Supplementary Tables

Table S1. Characteristics of the articles included in the review

Author/year/country	Focus area	Nudging objective	Population/ setting	Implementation details	Nudging labels	Findings	Statistically significant positive results	Nudging Dimension	COVID-19
Bourdeaux *et al* 2013, UK[18]	Ventilation	Increase prescription of chlorhexidine mouthwash and reduce the prescription of hydroxyethyl starch (HES) to patients in the ICU.	ICU admitting doctors	Chlorhexidine mouthwash was added as a default prescription to the prescribing template and HES was removed from the prescribing template. Both interventions were available to prescribe manually throughout the study period.	Defaults/pre-orders	Patients prescribed chlorhexidine increased from 55% to 90.4%, while patients prescribed hydroxyethyl starch decreased from 54% to 3%.	Yes	Passive/ Synchronous	Redesigning choices in the EHR can increase delivery of evidence-based interventions.
Bourdeaux *et al* 2016, UK[19]	Ventilation	Increase compliance with low tidal volume (TVe) ventilation in the ICU.	ICU clinical team	Default ventilator settings were adjusted to comply with low TVe targets from the initiation of ventilation unless actively changed by a clinician. A large dashboard was deployed displaying TVes with alerts when TVes were excessive.	Defaults/pre-orders; Alerts/reminders	In the dashboard intervention, TVe fell more quickly and by a greater amount.	Yes	Active/ Asynchronous	Adjustment of default ventilator settings and a dashboard with alerts for excessive TVe can influence clinical decision-making.
O'Reilly-Shah *et al* 2018, USA[20]	Ventilation	Improve compliance with lung-protective ventilation (LPV) strategies during general anaesthesia.	Hospital anaesthesiologists	Dashboard with compliance metrics were emailed to providers. Additionally, default setting on anaesthesia machines for tidal volume was decreased.	Defaults/pre-orders	Dashboards and modification of default ventilator settings improved provider compliance with LPV strategies.	Yes	Passive/ Asynchronous	Audit and feedback tools in conjunction with default changes improve provider compliance.
Anderson *et al* 2019, USA[21]	Ventilation	To promote sedation minimization and	ICU respiratory therapists and nurses	An automated application consisting of 1) a web-based dashboard with real-	Alerts/reminders	After implementation, patients were 28% more likely to be	Yes	Active/ Asynchronous	An EHR based dashboard and text-alert system can identify

		ventilator liberation.		time data on spontaneous breathing trial readiness, sedation depth, sedative infusions, and nudges to wean sedation and ventilatory support and 2) text-message alerts once patients met criteria for a spontaneous breathing trial and spontaneous awakening trial.		extubated and 31% more likely to be discharged from the ICU at any point.			opportunities to improve sedation minimization and ventilator liberation and reduce duration of mechanical ventilation and ICU stay.
Caris *et al* 2018, Netherlands[22]	Hand hygiene	Increase the use of alcohol-based hand rub.	ICU physicians and nurses	Hand hygiene posters were displayed on two hospital wards to assess their effect on the use of alcohol-based hand rub, measured with electronic dispensers. Poster 1: 'Half of all healthcare workers perform well in hand hygiene. Which category do you belong to?' Poster 2: '40% increase in hand hygiene, 40% decrease in healthcare-associated infections.	Environmental cueing/priming	Posters displayed next to dispensers increased their overall use on one ward and during doctor's rounds on both wards. Use of dispensers without nudges did not increase.	Yes	Passive/ Asynchronous	Posters with hand hygiene slogans next to dispensers can provide an easy, inexpensive measure to increase use of alcohol based hand rub.
King *et al* 2016, USA[23]	Hand hygiene	Influence hand hygiene compliance (HHC).	ICU physicians, nurses, and ancillary staff	Interventions included either an olfactory prime (clean, citrus smell) that was introduced to the environment through a commercially available aroma dispenser or visual prime (male or female eyes) placed above a hand gel dispenser to introduce a perception of being watched.	Environmental cueing/priming	A significant improvement in HHC was observed with the clean, citrus smell (46.9% vs. 15.0%) and also when a picture of "male eyes" was placed over the hand gel dispenser (33.3% vs. 15.0%). No significant improvement was	Yes	Passive/ Asynchronous	Visual and olfactory priming can influence HHC by increasing the use of alcohol-based hand rub.

						seen with a picture of female eyes.			
Kwok *et al* 2016, Australia[24]	Hand hygiene	Improve hand hygiene compliance (HHC).	Hospital ward clinicians	In a first phase nurse unit managers were provided with HHC rates via e-mail and shared them with staff at morning hand-over meetings. In a second phase teams were asked to set HHC goals and colleagues were encouraged to prompt each other to HHC.	Feedback; Goal setting	Intervention improved hand hygiene in the surgical ward who described themselves as socially cohesive team but not in the medical ward where distrust to compliance rates and reluctance to nudge each other were described.	No	Active/ Asynchronous	Goal setting with continuous feedback based on automated measurements and encouragement from colleagues in a socially cohesive team can improve HHC.
Birnbach *et al* 2013, USA[25]	Hand hygiene	Improve hand hygiene compliance (HHC)	Medical school students and recent graduates during a patient safety course.	Trainees were randomly assigned to groups via random number generation in different orders of training sessions so that some encountered a fresh-smelling environment and others the standard setting. There were four separate sessions which occurred in a single room; two of which had the active scent manipulation and the other two of which did not.	Environmental cueing/priming	The standard environment group had a hand hygiene compliance rate of 51% whereas participants in the fresh scent group had a higher rate of 80%	Yes	Passive/ Asynchronous	Hand hygiene behavior may be subconsciously influenced by cues in the environment. Fragrance appears to have a positive effect on HHC.
Iversen *et al* 2020, Denmark[26]	Hand hygiene	Improve hand hygiene compliance (HHC).	Surgical ward doctors and nurses.	An automated monitoring system was implemented in the ward measuring hand hygiene opportunities and alcohol-based hand rubbing events in patient and working rooms. Baseline HHC of HCPs were	Environmental cueing/priming; Feedback	Doctors significantly increased HHC in patient rooms (16% vs 42%) and working rooms (24% vs 78%). Nurses increased HHC significantly from baseline in	Yes	Active/ Synchronous	HHC can be significantly improved with light-guided nudging and data driven performance feedback using an automated hand hygiene system.

				compared with light-guided nudging from sensors on dispensers and data-driven performance feedback highlighting HHC in different rooms as well as before and after patient contact, individually and compared with colleagues.		both patient rooms (27% vs 43%), and working rooms (39% vs 64%), Nurses who subsequently received individual performance feed-back, further increased HHC.			
Kim *et al* 2018, USA[27]	Vaccination	Improve influenza vaccination rates.	Primary care practice medical assistants	An active choice intervention was implemented in the EHR prompting medical assistants to ask patients about influenza vaccination during check-in and template vaccination orders for clinicians to review during the visit.	Active choice	The intervention was associated with a 9.5% increase in vaccination rates (nearly a 20% relative increase compared with the preintervention period).	Yes	Active/ Synchronous	Active choice through the EHR can improve vaccination rates.
Patel *et al* 2017, USA[28]	Vaccination	Increase influenza vaccination rates.	Primary care physicians	The EHR confirmed patient eligibility during the clinic visit and, upon accessing the patient chart, prompted the physician and their medical assistant to actively choose to "accept" or "cancel" an order for the influenza vaccine.	Active choice	Intervention practice using active choice had a significantly greater increase than the control (37.3% increase) compared to pre-intervention. More than 99.9% of orders placed during the study resulted in vaccination.	Yes	Active/ Synchronous	Active choice through the EHR can improve vaccination rates.
Lehmann *et al* 2016, Netherlands[29]	Vaccination	Improve influenza vaccination rates of staff.	Tertiary care HCPs	HCPs were randomly assigned to one of two conditions. In the opt-out condition participants received an e-mail with a pre-scheduled appointment for influenza	Defaults/pre-orders	10 out of 61 HCPs in the opt-in group were vaccinated, against 12 of 61 in the opt-out group. In the opt-in condition, 12 of	No	Active/ Synchronous	Changing default to opt-out may not be enough to promote influenza vaccination among HCPs but might be an easy and cost-effective

				vaccination (could be changed or cancelled). In the opt-in condition participants received an e-mail explaining that they had to schedule an appointment if they wanted to get vaccinated. Opt-out participants that had changed or did not cancel their appointment were sent a reminder.		61 HCPs had an appointment, compared with 24 of 61 in the opt-out condition. Of 36 HCPs with an appointment, 25 got vaccinated, while only 2 of the 86 without an appointment got vaccinated.			alternative to complex vaccination if combined with other nudging techniques.
Schmidtke *et al* 2019, UK[30]	Vaccination	Increase influenza vaccination of front-line staff.	Hospital front-line staff	Staff were randomly allocated to receive one of four letters: a standard letter encouraging the staff to take up the vaccination (no norms), a second letter highlighted a type of social norm based on peer comparisons, a third letter highlighted a type of social norm based on an appeal to authority, a fourth letter included a combination of the social norms.	Alerts/reminders	Vaccination coverage in all groups was 43%. No evidence was found that the uptake of the seasonal influenza vaccination was affected by reminders using social norms to motivate uptake.	No	Passive/ Asynchronous	Using only letters based on social norms seems not to be a viable way to increase vaccination rates among HCPs
Lorini *et al* 2020, Italy[31]	Vaccination	Increase staff vaccination at nursing homes.	Nursing home workers	A paper letter was personally addressed to every NH worker, signed by the Chief Director of the Health Regional Agency and the Head of the Department of Health Sciences. Its goal was to raise awareness on the professional responsibility towards fragile people in case of non-vaccination, but	Education; Social norms	Influenza vaccination uptake in the 2018–2019 season was similar in the two groups (23.6% vs. 22.2% respectively, in the nudge and comparison group), but significantly different in the 2019–2020	Yes	Passive/ Asynchronous	A personal-addressed paper letter, signed by high-profile figures and aimed to raise awareness about the professional responsibility towards fragile people and colleagues, delivered with an information

				also on the personal working burden if colleagues contracted influenza. The letter ended with a manifestation of trust by the NH Chief Officer in its personnel, and a kind request to sign a delivering form and to compile a questionnaire on vaccination intent. A leaflet including useful information about how to get vaccinated was also provided.		season: 28% in the nudge vs. 20% in the comparison group. Also, the intention to get the vaccine in the 2020–2021 season was significantly different in the two groups: 37.9% in the nudge and 30.8% in the comparison group.			leaflet—could be useful in promoting influenza vaccination uptake.
Changolkar *et al* 2020, Australia[32]	Vaccination	Increase influenza vaccinations.	Primary care physicians and medical assistants	Prior to meeting with the physician, patients met with a medical assistant to check their vitals. At that time, the EHR assessed patient eligibility for influenza vaccination and prompted medical assistants to accept or cancel an order for the vaccine. If accepted, the order was templated for the physician to review and sign during patient visit.	Active choice	Influenza vaccination rates for the lower clinical workload group at intervention practices increased from 47.1% to 51.5%. For the higher workload group, vaccination rates increased from 42.0% to 51.4%.	Yes (among high workload group, but not low)	Passive/ Synchronous	An active choice intervention in the EHR to prompt medical assistants to template influenza vaccination orders for physicians can increase influenza vaccination.
Meeker *et al* 2014, USA[33]	Antibiotics	Encourage judicious use of antibiotics for acute respiratory infections (ARIs).	Community clinicians	Poster-sized commitment letters were displayed in examination rooms. These letters, featuring clinician photographs and signatures, stated their commitment to avoid inappropriate antibiotic prescribing for ARIs. It was written	Environmental cueing/priming	Controlling for baseline prescribing the posted commitment letter resulted in a 19.7 absolute percentage reduction in inappropriate antibiotic	Yes	Passive/ Asynchronous	Displaying poster-sized commitment letters in examination rooms can decrease inappropriate antibiotic prescribing for ARIs.

				at an eighth grade reading level and displayed in English and Spanish.		prescribing rate relative to control.			
Meeker *et al* 2016, USA[34]	Antibiotics	Reduce inappropriate antibiotic prescribing.	Primary care clinicians	3 behavioural interventions, implemented alone or in combination: (1) suggested alternatives presented in the EHR suggesting non antibiotic treatments; (2) accountable justification prompting clinicians to enter free-text justifications for prescribing antibiotics into patients' EHR; (3) peer comparison sent emails to clinicians that compared their antibiotic prescribing rates with those of "top performers".	Peer-comparison; Accountable justification; Suggested alternatives	Mean antibiotic prescribing rates decreased by 11% for control practices, 16% for suggested alternatives, 18% for accountable justification, and 16% for peer comparison. There were no statistically significant interactions (neither synergy nor interference) between interventions.	Yes (interventions 2 and 3)	Active/ Synchronous	Socially motivated interventions like accountable justification and peer comparison can reduce inappropriate antibiotic prescribing.
Yadav *et al* 2019, USA[35]	Antibiotics	Reduce inappropriate antibiotic prescribing.	Emergency clinicians	Compared an adapted intervention including provider and patient education, a physician champion, and departmental feedback with an enhanced intervention also including peer comparison feed-back and locally tailored public-facing demonstration of commitment to judicious antibiotic prescribing. Peer comparison was distinct from traditional audit-and-feedback interventions, in that individuals were	Peer-comparison; Environmental cueing/priming	Antibiotic prescribing for acute respiratory infection visits dropped from 6.2% to 2.4%. After adjusting for health-system and provider-level effects, inappropriate prescribing dropped from 2.2% to 1.5%. More intensive behavioural nudging methods were not more effective in high-performance settings.	Yes	Passive/ Asynchronous	Implementation of antibiotic stewardship for ARI is feasible and effective to remind prescriber to appropriately prescribe antibiotics.

				compared to top-performing peers.					
Tannenbaum *et al* 2014, USA[36]	Antibiotics	Improve guideline concordance for acute respiratory infection treatment.	Primary care physicians	Providers were randomly assigned to one of two menu partitions in simulated EHR displays. In the antibiotic-inappropriate panel, the treatment menu either listed over-the-counter (OTC) medications individually, while grouping prescriptions together or displayed the reverse partition. In the antibiotic-appropriate panel, the treatment menu either listed narrow-spectrum antibiotics individually while grouping broad-spectrum antibiotics or displayed the reverse partition.	Defaults/pre-orders	There was an 11.5 per-centage point reduction in choosing aggressive treatment options (e.g., broad-spectrum antibiotics) when aggressive options were grouped compared to when those same options were listed individually.	Yes	Passive/ Synchronous	Using order sets in the EHR can help reduce inappropriate antibiotic prescribing.
Dos Santos *et al* 2020, Brazil[37]	Antibiotics	Improve dosing for antimicrobials.	Physicians at a large public university hospital	A window was inserted in the computerized physician order entry (CPOE) in the EHR with measurements of patient's renal function. Before the intervention this information had to be accessed by actively clicking (4 clicks) on the system, a task that required ~15–20 seconds.	Information transparency	The approach increased appropriateness of dosing from 33.9% to 41.4%	Yes	Active/ Synchronous	A simple change in the EHR layout for prescribing physicians can boost strategies for appropriate antibiotic use.