Maia et al. 2016	Unknown	Primary care physicians, nurses	Global management of chronic disease(s)	Diabetes (T2)
26	Marcolino et al. 2021	Unknown	Primary care physicians, nurses, other PCPs (non-physicians)	Prevention (disease, test ordering), global management of chronic diseases	Diabetes (T2), hypertension, cardiovascular risk treatment
27	Minian et al. 2021	Unknown	Nurses, other PCPs (non-physicians)	Prevention (disease, test ordering)	Alcohol intervention
28	Montini et al. 2013	Unknown	Other PCPs (non-physicians)	Prevention (disease, test ordering), therapeutics (prescribing, vaccination)	Tobacco use screening and treatment
29	Pannebakker et al. 2019	Unknown	Primary care physicians	Prevention (disease, test ordering)	Assessment of pigmented skin lesions
30	Peiris et al. 2014	Unknown	Primary care physicians	Diagnosis, therapeutics (prescribing, vaccination)	Management of back pain
31	Praveen et al. 2014	Unknown	Primary care physicians, other PCPs (non-physicians)	Global management of chronic disease(s)	Cardiovascular risk management and referral

32	Price et al. 2017	Unknown	Primary care physicians, nurses	Prevention (iatrogenesis)	Potentially inappropriate prescriptions in the elderly
33	Richardson et al. 2019	Unknown	Primary care physicians, nurses	Therapeutics (prescribing, vaccination)	Sore throat, upper respiratory tract infection
34	Rieckert et al. 2018 and 2019 (2 articles)	PRIMA-eDS tool	Primary care physicians	Prevention (iatrogenesis)	Potentially inappropriate prescriptions in the elderly
35	Rousseau et al. 2003	Unknown	Primary care physicians, nurses, other PCPs (non-physicians)	Therapeutics (prescribing, vaccination), global management of chronic disease(s)	Asthma and angina in adults
36	Rubin et al. 2006	Unknown	Primary care physicians, nurses, other specialists, other PCPs (non-physicians)	Diagnosis, therapeutics (prescribing, vaccination)	Acute respiratory tract infections
37	Silveira et al. 2019	TeleHAS	Primary care physicians	Prevention (disease, test ordering), therapeutics	Cardiovascular risk and hypertension
38	Sukums et al. 2015	The QUALMAT eCDSS	Other PCPs (non-physicians)	Therapeutics (prescribing, vaccination)	Antenatal and intrapartum care
39	Toth-Pal et al. 2008	Evibase	Primary care physicians	Global management of chronic disease(s)	Congestive heart failure
40	Trafton et al. 2010	ATHENA-OT	Primary care physicians, nurses	Therapeutics (prescribing, vaccination)	Opioid therapy for chronic, noncancer pain
41	Trinkley et al. 2021	Unknown	Primary care physicians, other specialists	Therapeutics (prescribing, vaccination)	Heart failure
42	Wan et al. 2012	Unknown	Primary care physicians, nurses	Global management of chronic disease(s)	Diabetes (T2)
43	Williams et al. 2016	Pediatric Cardiovascular Risk Reduction CDS Tool	Primary care physicians	Prevention (disease, test ordering)	Pediatric cardiovascular risk management
44	Wilson et al. 2007	EMPOWER	Primary care physicians	Prevention (disease, test ordering), therapeutics (prescribing, vaccination)	Cardiovascular risk and hypertension
45	Zheng et al. 2005	Clinical Reminder System (CRS)	Primary care residents	Prevention (iatrogenesis, disease, test ordering), therapeutics (prescribing, vaccination), global management of chronic disease(s)	Diabetes (T2), hyperlipidemia, steroid-induced osteoporosis, influenza, pneumonia, breast cancer, cervical cancer

Supplemental Appendix 2C. CDSS knowledge base

Study		CDSS Name	Knowledge-based CDSS	Updates of the knowledge database	Cites the strength of evidence	Provides links to the sources of recommendations	Provides educational materials to assist patients in shared decision-making
1	Abimbola et al. 2019	HealthTracker	Yes	Yes	Unknown	No	Yes
2	afKlercker et al. 1998	Unknown	Yes	Unknown	No	No	No
3	Alagiakrishnan et al. 2016	SMART CDS	Yes	Unknown	Yes	Yes	No
4	Arts et al. 2018	Unknown	Yes	Unknown	No	Yes	No
5	Ash et al. 2011	Unknown	Yes	Yes	Unknown	Unknown	No
6	Bandong et al. 2019	My Whiplash Navigator	Yes	Unknown	Unknown	Unknown	Yes
7	Bessat et al. 2019	Registre Electronique des Consultations (REC)	Yes	Unknown	Unknown	Unknown	No
8	Bindels et al. 2003	GRIF Automated Feedback System	Yes	Unknown	Unknown	Yes	No
9	Curry et al. 2011	Decision Support Server	Yes	No	Unknown	Yes	No
10	Dixon et al. 2013	Unknown	Yes	No	Unknown	Yes	No
11	Doerr et al. 2014	My Family	Yes	Unknown	Unknown	Yes	Yes
12	Edelman et al. 2014	The Pregnancy and Health Profile (PHP)	Yes	Unknown	Unknown	Unknown	Yes
13	Feldstein et al. 2013	Patient Panel-Support Tool (PST)	Yes	Unknown	No	No	Yes
14	Guenter et al. 2019	McMaster Pain Assistant (MPA)	Yes	No	No	Yes	Yes
15	Helldèn et al. 2015	The renal button	Yes	Unknown	Unknown	Yes	No
16	Heselmans et al. 2020, Koskela et al. 2016	EBMeDS	Yes	Yes	Yes	Yes	No
17	Jensen et al. 2019	eIMCI	Yes	Yes	No	Unknown	No
18	Jenssen et al. 2016	Unknown	Yes	Yes	No	Yes	No
19	Kempe et al. 2017	Immunization information systems	Yes	Unknown	Unknown	Unknown	No
20	LamShinCheung et al. 2020	eAMS (Electronic Asthma Management System)	Yes	Yes	No	No	Yes
21	Lemke et al. 2020	The Genetic and Wellness Assessment	Yes	Unknown	No	No	No
22	Litvin et al. 2012	ABX-TRIP CDSS	Yes	No	No	Yes	Yes
23	Litvin et al. 2016	Unknown	Yes	No	Unknown	Yes	No
24	Lugtenberg et al. 2015 (2 articles)	NHGDoc	Yes	Yes	No	Unknown	No

#	Study	CDSS Name					
25	Maia et al. 2016	Unknown	Yes	No	No	No	No
26	Marcolino et al. 2021	Unknown	Yes	Yes	Unknown	Yes	Unknown
27	Minian et al. 2021	Unknown	Yes	Yes	No	No	No
28	Montini et al. 2013	Unknown	Yes	No	Unknown	No	No
29	Pannebakker et al. 2019	Unknown	Yes	Unknown	Unknown	Unknown	No
30	Peiris et al. 2014	Unknown	Yes	No	Unknown	Yes	Yes
31	Praveen et al. 2014	Unknown	Yes	Yes	No	Yes	No
32	Price et al. 2017	Unknown	Yes	No	Yes	Yes	No
33	Richardson et al. 2019	Unknown	Yes	No	Unknown	No	Yes
34	Rieckert et al. 2018 and 2019 (2 articles)	PRIMA-eDS tool	Yes	Unknown	Unknown	Yes	No
35	Rousseau et al. 2003	Unknown	Yes	No	Yes	Yes	Yes
36	Rubin et al. 2006	Unknown	Yes	Unknown	Unknown	Unknown	No
37	Silveira et al. 2019	TeleHAS	Yes	Yes	Unknown	Yes	No
38	Sukums et al. 2015	The QUALMAT eCDSS	Yes	Unknown	Unknown	Unknown	No
39	Toth-Pal et al. 2008	Evibase	Yes	Unknown	Unknown	Yes	No
40	Trafton et al. 2010	ATHENA-OT	Yes	No	Unknown	Yes	No
41	Trinkley et al. 2021	Unknown	Yes	No	Unknown	Yes	No
42	Wan et al. 2012	Unknown	Yes	No	No	No	Yes
43	Williams et al. 2016	Pediatric Cardiovascular Risk Reduction CDS Tool	Yes	Unknown	Unknown	Unknown	No
44	Wilson et al. 2007	EMPOWER	Yes	No	Unknown	Unknown	Yes
45	Zheng et al. 2005	Clinical Reminder System (CRS)	Yes	No	No	Yes	No

Supplemental Appendix 2D. CDSS interface

Study		CDSS Name	Participants trained to the CDSS	EHR integration	Data entry by the PCP	Data entry by the patient	Duplication of data entry	Active or passive	Push or pull	Interruptive or not	Requires reason for over-ride
1	Abimbola et al. 2019	HealthTracker	No	Partially integrated	During the encounter	No	No	Active	Pull	Not interruptive	No
2	afKlercker et al. 1998	Unknown	Yes	Not integrated	During the encounter	No	Yes	Passive	Pull	Not interruptive	No

3	Alagiakrishnan et al. 2016	SMART CDS	Yes	Fully integrated	During the encounter	No	No	Active and Passive	Pull	Interruptive	Yes
4	Arts et al. 2018	Unknown	Yes	Partially integrated	During the encounter	No	Yes	Active	Pull	Not interruptive	Yes
5	Ash et al. 2011	Unknown	Yes	Fully integrated	During the encounter	No	No	Active and Passive	Pull	Interruptive and not interruptive (depending on what aspect of the CDSS is triggered)	No
6	Bandong et al. 2019	My Whiplash Navigator	Yes	Not integrated	During the encounter	Yes - before the encounter	Yes	Passive	Pull	Not interruptive	No
7	Bessat et al. 2019	Registre Electronique des Consultations (REC)	Yes	Not integrated	During the encounter	No	Yes	Passive	Pull	Not interruptive	No
8	Bindels et al. 2003	GRIF Automated Feedback System	Unknown	Partially integrated	During the encounter	No	Yes	Active	Pull	Interruptive	Yes
9	Curry et al. 2011	Decision Support Server	Yes	Fully integrated	During the encounter	No	No	Passive	Pull	Interruptive	Unknown
10	Dixon et al. 2013	Unknown	Yes	Fully integrated	During the encounter	No	No	Active	Pull	Not interruptive	No
11	Doerr et al. 2014	My Family	Yes	Fully integrated	No	Yes - before the encounter	No	Passive	Pull	Not interruptive	No
12	Edelman et al. 2014	The Pregnancy and Health Profile (PHP)	Yes	Not integrated	No	Yes - before the encounter	Yes	Passive	Pull	Not interruptive	No
13	Feldstein et al. 2013	Patient Panel-Support Tool (PST)	Yes	Partially integrated	During the encounter	No	No	Passive	Pull	Not interruptive	No
14	Guenter et al. 2019	McMaster Pain Assistant (MPA)	Yes	Fully integrated	During the encounter	No	No	Passive	Pull	Not interruptive	Unknown
15	Helldèn et al. 2015	The renal button	Yes	Fully integrated	During the encounter	No	No	Active	Pull	Not interruptive	No
16	Heselmans et al. 2020, Koskela et al. 2016	EBMeDS	Yes	Fully integrated	During the encounter	No	No	Active	Pull	Interruptive	No
17	Jensen et al. 2019	eIMCI	Yes	Fully integrated	During the encounter	No	No	Active	Pull	Interruptive	No
18	Jenssen et al. 2016	Unknown	Yes	Fully integrated	During the encounter	No	Yes	Active	Pull	Not interruptive	No
19	Kempe et al. 2017	Immunization information systems	No	Not integrated	During the encounter	No	Yes	Passive	Pull	Not interruptive	No
20	LamShinCheung et al. 2020	eAMS (Electronic Asthma Management System)	Yes	Fully integrated	During the encounter	Yes - before the encounter	No	Active	Pull	Interruptive	No

#	Study	Tool	Col1	Integration	Timing	Col2	Col3	Active/Passive	Pull/Push	Interruptive	Col4
21	Lemke et al. 2020	The Genetic and Wellness Assessment	Unknown	Fully integrated	During the encounter	Yes - before the encounter	No	Active	Unknown	Unknown	Unknown
22	Litvin et al. 2012	ABX-TRIP CDSS	Yes	Fully integrated	During the encounter	No	No	Passive	Pull	Not interruptive	No
23	Litvin et al. 2016	Unknown	Yes	Fully integrated	During the encounter	No	No	Passive	Pull	Not interruptive	No
24	Lugtenberg et al. 2015 (2 articles)	NHGDoc	Yes	Fully integrated	During the encounter	No	No	Passive	Pull	Not interruptive	No
25	Maia et al. 2016	Unknown	Yes	Not integrated	During the encounter	No	Yes	Passive	Pull	Not interruptive	Unknown
26	Marcolino et al. 2021	Unknown	Yes	Not integrated	During the encounter	No	Yes	Passive	Pull	Not interruptive	No
27	Minian et al. 2021	Unknown	Yes	Not integrated	During the encounter	No	No	Passive	Pull	Interruptive	No
28	Montini et al. 2013	Unknown	Yes	Not integrated	During the encounter	No	Yes	Passive	Pull	Not interruptive	No
29	Pannebakker et al. 2019	Unknown	Yes	Fully integrated	During the encounter	No	No	Passive	Pull	Not interruptive	No
30	Peiris et al. 2014	Unknown	Unknown	Not integrated	During the encounter	No	Yes	Passive	Pull	Not interruptive	No
31	Praveen et al. 2014	Unknown	Yes	Not integrated	During the encounter	No	No	Passive	Pull	Not interruptive	No
32	Price et al. 2017	Unknown	Yes	Fully integrated	During the encounter	No	No	Active	Pull	Not interruptive	No
33	Richardson et al. 2019	Unknown	Unknown	Fully integrated	During the encounter	No	No	Active	Pull	Interruptive	No
34	Rieckert et al. 2018 and 2019 (2 articles)	PRIMA-eDS tool	Yes	Not integrated	Outside and/or during the encounter	No	Yes	Passive	Pull	Not interruptive	No
35	Rousseau et al. 2003	Unknown	Yes	Fully integrated	During the encounter	No	No	Active	Pull	Interruptive	No
36	Rubin et al. 2006	Unknown	Yes	Not integrated	During the encounter	No	Yes	Passive	Pull	Not interruptive	No
37	Silveira et al. 2019	TeleHAS	No	Not integrated	Outside and/or during the encounter	No	Yes	Passive	Pull	Not interruptive	No
38	Sukums et al. 2015	The QUALMAT eCDSS	Yes	Not integrated	During the encounter	No	Yes	Passive	Pull	Not interruptive	No
39	Toth-Pal et al. 2008	Evibase	Yes	Not integrated	Outside and/or during the encounter	No	Yes	Passive	Pull	Not interruptive	Unknown
40	Trafton et al. 2010	ATHENA-OT	Yes	Fully integrated	Outside and/or during the encounter	No	No	Active	Pull	Interruptive	No
41	Trinkley et al. 2021	Unknown	Yes	Fully integrated	During the encounter	No	No	Active	Push	Interruptive	Yes
42	Wan et al. 2012	Unknown	No	Partially integrated	During the encounter	No	Yes	Active	Pull	Not interruptive	No
43	Williams et al. 2016	Pediatric Cardiovascular Risk Reduction CDS Tool	No	Not integrated	During the encounter	No	Yes	Passive	Pull	Not interruptive	No
44	Wilson et al. 2007	EMPOWER	Yes	Partially integrated	During the encounter	No	No	Passive	Pull	Not interruptive	Unknown

| 45 | Zheng et al. 2005 | Clinical Reminder System (CRS) | Yes | Partially integrated | During the encounter | No | Yes | Passive | Pull | Not interruptive | No |

Supplemental Table 2. Quality assessment of the included studies (QuADS criteria)

		1	2	3	4	5	6	7	8	9	10	11	12	13
1	Abimbola et al. 2019	C	M	M	C	VS	C	C	C	VS	NM	M	C	M
2	afKlercker et al. 1998	M	C	C	C	C	C	C	C	NM	VS	C	NM	M
3	Alagiakrishnan et al. 2016	C	C	M	C	NM	NM	M	M	M	NM	M	C	C
4	Arts et al. 2018	C	C	C	C	M	C	C	C	C	NM	M	M	C
5	Ash et al. 2011	C	C	C	M	M	M	M	M	VS	NM	C	C	NM
6	Bandong et al. 2019	C	C	C	C	C	NM	M	C	C	NM	M	C	M
7	Bessat et al. 2019	C	C	C	C	M	NM	C	C	VS	VS	M	VS	M
8	Bindels et al. 2003	C	C	M	C	NM	M	C	M	C	M	C	C	M
9	Curry et al. 2011	C	M	C	M	VS	NM	M	VS	C	NM	M	NM	NM
10	Dixon et al. 2013	C	C	C	M	VS	NM	VS	M	VS	VS	M	M	M
11	Doerr et al. 2014	C	C	C	C	C	M	C	C	NM	M	M	VS	C
12	Edelman et al. 2014	C	C	C	M	M	NM	M	C	C	NM	M	NM	C
13	Feldstein et al. 2013	C	C	C	C	C	M	C	C	C	VS	C	NM	M
14	Guenter et al. 2019	C	C	C	C	M	C	C	M	M	VS	C	C	M
15	Helldèn et al. 2015	C	C	M	C	VS	C	C	M	C	VS	C	C	C
16	Heselmans et al. 2020	C	M	C	M	VS	VS	M	M	C	C	M	NM	C
17	Jensen et al. 2019	C	C	C	C	M	NM	M	C	M	NM	M	C	C
18	Jenssen et al. 2016	C	C	C	C	NM	M	VS	M	VS	NM	M	C	M
19	Kempe et al. 2017	C	C	C	M	C	C	M	C	C	NM	M	C	M
20	Koskela et al. 2016	C	C	C	C	C	NM	M	C	M	NM	M	NM	C
21	LamShinCheung et al. 2020	C	C	C	M	VS	NM	M	C	C	NM	M	C	M
22	Lemke et al. 2020	C	C	C	C	C	C	C	C	VS	M	C	C	C
23	Litvin et al. 2012	C	C	C	C	NM	M	C	M	C	NM	C	C	M
24	Litvin et al. 2016	C	C	C	C	NM	M	C	M	C	NM	M	NM	C
25	Lugtenberg, Pasveer et al. 2015	C	C	C	C	C	C	C	C	C	C	C	NM	M
26	Lugtenberg, Weeninck et al. 2015	C	C	C	C	M	M	M	C	C	M	M	NM	C
27	Maia et al. 2016	C	C	C	M	M	NM	M	VS	M	NM	NM	C	M
28	Marcolino et al. 2021	C	C	C	C	VS	VS	C	M	M	NM	M	C	M

#	Study	1	2	3	4	5	6	7	8	9	10	11	12	13
29	Minian et al. 2021	C	C	C	C	C	C	C	C	C	C	C	NM	C
30	Montini et al. 2013	C	M	C	C	VS	M	M	M	M	NM	M	C	VS
31	Pannebakker et al. 2019	C	C	C	C	C	C	C	C	VS	M	C	C	M
32	Peiris et al. 2014	C	C	C	C	VS	M	C	VS	VS	M	C	C	VS
33	Praveen et al. 2014	C	C	C	C	VS	C	C	C	NM	M	C	C	VS
34	Price et al. 2017	C	C	C	C	C	VS	M	VS	C	NM	M	NM	M
35	Richardson et al. 2019	C	C	C	C	C	NM	C	M	VS	C	C	NM	C
36	Rieckert et al. 2018	C	C	C	C	C	NM	M	C	M	M	C	NM	C
37	Rieckert et al. 2019	C	C	C	C	M	C	C	C	C	C	C	NM	C
38	Rousseau et al. 2003	C	M	C	C	C	C	C	C	M	NM	NM	NM	M
39	Rubin et al. 2006	C	C	C	M	VS	NM	M	VS	C	NM	M	NM	M
40	Silveira et al. 2019	C	C	C	C	VS	NM	C	VS	C	NM	M	C	NM
41	Sukums et al. 2015	C	C	C	C	M	M	C	C	VS	M	C	NM	M
42	Toth-Pal et al. 2008	C	C	C	C	M	VS	C	C	C	C	C	NM	M
43	Trafton et al. 2010	C	M	C	C	VS	NM	C	M	VS	NM	M	C	M
44	Trinkley et al. 2021	C	C	C	C	M	VS	M	M	VS	VS	C	C	C
45	Wan et al. 2012	C	C	C	C	M	NM	C	C	C	NM	C	NM	C
46	Williams et al. 2016	C	C	C	M	VS	NM	M	M	VS	C	M	NM	C
47	Wilson et al. 2007	C	C	C	C	VS	NM	M	M	M	NM	M	NM	VS
48	Zheng et al. 2005	C	C	VS	C	M	VS	C	VS	VS	C	C	NM	VS

C: complete; M: moderately; VS: very slightly; NM: no mention at all
1: Theoretical or conceptual underpinning to the research
2: Statement of research aim(s)
3: Clear description of research settings and target population
4: The study design is appropriate to address the stated research aim/s
5: Appropriate sampling to address the research aim/s
6: Rationale for choice of data collection tool/s
7: The format and content of data collection tool is appropriate to address the stated research aim/s
8: Description of data collection procedure
9: Recruitment data provided
10: Justification for analytic method selected
11: The method of analysis was appropriate to answer the research aim/s
12: Evidence that the research stakeholders have been considered in research design or conduct.
13: Strengths and limitations critically discussed

Supplemental Table 3. Methodological characteristics of included studies

Studies n=48	Data collection	Evaluation framework	Number of interviewed participants
Abimbola et al. 2019	Quantitative (cross-sectional survey) Qualitative (focus group discussions)	NASSS[1] framework	Unknown
af Klercker et al. 1998	Qualitative (focus group)	None	1 primary care physician, 4 nurses
Alagiakrishnan et al. 2016	Quantitative (cross-sectional survey) Qualitative (semi-structured interviews)	None	6 primary care physicians, 2 geriatric medicine specialists
Arts et al. 2018	Quantitative (cross-sectional survey) Qualitative (focus group discussions)	UTAUT[2] framework	34 primary care physicians
Ash et al. 2011	Qualitative (semi-structured interviews)	Socio-Technical Model of Health Information Technology	18 primary care physicians, 14 other specialists, 4 staff members
Bandong et al. 2019	Quantitative (cross-sectional survey) Qualitative (focus group discussions)	NSW[3] Translational Research Framework	24 primary care physicians, 13 other specialists, 60 PCP students
Bessat et al. 2019	Qualitative (in-depth interviews and focus group discussions)	None	21 health workers (non-physicians)
Bindels et al. 2003	Quantitative (longitudinal survey) Qualitative (in-depth interviews)	IBM computer usability satisfaction questionnaire	11 primary care physicians
Curry et al. 2011	Quantitative (cross-sectional survey, log data) Qualitative (semi-structured interviews)	None	19 primary care physicians
Dixon et al. 2013	Quantitative (log data) and Qualitative (meeting minutes)	None	3 primary care physicians
Doerr et al. 2014	Quantitative (cross-sectional survey) Qualitative (semi-structured interviews)	CFIR[4] framework	4 primary care physicians, 4 other specialists, 2 nurses
Edelman et al. 2014	Quantitative (longitudinal survey) Qualitative (semi-structured interviews and open questions in survey)	None	11 primary care physicians, 10 primary care residents
Feldstein et al. 2013	Qualitative (in-depth interview)	None	17 primary care physicians, 4 nurse practitioners or physician assistants, 11 medical assistants, 20 other managerial staff
Guenter et al. 2019	Quantitative (longitudinal survey) Qualitative (focus group discussions)	Pathman awareness-to-adherence model	10 primary care physicians (4 family practitioners, 6 obstetrics-gynecology physicians), 10 primary care residents, 3 nurse practitioners
Helldén et al. 2015	Qualitative (focus group discussions)	Technology Acceptance Model (TAM)	7 primary care physicians
Heselmans et al. 2020	Quantitative (cross-sectional survey)	None	14 primary care physicians
Jensen et al. 2019	Quantitative (log data)	None	32 IMCI practitioners (professional nurses who have been trained in primary healthcare), 6 operational

	Qualitative (focus group discussions and in-depth interview)		managers (senior nurses appointed to oversee the day-to-day operations)
Jenssen et al. 2016	Quantitative (log data, cross-sectional survey) Qualitative (focus group discussions and open questions in survey)	IBM computer usability satisfaction questionnaire	17 primary care physicians
Kempe et al. 2017	Quantitative (cross-sectional survey)	None	907 primary care physicians (325 pediatricians, 310 family practitioners, 272 general internists)
Koskela et al. 2016	Qualitative (focus group discussions)	None	9 primary care physicians, 12 nurses
Lam Shin Cheung et al. 2020	Quantitative (cross-sectional survey) Qualitative (open questions in survey)	System Usability Scale (SUS)	18 primary care physicians, 1 nurse practitioner
Lemke et al. 2020	Qualitative (semi structured interviews)	None	24 primary care physicians (12 general internal medicine, 8 family medicine, and 4 obstetrics-gynecology)
Litvin et al. 2012	Quantitative (log data) Qualitative (semi structured interviews)	None (based on previous findings)	27 primary care physicians, 6 nurse practitioners, 6 physician's assistants
Litvin et al. 2016	Quantitative (log data) Qualitative (semi structured interviews)	None (based on previous findings)	25 primary care physicians and 15 midlevel providers
Lugtenberg et al. 2015	Qualitative (focus group discussions)	None (based on previous findings)	15 primary care physicians, 4 primary care residents, 5 practice nurses
Lugtenberg et al. 2015	Quantitative (cross-sectional survey)	None (based on previous findings)	112 primary care physicians, 52 practice nurses
Maia et al. 2016	Quantitative (cross-sectional survey) Qualitative (open questions in survey)	None	2 primary care physicians, 10 nurses
Marcolino et al. 2021	Quantitative (cross-sectional survey) Qualitative (focus group discussions)	None (based on previous findings)	25 primary care physicians, 44 nurses, 27 other PCPs (non-physicians)
Minian et al. 2021	Qualitative (semi structured interviews)	Hexagon Tool framework	13 nurses, 4 pharmacists, 7 other PCPs (non-physicians)
Montini et al. 2013	Quantitative (log data) Qualitative (semi structured interviews)	Technology Acceptance Model (TAM)	10 associate student dentists
Pannebakker et al. 2019	Qualitative (semi structured interviews)	CFIR[4] framework	14 primary care physicians
Peiris et al. 2014	Quantitative (log data) Qualitative (semi structured interviews)	None	20 primary care physicians
Praveen et al. 2014	Quantitative (cross-sectional survey) Qualitative (semi structured interviews)	COM-B[5] theory of behavior change	3 primary care physicians, 35 ASHAs (accredited social health activist),
Price et al. 2017	Quantitative (log data) Qualitative (semi structured interviews)	None	5 primary care physicians

Richardson et al. 2019	Qualitative (semi structured interviews)	None	3 primary care physicians
Rieckert et al. 2018	Qualitative (semi structured interviews)	None	21 primary care physicians
Rieckert et al. 2019	Quantitative (cross-sectional survey)	None	161 primary care physicians
Rousseau et al. 2003	Qualitative (semi structured interviews)	None	8 primary care physicians, 3 nurses, and 2 practice managers
Rubin et al. 2006	Quantitative (cross-sectional survey) Qualitative (open questions in survey)	None	65 primary care physicians
Silveira et al. 2019	Quantitative (longitudinal survey) Qualitative (semi structured interviews)	None	10 primary care physicians
Sukums et al. 2015	Quantitative (longitudinal survey) Qualitative (semi structured interviews)	FITT[6] framework	56 other PCPs (non-physicians)
Toth-Pal et al. 2008	Quantitative (log data) Qualitative (semi structured interviews)	None	5 primary care physicians
Trafton et al. 2010	Quantitative (longitudinal survey, log data) Qualitative (semi structured interviews)	System Usability Scale (SUS) and Center for Health Care Evaluation adapted provider satisfaction questionnaire	11 primary care physicians, 1 nurse practitioner
Trinkley et al. 2021	Qualitative (semi structured interviews)	Modified System Usability Scale (SUS)	21 primary care physicians
Wan et al. 2012	Qualitative (semi structured interviews)	None	15 primary care physicians, 2 practice nurses
Williams et al. 2016	Quantitative (cross-sectional survey) Qualitative (feedback minutes)	System Usability Scale (SUS)	14 primary care physicians
Wilson et al. 2007	Qualitative (semi structured interviews)	None	5 primary care physicians
Zheng et al. 2005	Quantitative (log data) Qualitative (semi structured interviews)	IBM computer usability satisfaction questionnaire	16 primary care residents

1: Framework for theorizing and evaluating Nonadoption, Abandonment, and challenges to the Scale-Up, Spread, and Sustainability of health and care technologies
2: Unified Theory of Acceptance and Use of Technology
3: New South Wales
4: Consolidated Framework for Implementation Research
5: Capability, Opportunity, and Motivation as three key factors capable of changing behavior (B)
6: Fit between Individual, Task and Technology

Supplemental Appendix 3. Complete list of identified main barriers and facilitators, and explanatory elements, according to the HOT-fit framework

Classification of inductive codes in the HOT-fit framework [n CDSSs]

Human [n=41]

    System use [n=39]

        Attitude [n=21]

            (-) PCPs don't need help with the targeted health issue [n=8]

            (-) Lack of engagement from PCPs (inertia of previous practice) [n=8]

            (-) Concerns about the explainability of CDSS recommendations [n=5]

            (-) Fear of patient opinion [n=4]

            (-) Stress associated with a new task [n=2]

            (-) Fear of data loss in case of breakdowns [n=1]

            (+) PCP commitment [n=1]

        Expectations or belief [n=12]

            (-) Using CDSSs reduces PCPs' expertise and may lead to "cookbook medicine" [n=6]

                The recommendation should not be directive but give attention so that they facilitate PCPs' own judgment [n=1]

            (-) CDSS are mostly useful to less experienced PCPs [n=5]

            (-) Creating a specific to-do list would be useful to later reassess recommendations not completed during the medical consultation [n=2]

            (-) Not following CDSS recommendations may led PCPs to legal issues [n=2]

            (-) Concerns regarding the misuse of data by third parties (health inspectorate or health insurance companies) [n=1]

        Knowledge and expertise [n=7]

            (-) Lack of computer skills [n=7]

        Level of use [n=5]

            (-) Don't feel qualified to perform CDSS recommendations [n=3]

            (-) Old age [n=2]

        Motivation to use [n=18]

            (-) Technical problems hinders the motivation to use the CDSS [n=9]

            (+) Patients' perceived usefulness of the CDSS increases PCPs' motivation to use it [n=7]

            (-) Ask for financial compensation to CDSS use [n=7]

                Need to reward support staff for their productivity with the CDSS [n=1]

            (+) Using CDSSs is a source of motivation to provide better care (PCPs feels more advanced compared to others) [n=3]

            (-) No motivational information as to why it is important to use the CDSS [n=2]

            (+) Positive feedback is appreciated by PCPs when they had completed a CDSS's recommended task [n=1]

(-) Positive feedback is wanted by PCPs when they had completed a CDSS's recommended task [n=1]

(-) Lack of job security [n=1]

Nature of use [n=1]

(-) Depending on the setting, some clinical information requested by the CDSS is too difficult to obtain [n=1]

Purpose of use [n=3]

(-) CDSS's targeted health care issue represents only a small part of the PCPs' everyday concerns [n=2]

(+) CDSS opens teaching opportunities for trainees [n=1]

Report acceptance [n=15]

(-) Information overload [n=15]

Alert fatigue [n=13]

Lack of concise synthesis of the recommendation [n=7]

Resistance or reluctance [n=19]

(-) Conflicts between CDSS recommendations and PCPs expertise or beliefs [n=18]

CDSS recommendations don't reflect the complexity of the situation [n=12]

CDSS recommendations may result in over-referral [n=3]

Concerns about overdiagnosis [n=2]

Perceived shortcomings of evidence-based medicine explain PCP refusal of CDSS recommendations [n=1]

(-) PCPs reluctance due to patient disagreement with CDSS recommendations [n=6]

(-) Conflicts between CDSSs recommendations and local guidelines [n=1]

(-) Too stressful to use the CDSS with the patient present [n=1]

Training [n=18]

(-) Training before use is needed [n=11]

PCPs are not aware of customization options [n=2]

Advanced features are unused or not understood, due to lack of training [n=2]

The training session to the CDSS is inadequate or too short [n=4]

(+) Training before use is appreciated [n=10]

(-) Ask for yearly refresher training [n=2]

User satisfaction [n=31]

Decision making satisfaction [n=0]

Enjoyment [n=0]

Overall satisfaction [n=7]

    (+) CDSSs increase PCPs satisfaction [n=7]

Perceived usefulness [n=24]

    (+) Perceived usefulness of the CDSS [n=23]

    (+) The computerization of decision support is appreciated [n=5]

    (-) Alert content not consistent with the varying needs of different types of PCPs [n=2]

Satisfaction with specific functions [n=3]

    (-) CDSS required "extra clicks" [n=1]

    (-) Impossibility of skipping steps [n=1]

    (+) Minimal interruptive alerts [n=1]

Software satisfaction [n=12]

    (+) PCPs would continue to use the CDSS [n=9]

    (+) PCPs will recommend the CDSS to colleagues [n=6]

Net benefits [n=42]

Clinical Practice [n=22]

    (+) CDSS is a way to update your knowledge [n=17]

    (+) CDSS leads to better teamwork in primary care [n=7]

    (+) The CDSS increases PCPs confidence [n=7]

    (+) The CDSS helps the PCP to prepare the encounter [n=4]

    (+) Collecting structured data facilitates follow up of patients [n=2]

    (+) CDSS enables urgent referral pathways [n=1]

    (-) CDSS recommendations were hard to realize [n=1]

Communication [n=26]

    (+) The CDSS helps focus on patient education [n=18]

        CDSS helps to increase patient engagement [n=14]

    (+) CDSS facilitates patient-PCP communication [n=13]

    (-) Negative effect on patient communication [n=7]

    (+) The CDSS facilitated communication between PCPs and other specialists [n=3]

    (+) The CDSS is used by PCPs to legitimate their refusal to prescribe unnecessary tests or medications [n=3]

    (-) Education materials provided to patients are sometimes difficult for them to understand [n=2]

Decision making quality [n=25]

    (+) CDSS facilitates decision making [n=22]

        The CDSS facilitate in treatment decision making [n=10]

        CDSS is facilitating decision making about referral [n=5]

(-) No real impact on decision making [n=3]

(+) Help PCPs to set priorities for quality improvement [n=2]

Error reduction [n=17]

(+) CDSS helps PCPs to identify unrecognized information needs [n=17]

(+) Reduced need for clinical supervision [n=1]

Perceived effectiveness [n=25]

(+) Potential to improve the quality of care [n=23]

CDSS helps to systematize assessment of every patient [n=13]

Brings primary and secondary preventive care needs to the forefront [n=7]

(+) CDSS helps PCPs to improve guideline adherence [n=11]

(+) The CDSS facilitates patient care management [n=9]

(+) Perceived effectiveness in the personalization of care [n=4]

(-) CDSS did not aid adherence to guidelines [n=1]

Perceived efficiency [n=37]

(-) Increased workload during the consultation [n=33]

Lack of time to use the CDSS during the encounter [n=31]

Duplication of data collection [n=12]

Structured data collection takes too much time [n=15]

Lack of practice in documenting within the structured form in the EHR [n=1]

Comfort with previous habits without the CDSS [n=1]

Coping strategies:

Increased consultation time [n=14]

The CDSS increases discussion time with the patient [n=3]

Using CDSS lengthens the decision-making process [n=1]

PCPs need additional time using the CDSS outside the consultation [n=8]

Having dedicated CDSS time [n=3]

Scheduling follow up appointments [n=5]

(+) Using CDSS saves time [n=22]

Shortening documentation time [n=8]

Giving a quick patient evaluation from relevant data in patients' EHRs [n=6]

The CDSS enhances visit productivity [n=3]

Organization [n=41]

Environment [n=18]

Competition [n=2]

(-) Competing obligations (other incentive programs) [n=2]

External communication [n=0]

Financing source [n=2]

(-) Cost of the CDSS [n=1]

(-) Lack of funding for trainings, support, or hardware maintenance [n=1]

Government [n=1]

(+) Benefits from federal meaningful use initiatives [n=1]

Inter-organizational relationship [n=11]

(-) Difficulty to use the CDSS for patients comanaged by other specialists [n=11]

Information is sometimes missing or not integrated from other external sources (other specialists or hospital data) [n=6]

Disagreement between CDSS recommendations and prescriptions of other specialists [n=2]

(-) No possibility to consult patient data from other practices within the same regional primary care structure [n=2]

Localisation [n=0]

Politics [n=0]

(+) Being part of a national project [n=1]

(+) Bottom-up design of the CDSS within an organised regional primary care structure [n=1]

(-) Intellectual property of CDSS's knowledge artifacts translated from guidelines is an obstacle to their customization by PHPs [n=1]

Population served [n=5]

(-) Patients cannot afford CDSS's proposed care [n=3]

New consultations programmed to discuss about the CDSS may cost too much for patients [n=1]

(-) PCPs think that patients have competing priorities that hinders acceptation of CDSS recommendations [n=3]

Structure [n=39]

Autonomy [n=10]

(+) Producing reports of quality measures through collected data increases the value from the CDSS's use in clinical practice [n=7]

(-) Data generated by the CDSS can't be used to produce reports of quality measures [n=3]

(-) Poor availabilities to medication or post referral hinder motivation to use the CDSS [n=3]

Frequent running out of stock of medical equipment, supplies, and medicines affected the CDSS use during patient care [n=1]

Clinical process [n=35]

(-) Using CDSS disrupts usual workflow [n=25]

(+) Natural integration of the CDSS in clinical workflow [n=13]

(-) There were already protocols or CDSS in place for this issue [n=4]

(-) No education sheet for patients provided by the CDSS [n=2]

(+) Data entry by patients prior to the consultation [n=2]

Communication [n=4]

(-) PCPs not informed of disposable CDSSs integrated in the EHR [n=2]

(+) Collaboration between project and site staff to complete protocols and applications [n=1]

(+) Regular communication of updates by the clinic manager [n=1]

Culture [n=2]

(+) Structures already engaged in quality improvement work (good operational structure) [n=1]

(-) The diversity of medical practices involved complicates the development of shared clinical content [n=1]

Hardware [n=16]

(-) Lack of computers or tablets in the structure [n=7]

(-) Poor internet or wireless connectivity [n=6]

(-) Malfunctioning computers [n=5]

Slowness of the computers [n=2]

(-) Limited printing capabilities preventing use of POC patient education [n=3]

(-) Limited battery life (CDSS on tablets) [n=3]

(-) Screen damage (CDSS on tablets) [n=1]

(-) Small sized computer screens [n=1]

(-) Unreliable power supply [n=1]

Leadership [n=7]

(+) Available leadership support [n=6]

Identified clinical champion in the facility [n=3]

Identified technical champion in the facility [n=4]

(-) Missing leadership support [n=5]

Lack of clinical champion in each facility [n=5]

Technical champion is needed [n=3]

Mediator [n=1]

(+) Known mediator (e.g., physician association) between the user and the vendor [n=1]

Medical sponsorship [n=0]

Nature (type, size) [n=5]

(+) CDSS (on tablets) ease access to isolated population [n=1]

(-) Changing to an incompatible EHR [n=1]

(+) Equipment and supplies (medical) available [n=1]

(-) Limitation of the reach of the CDSS for PCPs without access to technology [n=1]

(-) No private space in which patients can complete the questionnaire [n=1]

Planning [n=0]

Strategy management [n=0]

Teamwork [n=19]

(-) Need of more teamwork with other PCPs to help physicians with CDSS's increased workload [n=13]

Physicians fear more the CDSS workload than assistants or nurses [n=4]

CDSS could be an opportunity for increasing interprofessional collaboration [n=1]

Nurses not allowed to code diagnosis [n=1]

(+) Other professionals ease physician's increased workload with the CDSS [n=6]

Expansion of skill set and roles in assisting physicians and patients in meeting care needs [n=3]

(-) Staff turnover [n=3]

(-) CDSS use in teams may lead to conflicts [n=2]

(-) No good communication between physicians and staff about good practice with the CDSS [n=2]

(+) Can manage the CDSS without a technical staff member [n=1]

(-) Staff assistant express apprehension with their new responsibilities [n=1]

(-) Low GP confidence in health workers using the CDSS [n=1]

(-) Unclear expectation at the PCP and support staff level as to who completes what task and how to coordinate work [n=1]

Top management support [n=0]

Technology [n=45]

Information quality [n=40]

Accuracy [n=1]

(-) Lack of accuracy of the CDSS recommendations [n=1]

Completeness [n=13]

(-) Incompleteness of CDSS' recommendations [n=7]

(+) Completeness of the CDSS [n=4]

(-) Documentation provided in CDSS recommendations is too poor [n=2]

(-) Data collection surveys for patients are not complete enough [n=1]

Conciseness [n=6]

(+) Conciseness of the recommendations [n=6]

Data entry methods [n=7]

(+) Easy data collection [n=5]

Automatic data entry (retrieval from the EHR) [n=1]

(-) Data entry by patients is hindered by lack of patient understanding of the CDSS questions [n=1]

(-) Some coding is difficult to find [n=1]

Format [n=18]

(-) Format of recommendations (length, structure, font colors) [n=13]

(+) Pleasing visual layout [n=12]

(-) CDSS's notifications are phrased too tentatively [n=1]

Importance [n=0]

Legibility [n=4]

(-) Need for a common vocabulary [n=4]

Terminology used is not understood by PCPs [n=2]

Relevance [n=19]

(-) CDSS recommendations are not relevant [n=11]

Conflict between patient-driven acute needs and CDSS-related care needs [n=7]

General recommendations are often irrelevant [n=4]

General recommendations have less impact on GP's decision-making process [n=1]

The CDSS recommendations don't fit with vague complaints [n=1]

Irrelevant alert for different PCP groups (such as for nurses or GPs) [n=1]

(+) CDSS recommendations are relevant [n=11]

Reliability [n=17]

(-) Doubtful reliability of the recommendations [n=12]

The reliability of the recommendations depends on the quality and completeness of the information collected [n=11]

(+) CDSS recommendations are reliable [n=9]

General agreement with the validity of CDSS recommendations [n=4]

Full guidelines linked to each recommendation [n=1]

Timeliness [n=6]

(-) CDSS recommendations are not displayed at the right time [n=5]

Recommendation appearing after the patient chart was closed or decision was made [n=2]

(+) CDSS recommendations are displayed at the right time [n=1]

(-) CDSS recommendations are not displayed at the right time [n=5]

Recommendation appearing after the patient chart was closed or decision was made [n=2]

(+) CDSS recommendations are displayed at the right time [n=1]

Usefulness [n=21]

    (+) Information provided is useful for the targeted process of care [n=13]

    (-) CDSS recommendations are not helpful [n=8]

        The recommendation is sometimes too vague to be useful [n=2]

    (+) Educational material for patients is valuable [n=7]

Service quality [n=11]

    Assurance [n=0]

    Empathy [n=0]

    Follow up service [n=0]

    Quick responsiveness [n=0]

    Technical support [n=11]

        (+) Satisfaction with the CDSS service support [n=7]

            CDSS technical staff availability [n=6]

        (-) Inadequate or delayed user support [n=5]

        (+) Periodic auditing enables to detect technical issues before clinician complaints [n=3]

        (-) User manual is too long [n=1]

System quality [n=45]

    Availability [n=2]

        (+) Tool is consistently available [n=2]

    Data accuracy [n=7]

        (-) No updates of the CDSS [n=4]

        (+) EHR's collected data is more accurate [n=2]

        (-) Inaccurate collected data in the EHR [n=2]

    Database contents [n=18]

        (-) The CDSS should target more health issues [n=11]

        (-) Questioning validity of CDSS's knowledge database [n=7]

            PCPs expect the tool's independence from the pharmaceutical industry and being free of commercial advertisements [n=3]

                CDSS recommendations went too far in recommending brands [n=1]

        (-) No link to guidelines [n=1]

    Ease of learning [n=9]

        (+) Easy to use after a short learning period [n=9]

    Ease of use [n=39]

        (+) The CDSS is user-friendly (ergonomic) [n=30]

            No need to switch windows in the EHR while using CDSSs [n=1]

        (-) The CDSS is not user-friendly [n=21]

Need to switch windows in the EHR while using CDSSs [n=9]

Location of CDSS recommendations should be changed [n=8]

Need to switch windows between the EHR and the CDSS [n=5]

Difficulty accessing different CDSS functions [n=3]

The recommendation is not displayed at the right place or difficult to find [n=3]

CDSS should be designed to help shared decision making [n=1]

(+) CDSS recommendations are easy to understand [n=9]

(-) Breakdowns requiring restarts [n=4]

(+) Absence of breakdown [n=1]

(-) CDSS recommendations are not easy to understand [n=1]

(+) Gathering a complete assessment within a single device [n=1]

Efficiency [n=4]

(+) Allows for quick and easy search and retrieval of information for an individual patient or subgroup of patients [n=4]

Flexibility [n=13]

(-) Need of customization options [n=8]

(-) Conflict between usual codes (e.g., diagnostic classification) and codes used by the CDSS = semantic interoperability issue [n=3]

(+) Customization of the CDSS is appreciated [n=3]

Reliability [n=2]

(+) PCPs trust the CDSS knowledge database [n=2]

Resource utilization [n=0]

Response time [n=0]

Security [n=3]

(-) Concerns about data security [n=3]

Technical support [n=1]

(+) Access to technical support integrated into CDSS [n=1]

Turnaround time [n=18]

(-) CDSS slowness [n=16]

CDSS's slowness impairs the interaction with the patient and increases the consultation time [n=5]

(+) CDSS is quick and prompt [n=3]

Usefulness of system features and functions [n=33]

(-) CDSS not fully integrated in the EHR [n=14]

A CDSS not fully integrated in the EHR is time consuming and disrupts workflow [n=4]

The most current information collected in the EHR is sometimes not updated in the CDSS [n=3]

(+) Reminder system [n=8]

(-) Lack of learning capacity of the CDSS [n=6]

(+) Full integration in the EHR [n=3]

(-) CDSS fully integrated but integration to be enhanced [n=3]

(-) Interruptive recommendations hampers clinical workflow [n=3]

(+) Risk assessment within the CDSS [n=2]

(+) Possibility to overview patients concerned with specific recommendation through patient registry [n=2]

(-) No search & find tool [n=2]

(+) Medication order linked to the advice of the CDSS [n=1]

(-) No possibility to add photos [n=1]

(-) Dismiss option encourages dismissal [n=1]

(-) Passive CDSS [n=1]

(+) Pull function [n=1]

(-) Too many login points [n=1]

(+) Guided mode (preferred over critiquing mode) [n=1]

(-) Lack of easy and efficient way to document and track patient refusal of services or team effort made [n=1]

(+) CDSS designed to be independent from internet connection [n=1]

(+) Asking reason to override the recommendation helps physicians communicate with each other about their practice [n=1]

(-) Asking reasons for overriding recommendations is defensive medicine and does not contribute to patient care [n=1]

(-): barriers; (+): facilitators; [n CDSSs]

Supplemental Table 4. Number of barriers and facilitators identified per CDSS

	Total (n/255)	Main barriers and facilitators (n/186)	Explanatory elements (n/69)
1 Abimbola et al. (2019)	64	45	19
2 af Klercker et al. (1998)	12	8	4
3 Alagiakrishnan et al. (2016)	29	25	4
4 Arts et al. (2018)	34	23	11
5 Ash et al. (2011)	29	21	8
6 Bandong et al. (2019)	19	17	2
7 Bessat et al. (2019)	48	36	12
8 Bindels et al. (2003)	31	22	9
9 Curry et al. (2011)	9	8	1
10 Dixon et al. (2013)	11	8	3
11 Doerr et al. (2014)	46	35	11
12 Edelman et al. (2014)	42	28	14
13 Feldstein et al. (2013)	87	59	28
14 Guenter et al. (2019)	13	9	4
15 Helldén et al. (2015)	23	17	6
16 Heselmans et al. (2020) and Koskela et al. (2016)	33	25	8
17 Jensen et al (2019)	29	23	6
18 Jenssen et al. (2016)	8	7	1
19 Kempe et al. (2017)	12	7	5
20 Lam Shin Cheung et al. (2020)	25	20	5
21 Lemke et al (2020)	37	28	9
22 Litvin et al. (2012)	34	23	11
23 Litvin et al. (2016)	30	21	9
24 Lugtenberg et al. (2015) (2 articles)	39	27	12
25 Maia et al. (2016)	16	11	5
26 Marcolino et al. (2021)	35	25	10
27 Minian et al. (2021)	23	17	6
28 Montini et al. (2013)	14	10	4
29 Pannebakker et al (2019)	22	18	4

30 Peiris et al. (2014)	17	15	2
31 Praveen et al. (2014)	26	24	2
32 Price et al. (2017)	10	5	5
33 Richardson et al. (2019)	17	12	5
34 Rieckert et al. (2018, 2019)	50	37	13
35 Rousseau et al. (2003)	42	27	15
36 Rubin et al. (2006)	15	10	5
37 Silveira et al. (2019)	33	22	11
38 Sukums et al. (2015)	48	33	15
39 Toth-Pal et al. (2008)	33	24	9
40 Trafton et al. (2010)	32	29	3
41 Trinkley et al. (2021)	18	14	4
42 Wan et al. (2012)	49	35	14
43 Williams et al. (2016)	15	11	4
44 Wilson et al. (2007)	23	20	3
45 Zheng et al (2005)	20	13	7
Mean	28.9		

Supplemental Table 5. Individual impacts of the three HOT-fit factors (human, organization, technology) and the net benefits dimension on the use of each CDSS

CDSS ranked by continent of use	Individual impacts (Y facilitators – X barriers)							
	Human 41/45 CDSSs		**Organization** 41/45 CDSSs		**Technology** 45/45 CDSSs		**Net Benefits** 42/45 CDSSs	
North America								
Alagiakrishnan et al. (2016)	**-2**	(3 – 5)	**-2**	(0 – 2)	**4**	(6 – 2)	**5**	(6 – 1)
Ash et al. (2011)	**-2**	(1 – 3)	**4**	(7 – 3)	**-3**	(1 – 4)	**0**	(1 – 1)
Curry et al. (2011)	**0**	(1 – 1)	**0**	(1 – 1)	**-2**	(0 – 2)	**0**	(1 – 1)
Dixon et al. (2013)		(0 – 0)	**-2**	(0 – 2)	**-4**	(1 – 5)		(0 – 0)
Doerr et al. (2014)	**-3**	(1 – 4)	**2**	(2 – 0)	**1**	(8 – 7)	**11**	(12 – 1)
Edelman et al. (2014)	**-2**	(1 – 3)	**1**	(4 – 3)	**-3**	(3 – 6)	**4**	(6 – 2)
Feldstein et al. (2013)	**1**	(8 – 7)	**-1**	(4 – 5)	**4**	(14 – 10)	**9**	(10 – 1)
Guenter et al. (2019)	**-3**	(0 – 3)		(0 – 0)	**2**	(3 – 1)	**2**	(2 – 0)
Jenssen et al. (2016)	**2**	(2 – 0)		(0 – 0)	**0**	(2 – 2)	**1**	(1 – 0)
Kempe et al. (2017)	**-1**	(0 – 1)	**-2**	(0 – 2)	**-3**	(0 – 3)	**-1**	(0 – 1)
Lam Shin Cheung et al. (2020)	**-1**	(0 – 1)	**-4**	(0 – 4)	**5**	(6 – 1)	**6**	(7 – 1)
Lemke et al (2020)	**-6**	(1 – 7)	**-4**	(0 – 4)	**-7**	(0 – 7)	**7**	(8 – 1)
Litvin et al. (2012)	**-1**	(1 – 2)	**-4**	(1 – 5)	**-1**	(3 – 4)	**3**	(5 – 2)
Litvin et al. (2016)	**-3**	(1 – 4)	**-3**	(1 – 4)	**2**	(4 – 2)	**5**	(5 – 0)
Minian et al. (2021)	**-3**	(2 – 5)	**-3**	(0 – 3)	**1**	(3 – 2)	**0**	(1 – 1)
Montini et al. (2013)		(0 – 0)	**-4**	(0 – 4)	**0**	(1 – 1)	**2**	(3 – 1)
Price et al. (2017)		(0 – 0)	**0**	(1 – 1)	**-3**	(0 – 3)		(0 – 0)
Richardson et al. (2019)	**-1**	(0 – 1)	**-1**	(0 – 1)	**-3**	(2 – 5)	**1**	(2 – 1)
Rubin et al. (2006)		(0 – 0)	**-1**	(0 – 1)	**1**	(3 – 2)	**2**	(3 – 1)
Trafton et al. (2010)	**1**	(3 – 2)	**-2**	(1 – 3)	**4**	(9 – 5)	**2**	(4 – 2)
Trinkley et al. (2021)	**0**	(1 – 1)	**1**	(1 – 0)	**3**	(6 – 3)	**2**	(2 – 0)
Williams et al. (2016)	**1**	(2 – 1)		(0 – 0)	**-2**	(3 – 5)		(0 – 0)
Zheng et al (2005)	**-1**	(0 – 1)	**-2**	(0 – 2)	**-2**	(2 – 4)	**0**	(2 – 2)
Europe								
af Klercker et al. (1998)	**-3**	(0 – 3)		(0 – 0)	**-4**	(0 – 4)	**-1**	(0 – 1)

Arts et al. (2018)	**0**	(3 – 3)	**-2**	(0 – 2)	**-6**	(3 – 9)	**1**	(2 – 1)
Bindels et al. (2003)	**-2**	(1 – 3)	**-2**	(0 – 2)	**0**	(5 – 5)	**2**	(4 – 2)
Helldén et al. (2015)	**2**	(3 – 1)	**-1**	(0 – 1)	**3**	(5 – 2)	**5**	(5 – 0)
Heselmans et al. (2020), Koskela et al. (2016)	**-1**	(2 – 3)	**-2**	(1 – 3)	**4**	(7 – 3)	**2**	(4 – 2)
Lugtenberg et al. (2015) (2 articles)	**-5**	(1 – 6)	**-3**	(0 – 3)	**-9**	(2 – 11)	**0**	(2 – 2)
Pannebakker et al (2019)	**-3**	(2 – 5)	**-1**	(1 – 2)	**-2**	(1 – 3)	**4**	(4 – 0)
Rieckert et al. (2018, 2019)	**-2**	(3 – 5)	**-3**	(1 – 4)	**0**	(6 – 6)	**8**	(10 – 2)
Rousseau et al. (2003)	**-5**	(1 – 6)	**-4**	(0 – 4)	**-3**	(4 – 7)	**1**	(3 – 2)
Toth-Pal et al. (2008)	**-7**	(3 – 10)	**-2**	(0 – 2)	**2**	(3 – 1)	**3**	(4 – 1)
Australia								
Abimbola et al. (2019)	**-5**	(2 – 7)	**-8**	(3 – 11)	**0**	(7 – 7)	**4**	(6 – 2)
Bandong et al. (2019)	**3**	(3 – 0)	**0**	(1 – 1)	**1**	(5 – 4)	**1**	(2 – 1)
Peiris et al. (2014)	**-3**	(0 – 3)	**-1**	(0 – 1)	**-5**	(2 – 7)	**2**	(2 – 0)
Wan et al. (2012)	**-1**	(3 – 4)	**-2**	(1 – 3)	**-5**	(5 – 10)	**5**	
Wilson et al. (2007)	**-1**	(1 – 2)	**-2**	(1 – 3)	**2**	(6 – 4)	**1**	(2 – 1)
South America								
Maia et al. (2016)	**1**	(2 – 1)	**-1**	(1 – 2)	**0**	(1 – 1)	**1**	(2 – 1)
Marcolino et al. (2021)	**3**	(4 – 1)	**-1**	(1 – 2)	**7**	(8 – 1)	**6**	(7 – 1)
Silveira et al. (2019)	**-1**	(2 – 3)	**-1**	(1 – 2)	**2**	(5 – 3)	**4**	(5 – 1)
Africa								
Bessat et al. (2019)	**-2**	(5 – 7)	**-1**	(2 – 3)	**-2**	(3 – 5)	**7**	(9 – 2)
Jensen et al (2019)	**0**	(2 – 2)	**0**	(2 – 2)	**2**	(3 – 1)	**7**	(9 – 2)
Sukums et al. (2015)	**-4**	(2 – 6)	**-10**	(2 – 12)	**-5**	(2 – 7)	**0**	(1 – 1)
Asia								
Praveen et al. (2014)	**-3**	(1 – 4)	**-4**	(3 – 7)	**1**	(2 – 1)	**6**	(6 – 0)

Regarding the CDSS evaluated by Abimbola et al., seven barriers and two facilitators were classified in the human factor. The balance is therefore calculated at -5, which can be interpreted as a global negative impact of the human fact