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Review Article

REVIEW ARTICLE

Systematic review to determine which validated measurement tools can be used to assess risk of problematic analgesic use in patients with chronic pain

R. Lawrence[1,*], D. Mogford[1] and L. Colvin[2]

[1]Ritson Clinic, Royal Edinburgh Hospital, Morningside Terrace, Edinburgh EH10 5HF, UK and [2]Department of Anaesthesia, Critical Care & Pain Medicine, University of Edinburgh, Western General Hospital, Crewe Rd, Edinburgh EH4 2XU, UK

*Corresponding author. E-mail: rebecca.lawrence@nhslothian.scot.nhs.uk

Abstract

Background. Misuse of prescription opioids, and other drugs prescribed for chronic pain, has increased, with major concerns about harm. This review was undertaken to identify validated measurement tools for risk assessment and monitoring of chronic non-cancer pain patients being considered for, or currently prescribed, analgesic drugs with abuse potential.
Methods. Selected databases (Embase, Medline, Cochrane library/CENTRAL, PsycINFO, PubMed, CINAHL) were systematically searched for studies evaluating tools for risk of analgesic misuse, either before, or during, analgesic therapy for chronic pain, using predetermined inclusion/exclusion criteria. Two independent reviewers assessed abstracts, selected full texts, extracted data and assessed quality.
Results. 30 studies from 1844 met inclusion criteria, including three systematic reviews, with an additional four studies from bibliography review. The studies covered 14 tools pertaining to opioid use, with none for non-opioid analgesics. Although there is no single, clear factor identifying opioid misuse, previous substance misuse appears important. Deception, including lying to clinicians, and using drugs belonging to others are common features. Smoking history may be relevant.
Conclusions. For predicting prescription opioid misuse, the *pain medication questionnaire* (PMQ) and the *screener and opioid assessment for patients with pain* (SOAPP) had the best evidence; both developed and validated in five separate studies (four each of acceptable quality). The *current opioid misuse measure* (COMM) performed best screening for current misuse, developed and validated in three studies of acceptable quality. A small number of tools may accurately predict, or identify, opioid misuse. There are none for non-opioid analgesics, where there is a potential need.

Key words: analgesics, non-narcotic; analgesics, opioid; chronic pain; opioid-related disorders; pain; risk assessment; substance-related disorder,

Despite the wide availability of therapies for chronic pain, treatment remains challenging. Chronic pain lasting more than three months is common, and is thought to affect approximately one fifth of the population in Europe,[1] although higher rates have been found.[2] Prevalence is higher in chronic disease, increases with age and has significant cost implications.[3] Chronic pain is associated with various psychopathologies, including substance misuse disorders,[4] and psychiatric

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comorbidity appears to be an important risk factor for both chronic pain and addiction.[5]

Opioids remain an important component of drug therapy when used judiciously in selected patients,[6] despite growing concerns regarding long-term efficacy and harm.[7] There has recently been a large increase in their use to treat chronic non-cancer pain.[8] This may be as a result of reduced prescribing restrictions on opioids to treat pain, increased marketing by pharmaceutical companies, or an expectation by both physicians and patients that pain should be relieved.[9] Both prescribed opioid and illicit drug misuse have been shown to occur in patients prescribed opioids for chronic pain,[10] and prescription drug misuse has increased, particularly in the United States,[11] with growing concern regarding prescribed opioid analgesic misuse.[12] Caution must be balanced against potential benefit. A Cochrane review has shown that the risk of misuse may be low in those who have no history of substance abuse.[13]

The need for risk assessment, before prescribing and during therapy, and at a public health level, has been recognized,[14] and several tools have been developed to assess this for opioids. These can be used in conjunction with clinical judgment and urine toxicology. Identified risks include patient characteristic factors such as younger age, more reported pain, genetic variables, and abnormal drug seeking behaviours.[15] Some studies of available tools have excluded those with past substance use, and have largely been tested in tertiary pain clinic settings, so may be less applicable to routine clinical practice.[16] A number of systematic reviews have been carried out to assess risk of opioid misuse, although there have been no reviews of other analgesic agents.[17–21] Misuse of gabapentin and pregabalin, also used for chronic pain, is a major new emerging problem,[22] and risk assessment for this is also becoming increasingly important.

This review aimed to evaluate the use of validated measurement tools to assess risk of analgesic misuse (opioid *and* non-opioid), or associated aberrant drug-related behaviours, either before, or during, analgesic therapy for chronic pain. Although the search strategy included tools pertaining to tricyclic antidepressants and gabapentinoids and opioids, the only studies that were found examined risk of opioid misuse.

Methods

The review was registered with the PROSPERO international prospective register of systematic reviews (registration number 42016030087).[23]

Selected databases (Embase, Medline, Cochrane library/CENTRAL, PsycINFO, PubMed, CINAHL) were systematically searched for studies, using the following inclusion and exclusion criteria. Search strategies are shown in Supplementary Appendix S1.

Inclusion Criteria:

- Population: Adults (18 and over) with a diagnosis of chronic pain (pain persisting for more than three months), where analgesic medication is prescribed or under consideration
- Type of studies: Systematic reviews of controlled trials and prospective observational studies; controlled trials comparing use of a validated assessment tool with no tool (or with another tool), or open label extensions; prospective observational studies evaluating the use of a validated assessment tool; studies using an accepted method of assessing misuse of prescribed analgesics (clinical interview, structured interview, questionnaires, prescription drug monitoring, drug screening). Studies describing the initial derivation of tools and preliminary validation were also included
- Outcome Measures: Prediction of prescribed analgesic misuse (defined as taking more than the quantity prescribed; more frequent requests for prescriptions; or taking analgesics when not required for pain relief)
- Yr: 1990 to December 2015
- Publication status: Published in a peer-reviewed journal

Exclusion Criteria:

- Studies including patients with acute or cancer pain
- Studies using tools to predict misuse of non-prescribed substances
- Non-English language studies
- Editorials, commentaries, narrative reviews, conference proceedings, meeting abstracts.

Studies retrieved from searched terms were checked for duplicates, which were removed. Two independent reviewers (R.L. & D.M.) reviewed all the resulting abstracts to select eligible articles. Differences were discussed with an experienced third party (L.C.). Both reviewers then reviewed full copies of all eligible articles, and extracted data in accordance with pre-specified data items:

- Patient characteristics data (sex, age, socio-economic status)
- Type of pain, pain duration, other pain therapies
- Physical comorbidities
- Psychiatric comorbidities
- Current substance-use disorder (alcohol/drugs) or previous substance-use disorder, as defined in the ICD-10 classification of mental and behavioural disorders (WHO, 1992)
- Class/type/route of administration/dose range of prescribed analgesic
- Other medications
- Sample size, patient population
- Type of assessment tool used, including development and validation of tool
- Type and size of population used to validate tool was defined
- Purpose of assessment tool (to predict use of which analgesic, excessive use, use for reasons other than analgesic effect, diversion, use of other illicit drugs)
- Methods used to assess misuse of prescribed analgesic
- Timeframe of study and follow up

The reviewers also assessed risk of bias for included studies using the Cochrane "Risk of Bias" criteria.[24] Each study was rated as being of high, acceptable or low quality using the methodology outlined in the relevant Scottish Intercollegiate Guidelines Network (SIGN) checklists.[25] Risk of bias across all studies was also considered, including publication and selective reporting bias. Any differences were resolved by discussion that included the experienced third party noted above.

Results

Searches of all databases yielded 1844 abstracts; 30 studies were selected for full text review, including three systematic reviews. Four additional studies were added for full review, after review of bibliographies.

No studies were identified that described or evaluated tools that screened for, or predicted, problematic use of either gabapentinoids or tricyclic antidepressants, so all pertained to tools designed to identify or predict possible problematic use of opioids. All studies described tools that were developed and

validated in North America, although two included validation of tools in other European languages, but were published in English.

Table 1 lists all included studies, with quality rating, and the tools evaluated, specifying both purpose and format, and grouped into five different categories according to what the authors state the tool measures. Where available, sensitivity, specificity, positive predictive value and negative predictive value are summarised in later tables. Study patient characteristics are included in Supplementary Appendix S2.

Tools predicting risk of aberrant drug related behaviours or prescription opioid misuse

Seven tools were identified and reported by 17 studies,[26–42] with results summarised in Table 2.

The STAR (*screening tool for addiction risk*)[26] was administered once to a population grouped by a recent history of substance abuse, with review of patient records at two months.

The POTQ (*physician opioid therapy questionnaire*)[27] derived its questions from a review of addiction literature, incorporated into a psychological interview.

The *pain medication questionnaire* (PMQ), developed in a study of acceptable quality,[28] has been more extensively tested. It is a 26-item tool, with statements that are rated on a 5-point Likert scale, and it was developed using literature regarding opioid misuse and clinician experience to evaluate the risk of aberrant drug related behaviours in patients prescribed opioids for chronic pain. The authors piloted it on a sample of 184 patients, all of whom were presenting for initial assessment at a pain clinic. Ninety-eight received interdisciplinary treatment, and 86 received medical treatment only. Just over 60% were prescribed opioids at the start of the study. Overall, PMQ scores were divided into thirds, with the highest scoring classified as H-PMQ and the lowest as L-PMG. Test-retest reliability was deemed adequate when the tool was re-administered to a subset of 19 patients after 30 min (Pearson's r coefficient 0.85). Internal consistency improved when four items were dropped (Cronbach's alpha coefficient increased from 0.73 to 0.75). This study used a number of tools to assess pain and personality, mood and mental health, and the *physician risk assessment* (PRA), which was developed specifically for the study to measure clinicians' evaluation of risk. Concurrent validity was tested using both the PRA and knowledge of opioid misuse, and there was a correlation between these two measures and higher PMQ scores, but numbers were small. Convergent validity was calculated for substance abuse potential, disability & psychosocial distress, and discriminant validity for well-being and psychosocial coping, and was found to be significant ($P<0.01$).

The PMQ was further validated in a prospective study of 271 new patients to a pain management programme.[29] This study was also of acceptable quality, and again compared high (H-PMQ), medium (M-PMQ) and low (L-PMQ) groups (across a normal distribution). Those in the H-PMQ group were 2.6 times more likely to have known substance abuse when compared with those in the L-PMQ group (95% CI 1.27–5.32). The *physician risk assessment* was completed, with significant differences between the high, and both the medium and low scoring groups (SDs given). There were also significant differences in mean PMQ scores of 60 patients who asked for early medication refills and those who did not. Only 39 subjects of the original 271 took the PMQ both before and after treatment, and these showed a significant reduction in scores after treatment. Patients in the high scoring group were also 2.3 times more likely to leave treatment because of a lack of compliance than those in the lowest scoring group (95% CI 1.03–5.02).

The PMQ was further validated in two other studies, both of acceptable quality. The first prospectively studied a sample of 388 new patients at a pain management centre, although only 249 completed the PMQ so were included.[30] There were no significant differences in patient characteristics and outcomes between those who completed and those who did not. They used the *physician risk assessment* (carried out without knowing the PMQ score), and a battery of questionnaires, and noted patient medication agreements and early prescription refills from patient charts. As in previous studies, they scored subjects into groups, but used only H-PMQ ($\geq$25) and L-PMQ ($<$25), with no middle group. They found that all measures were significantly associated with total PMQ score ($P<0.01$) except VAS (*visual analogue scale*), and that those in the higher scoring group were 6.4 times more likely to have been referred to the pain centre with a diagnosis of known opioid misuse than the lower scorers (χ^2 (1)=7.14, $P<0.01$; OR = 6.40, 95% CI: 1.39–29.49). Mean PMQ scores for both groups (H-PMQ and L-PMQ) were significantly different on all items of the Physician Risk Assessment, and on total score of the latter (Pearson's correlation coefficients, $P<0.001$). The authors also noted that a subgroup scoring 30 showed particularly problematic behaviours. The other study used a reduced item version of the PMQ, with three questions removed after correlation coefficient analyses did not find them to be useful (internal consistency remained reasonable with Cronbach alpha of 0.703).[31] This study used a larger sample of 1813 patients referred to pain management, and divided subjects into three groups, with those scoring $<$21 classified as L-PMQ, those between 21 and 30 as M-PMQ, and those scoring$>$30 as H-PMQ. The authors used a sequential logistic regression model to establish what factors or behaviours were associated with high or low scores, and showed that requesting early prescriptions was the most important predictor, with 74% sensitivity and 93% specificity. This also correlated significantly with two items rated by the physician (concern about use of extra medication (χ^2 26.07, $P<0.01$) and their estimation of the individual's risk of misuse (χ^2 23.27, $P<0.01$)).

One other study, considered of low quality, was an initial validation of a Danish version of the PMQ, but of the 209 subjects, 7% had pain as a result of malignant disease, so the study was of limited relevance to this review.[43] The authors screened for addiction using Portenoy's criteria, which had been validated by the first author in another study, for the purpose of identifying addiction in patients with chronic pain treated with opioids. These criteria include desire and compulsive use of a drug and aberrant behaviours, such as manipulation of health professionals to acquire drugs, obtaining drugs from other sources, hoarding of drugs, and use of other drugs or alcohol.[44] The authors used a discriminant function analysis based on a diagnosis of addiction using Portenoy's criteria to generate sensitivities and specificities for different cut-off scores of the PMQ, with a score of $<$22 giving a sensitivity of 82% and specificity of 58%.

The *screener and opioid assessment for patients with pain* (SOAPP) Version 1.0 was developed in an acceptable quality study,[33] then further refined to the SOAPP-R (revised version) in another study of acceptable quality.[35] The initial study used concept mapping by 26 experts in pain or addiction, with 39 further professionals then sorting and rating items. Concept maps were generated, and items were based on these. A 24-item tool was reduced to 14 items that appeared to predict aberrant drug related behaviours. The tool was validated on a sample of 175

Table 1 All included studies with purpose, format of tools and final quality assessment

Author/yr of study	Type & purpose of study	Tool(s) evaluated	Purpose of tool	Format of tool	Quality assessment
1. Tools predicting aberrant drug related behaviours or future prescription opioid misuse					
Friedman and colleagues, 2003	Derivation and initial pilot/preliminary evaluation of a screening tool.	• STAR (Screening Tool for Addiction Risk)	To identify pain patients at risk for substance abuse before opioid treatment started	14-item self-report screening tool (true/false) Mood/employment Personal/family history of drug treatment/history of abuse Pain treatment Screen for drug/alcohol use & smoking	Low
Michna and colleagues, 2004	Prospective observational cohort study	• POTQ (Prescription Opioid Therapy Questionnaire)	To predict aberrant drug-related behaviour with opioid use in chronic non cancer pain	3-item physician-completed questionnaire (yes/no) Personal/family history of drug/alcohol use Past treatment of above Resultant legal problems	Low
Adams *et al.*, 2004	Prospective observational study. First step in development of self-report screening test.	• PMQ (Pain Medication Questionnaire)	Assess risk for aberrant behaviours when on opioid medication in patients with heterogeneous pain syndromes	26-item self-report tool (5-point Likert scale)	Acceptable
Holmes and colleagues, 2006	Prospective observational cohort study	• PMQ	To measure risk for opioid medication misuse among chronic pain patients	26-item self-report tool (5-point Likert scale)	Acceptable
Dowling and colleagues, 2007	Prospective observational cohort study - to further evaluate validity	• PMQ	To screen for opioid medication misuse/to predict development of aberrant opioid medication use behaviours in patients with chronic pain	26-item self-report tool (5-point Likert scale)	Acceptable
Buelow *et al.*, 2009	Prospective observational study. Further step in validation of PMQ.	• PMQ (reduced-item)	To assess potential risk of misuse of pain medication	26-item self-report tool (5-point Likert scale)Tested reduced item version	Acceptable
Hojsted and colleagues, 2011	Prospective observational cohort study (validation of Danish version of PMQ)	• PMQ	To identify patients on a range of potential risk factors	26-item self-report tool (5-point Likert scale) (Danish version)	Low
Butler and colleagues, 2004	Development (derivation) and initial validation of tool - prospective study	• SOAPP (Screener and Opioid Assessment for Patients with Pain, Version 1.0)	To determine potential risk of abuse in chronic pain patients when prescribed opioids for pain	24-item self-report tool (5-point Likert scale). Reduced to 14 items which appeared to predict ADRB	Acceptable
Akbik and colleagues, 2006	Prospective observational study, to further validate SOAPP	• SOAPP	To identify which chronic pain patients may be at risk for problems with long-term opioid medication	14 items	Acceptable

Continued

Table 1 (continued)

Author/yr of study	Type & purpose of study	Tool(s) evaluated	Purpose of tool	Format of tool	Quality assessment
Butler and colleagues, 2008	Development (derivation) and validation of tool - prospective study	• Revised Screener and Opioid Assessment for Patients with Pain (SOAPP-R)	To predict aberrant medication-related behaviours among chronic pain patients considered for long-term opioids	24-item self-report tool	Acceptable
Butler and colleagues, 2009	Prospective observational cohort study to cross-validate tool with new patient sample	• SOAPP-R	To predict aberrant medication-related behaviours in people with chronic pain	24-item self-report tool	Acceptable
Brown and colleagues, 2011	Prospective open-label, non-randomized, non-comparative, multi-centre observational study.	• SOAPP-R, as part of UP (universal precautions) approach.	To evaluate risk of aberrant drug-related behaviours in patients with chronic pain in primary care & monitor risk & ADRBs.	24-item self-report tool	Low
Webster and colleagues, 2005	Prospective observational cohort study – development (derivation) and initial validation	• ORT (Opioid Risk Tool)	To accurately predict who will develop aberrant behaviours when prescribed opioids for chronic pain	5-item self-report tool (10 yes/no answers), plus age/sex of patient, weighted based on validation data	Acceptable
Witkin and colleagues, 2013	Retrospective review of prospectively collected data	• ORT	To predict aberrant drug related behaviour in patients on opioids for chronic pain	Completed by both patient and physician in this study	Low
Jones and colleagues, 2013	Development (derivation) and initial validation of tool - prospective pilot study	• BRI (Brief Risk Interview)	To identify patients more likely to engage in future medication aberrant behaviour	Clinician administered tool	Acceptable
Jones and colleagues, 2014	Prospective cohort study further validating BRI	• BRI	To predict future medication aberrant behaviour	6-12 min structured clinician administered interview	Acceptable
Jones and colleagues, 2015	Development (derivation) and initial validation of tool - prospective study	• BRQ (Brief Risk Questionnaire)	To assess risk of opioid misuse, abuse, addiction & diversion before starting opioids for chronic pain	12-item self-report tool (yes/no answers and rating scales)	Acceptable
2. Tools screening for current aberrant drug related behaviours or current opioid misuse					
Manchikanti and colleagues, 2003	Prospective cohort study - external validation of tool developed by Atluri & Sudarshan (2002)	• Unnamed tool	To identify drug abuse behaviours in patients in pain treatment practices.	12 sections with 27 items. Administered by physician and nurse.	Low
Butler and colleagues, 2007	Development (derivation) and initial validation - prospective study	• COMM (Current Opioid Misuse Measure)	To measure current aberrant drug-related behaviour - specifically to periodically monitor misuse of medication (in the past 30 days)	17-item self-report tool (Original alpha version used in this study had 40 items)	Acceptable
Butler and colleagues, 2010	Prospective observational study. Aim - to cross validate tool with a new sample of CNCP patients	• COMM	To identify people with chronic pain who are prescribed opioids for pain who are currently misusing opioids	17-item self-report tool	Acceptable

Continued

Table 1 (continued)

Author/yr of study	Type & purpose of study	Tool(s) evaluated	Purpose of tool	Format of tool	Quality assessment
Meltzer and colleagues, 2011	Prospective cross-sectional study.	• COMM	To identify prescription drug use disorder	40 question beta version of COMM used (reduced to 17 in validation study)	Acceptable
Knisely and colleagues, 2008	Prospective cohort study (? comparative, cross-sectional. Not controlled)	• POMI (Prescription Opioid Misuse Index)	To identify patients who misuse opioid medications	8-item inventory (Yes/no answers). Unclear if self-administered or not	Low
3. Tools screening for and predicting both current and future aberrant drug related behaviours or prescription opioid misuse					
Compton and colleagues, 1998	Prospective observational cohort study - pilot study to test tool	• Prescription Drug Use Questionnaire (PDUQ)	To evaluate pain, opioid use, social & family factors, FH pain, substance abuse, history of substance abuse & psychiatric history	42-item clinician-administered screening tool. 20 min to administer (39 scored items)	Acceptable
Compton and colleagues, 2008	Prospective observational cohort study - to evaluate preliminary psychometric properties of self-administered version, and to evaluate its predictive utility	• PDUQp (Prescription Drug Use Questionnaire p)	To predict or identify opioid addiction in chronic pain patients on opioids	31-item self-report screening tool (1 item not scored)	Acceptable
Jamison and colleagues, 2014	Development (derivation) and initial validation of tool - prospective study	• OCC (Opioid Compliance Checklist)	To monitor opioid adherence/compliance in chronic pain patients on long-term opioids	5-item self-report tool	High
Jamison and colleagues, 2015	Prospective observational cohort study - further validation of OCC in primary care.	• OCC	To assess efficacy of OCC monitoring opioid adherence in CNCP patients in primary care. To identify current & future opioid misuse.	8-item self-report tool (4 items omitted as not clinically useful in improving predictive power in determining opioid misuse)	High
4. Studies comparing different tools					
Jones and colleagues, 2012	2 studies. Study 1- compared tools predicting opioids stopped because of ADRBs.**? Retrospective analysis**. Study 2 - prospective study comparing risk assessment measures	• SOAPP-R • PMQ • ORT	See derivation studies	See derivation studies	Low
Ferrari and colleagues, 2014	Prospective observational cohort study (preliminary validation of Italian versions of instruments)	• PMQ • DIRE (Diagnosis Intractability Risk and Efficacy Score)	See derivation studies	DIRE - assessment tool requiring medical & psychological assessment, completed by multidisciplinary team.	Acceptable
Moore and colleagues, 2009	Prospective observational study - to compare predictive validity of 3 tools.	• SOAPP • DIRE • ORT	See derivation studies	See derivation studies	Low
5. Tools used to monitor/document aberrant drug related behaviours or prescription opioid misuse					
Passik and colleagues, 2004	Development (derivation) and initial field-testing of tool.	• Pain Assessment and Documentation Tool (PADT)	Evaluate outcomes and record patient care	Clinician-directed interview. Brief 2-sided chart note. Revised version completed in min	Acceptable

Continued

Table 1 (continued)

Author/yr of study	Type & purpose of study	Tool(s) evaluated	Purpose of tool	Format of tool	Quality assessment
Wu and colleagues, 2006	Development (derivation) and initial validation - prospective study	• ABC (Addiction Behaviors Checklist)	Track behaviours	20-item clinician administered tool	Acceptable
6. Systematic Reviews					
Turk and colleagues, 2008	Systematic review	• SISAP • PDUQ • STAR • POTQ • PMQ • SOAPP • ORT • ABC • COMM	Tools to predict opioid misuse by chronic pain patients	See individual studies	Acceptable
Chou and colleagues, 2009	Systematic review	• SOAPP V.1 • SOAPP-R • ORT (Opioid Risk Tool) • PMQ • 6-item instrument (Atluri, 2004) • COMM • PDUQ • 4 item instrument (Manchikanti, 2004) • POTQ • PDUQ (psychiatric items, Wasan, 2007) • ABC	Both to predict use AND to identify current use	• **Predictors** all self-report. • **Current use** self-report, interviewer-administered and unclear.	High
Becker and colleagues, 2013	Systematic review	• PADT • COMM • PDUQ-p • mPMQ • POMI • PODS (other tools assessing bowel function)	Review of psychometric development and testing of patient-reported instruments assessing safety, efficacy and misuse of opioids; and ifpossible the operating characteristics of tools	See individual studies/ tools	High

subjects, with six months follow up data collected for 95 out of 116. The *aberrant drug behaviour index* (ADBI), based on a structured interview (*prescription drug use questionnaire* - PDUQ), reports by clinical staff and urine toxicology, was used to validate the SOAPP. Internal consistency was reasonable (alpha coefficient 0.74), as was test-rest reliability after six months (Pearson product moment correlation 0.74). A score of ≥ 7 gave a sensitivity of 91% and specificity of 69%.

The SOAPP-R was created using the original concept mapping from the SOAPP v.1.0, with a large number of items (142) used for an alpha version, of which 94 were retained for a beta version after empirical testing on 85 subjects. Twenty-four items were ultimately selected based on factors including content, consistency, reliability and effect size, and initial validation was carried out on 283 pain clinic patients. Sensitivities and specificities, positive and negative predictive values, and positive and negative likelihood ratios were calculated for different cut-off scores with a cut-off of ≥ 18 considered useful (shown in Table 3).

The SOAPP version 1.0 was further validated in a sample of 397 patients, of whom 159 were from a veteran's pain centre (98.1% of these were male, and 66% had a service related injury).[34] The remainder were taken from a tertiary hospital centre. This study was of low quality, comparing scores with retrospectively examined urine toxicology only, and therefore identifying only illicit or non-prescribed drugs. Subjects were divided into high risk (score$\geq$8) or low risk (score $<$8). High risk subjects were younger ($P<0.05$), gave more urine screens ($P<0.01$) and had more abnormal results ($P<0.05$) than those in the low risk group.

The SOAPP-R was cross-validated in another prospective study of acceptable quality.[36] This study used a sample of 302

Table 2 17 studies of 7 tools predicting aberrant drug related behaviours (ADRBs) or risk of future prescription opioid misuse

Study	Tool	Sample size & population	Other methods used to assess pain, problem use of opioids or ADRBs	Sensitivity & Specificity	Follow up
Friedman and colleagues, (2003)	STAR	48 Chronic pain patients from large inner-city hospital (14 with substance abuse and hospitalized for chronic infections and/or AIDS)	Patients with substance abuse had >3 DSM-IV criteria for addiction	Not given	Chart review at 2 months
Michna and colleagues, (2004)	POTQ	145 Hospital based pain management centre, on, or being considered for, opioids	Interview by clinical psychologist/monitored by treating physician for average 5 months. Completed Physician Questionnaire on Aberrant Drug Behavior/ chart review by nurse, including urine toxicology (not all, assessors not blind to results)Divided into low/high risk groups	Not given	>6 months
Adams and colleagues, 2004	PMQ	184 Consecutive new patients in pain management centre. 98 received interdisciplinary treatment. 86 received medical treatment only. Just over 60% prescribed opioids at the start	BDI; CAGE; Dallas Pain Questionnaire; Medical Outcomes Short Form-36 Health Status Survey (SF-36); Million Behavioural Health Inventory (MBHI); MMPI-2 (including MAC-R, APS & AAS); Oswestry Pain Disability Questionnaire (OSW); Patient Information Form; Physician Risk Assessment (PRA) (developed for this study to quantify physicians' independent assessment of risk for opioid misuse - used as one means of validation); Visual Pain Analogue (VPA); West-Haven-Yale Multidimensional Pain Inventory (MPI)	Not given	>8 months
Holmes and colleagues, 2006	PMQ	271 New patients at interdisciplinary pain management programme	BDI; Confidential Pain Questionnaire; Medical Outcomes Survey 36-Item Short Form Health Survey (SF-36) (MCS & PCS); Million Visual Analog Scale (MVAS); Oswestry Disability Questionnaire (ASW); Physician Risk Assessment (PRA); Visual Analog Scale (VAS). Data collected at intake, discharge and 6 months post-discharge	Not given	Data collected at intake, discharge and 6 months post-discharge

Continued

Table 2 (continued)

Study	Tool	Sample size & population	Other methods used to assess pain, problem use of opioids or ADRBs	Sensitivity & Specificity	Follow up
Dowling and colleagues, 2007	PMQ	249 New patients at pain management centre (388 prospective patients, only 249 completed the PMQ – no significant differences in patient characteristics & outcomes between completers & non-completers)	Physician Risk Assessment (PRA) – blind to PMQ score; BDI (only to those in IDT or who completed behavioural medicine evaluation); Million Visual Analog Scale (MVAS) for pain & disability); Medical outcomes short form-36 health status survey (SF-36) - MCS & PCS used; Oswestry pain disability questionnaire; Visual analog scale (VAS); Confidential pain questionnaire (CPQ) - centre specific for patient characteristics, etc. Patient medication agreements and early prescription refills obtained from patient charts	Not given	6 months
Buelow and colleagues, 2009	PMQ (reduced item)	1813 New patients at pain management centre	Psychological assessment - semi-structured interviews and tests. MVAS (Million Visual Analog Scale); OSW (Oswestry Pain Disability Questionnaire; PMQ (original 26 item); VAS (Visual Analog Scale. Also - history of drug abuse, history of alcohol abuse, history of opioid detox, history of substance abuse, history of rehab	Sensitivity 74% Specificity 93% (Predicting whether in H-PMQ or L-PMQ group)	
Hojsted and colleagues, 2011	PMQ (validation of Danish version)	209 Hospital patients with chronic non cancer pain or cancer pain (included so less relevant to this review)	Screened for addiction by both physician & nurse using Portenoy's Criteria (Portenoy, 1996) - independent and blind to each other. Questionnaire covering pain duration, opioid duration, patient characteristic data & alcohol & smoking sent. HADS and SF-36 MCS (Mental Component Summary) and SF-36 PCS (Physical Component Summary)	Cut off of < 22 - sensitivity 82%, specificity 58%	
Butler and colleagues, 2004	SOAPP, v.1.0	175 (95 re-evaluated after 6 months) Chronic non cancer pain patients in hospital pain management centre	Self-report using PDUQ (11 or higher considered positive); staff report (if 2 out of 3 judged that had serious drug problem, then considered to have ADRB); urine toxicology results (unexpected;	Sensitivity 91%, specificity 69% at cut off of ≥ 7	6 months (average 6.2; range 5-8)

Continued

Table 2 (continued)

Study	Tool	Sample size & population	Other methods used to assess pain, problem use of opioids or ADRBs	Sensitivity & Specificity	Follow up
			absence of prescribed; illicit). Aberrant Drug Behavior Index (ADBI) considered positive if ≥ 1 of these 3 positive		
Akbik and colleagues, 2006	SOAPP	397 238 from a tertiary hospital centre (A) and 159 from a Veterans Administration Pain Centre (B) 41 (? of original total) left 1 or more items blank so not included in analysis.	Urine toxicology	Not given	Cross-sectional
Butler and colleagues, 2008	SOAPP-R	283 (for testing of beta version) (85 for original empirical testing of alpha version) Pain clinic patients	Patient characteristics Questionnaire; BPI; short form of Marlowe-Crowne Social Desirability Scale Aberrant Drug Behaviour Index (ADBI) - based on PDUQ (score > 11), POTQ (2 or more physician rated aberrant behaviours) & toxicology.	At cut-off score of ≥ 18 – sensitivity .81, specificity .68	3 months
Butler and colleagues, 2009	SOAPP-R	302 Chronic, non-cancer patients recruited from pain management centres	Patient characteristics questionnaire; BPI; PDUQ (Prescription Drug Use Questionnaire); POTQ; Toxicology screen (confidential) at follow-up visit; ADBI (Aberrant Drug Behavior Index) 73% were followed up at five months with PDUQ, BPI and urine toxicology	At cut-off of 18, sensitivity .79, specificity .52	5 months
Brown and colleagues, 2011	SOAPP-R	1487 Recruited from primary care centre physicians with experience in prescribing opioids	Written agreement; prescription medication debit card; urine toxicology; pill count; PPAFT (Pain-Patient Assessment and Follow-up Tool - based on BPI, designed for this study); Investigator Assessment and Plan (IAP).	Not given	12 weeks?
Webster & Webster, 2005	ORT	185 New patients referred to pain clinic	ADRB recorded in chart by any member of clinical staff (not blind to ORT score). Query of state's prescription-monitoring program completed before 1st visit, at 6 month intervals, and if thought may be getting opioids elsewhere. Frequency & type of ADRBs recorded.	Not given 94.4% of subjects in the low risk group did not demonstrate aberrant drug related behaviours, and 90.9% of those in the high risk group did	12 months

Continued

Table 2 (continued)

Study	Tool	Sample size & population	Other methods used to assess pain, problem use of opioids or ADRBs	Sensitivity & Specificity	Follow up
			Chart review after 12 months.		
Witkin and colleagues, 2013	ORT	125 Recruited from single-centre tertiary care out patient pain management centre ORT completed by 125 clinicians & 87 patients	Medical records for each clinic visit during study period were reviewed & analysed for ADRBs. UDSs at each patient visit. Nonblinded reviewer compared substances in UDS to prescribed medication.	Not given	Minimum 2 months (average 7.8 months)
Jones and colleagues, 2013	BRI	196 Referrals to pain practice	ORT (medium and higher risk ratings counted as high) and SOAPP-R. Clinical interview Urine toxicology	Sensitivities: 0.58 (ORT), 0.53 (SOAPP-R) 0.73 (BRI) Specificities: 0.54 (ORT), 0.62 (SOAPP-R) 0.43 (BRI) No confidence intervals	6 months
Jones and colleagues, 2014	BRI	124 Referrals to pain clinics	BRI questions incorporated into a larger clinical intake interview. ORT & SOAPP-R (clinical staff blind to these). Urine toxicology	Sensitivity 83%, specificity 88% No confidence intervals	6 months
Jones and colleagues, 2015	BRQ	484 (30 later excluded as missing data) Consecutive patients referred to psychology practice working with a medical pain practice, and being considered for opioids	ORT; SOAPP-R; structured clinical interview rating system (BRI). Distress Thermometer; Zung Depression Scale; Zung Anxiety Scale; Pittsburgh Sleep Quality Index; pain Catastrophizing Scale. Overall opioid risk evaluation rating obtained based on BRI and given to prescriber	Sensitivity 80%, specificity 41% When dropouts were excluded: sensitivity 75%, specificity 45% No confidence intervals	6 months

patients, again recruited from pain management centres. The same methods were used as before to assess pain, problematic use and aberrant drug related behaviours, and 73% were followed up at five months when PDUQ, BPI and urine toxicology were undertaken. Sensitivities and specificities were calculated using ROC (*receiver operating characteristic*) curve analysis, giving an AUC (*area under the curve*) of 0.74 (95% CI 0.670 – 0.810; $P<0.001$). A cut off score of 18, as used in the initial validation study, gave a sensitivity of 0.79 and specificity of 0.52. Another study further validated the SOAPP-R in 1487 primary care patients, but was of low quality.[37] The size of the study, and the number of clinicians involved, presented particular difficulties, with level of risk sometimes being reduced, and the protocol being poorly adhered to. Urine drug screens were qualitative, and not confirmed by laboratory testing.

The ORT (*opioid risk tool*) was developed[38] using items developed from a literature review and the authors' own experience, and included personal and family history of prescription and illicit drug use and alcohol use. In addition, childhood sexual abuse and selected psychiatric disorders were incorporated, along with age and gender. It was further tested[39] in a retrospective review of prospectively collected data, comparing toxicology results and clinician assessment of aberrant drug related behaviours from patient case notes. Neither clinician nor patient completed tools were found to predict presence of aberrant drug related behaviours.

The most recent tools identified were the BRI (*brief risk interview*) and the BRQ (*brief risk questionnaire*). The BRI was developed[40] and further validated on another sample referred to a pain clinic using similar methods, and follow up time of six months.[41] It was developed by the first author of both papers from personal experience of using a diagnostic interview, based on an unexplained "introspective process", in combination with review of reports regarding patient risk and discharge.

The BRQ was developed from the BRI, to create a self-report tool that would reflect the content of the BRI[42] and included

Table 3 5 studies of 3 tools measuring current aberrant drug related behaviours (ADRBs) or current opioid use

Study	Tool	Sample size & population	Other methods used to assess pain, problem use of opioids or ADRBs	Sensitivity & Specificity	Follow up
Manchikanti and colleagues, 2003	Unnamed tool	500 (400 without and 100 with a history of drug abuse) Consecutive patients in an interventional pain management setting	Not clear how diagnosis of drug abuse was made	Not given Positive predictive value 94%	Followed for one yr before assessment
Butler and colleagues, 2007	COMM	227 Recruited from 2 hospital-based pain management centres	PDUQ; POTQ Marlowe-Crowne Social Desirability Scale - Short Form (Reynolds, 1982); urine toxicology (treating physician unable to access results); classification on ADBI (Aberrant Drug Behavior Index - positive if PDUQ positive or if urine toxicology AND POTQ positive)	Cut-off score of ≥ 9 gave sensitivity 0.77 & specificity of 0.68 with original group (0.94 & 0.73 with subgroup retested after 3 months)	Subset of 86 patients followed up after 3 months
Butler and colleagues, 2010	COMM	226 Chronic non cancer pain patients recruited from pain management centres	BPI; PDUQ (self-report; POTQ (physician completed with patient's chart); toxicology (confidential). ADBI (Aberrant Drug Behavior Index) - based on PDUQ, POTQ and toxicology (triangulation of data)	Cut off of 9 - sensitivity 0.712, specificity 0.713	5 months
Meltzer and colleagues, 2011	COMM	238 Primary care clinics of an urban, safety-net d, academic medical centre	DSM-IV diagnosis of prescription drug use disorder (PDD) - current (past yr). Prior drug disorder - $>$ 12 months ago. Socio-patient characteristics details; lifetime PTSD diagnosis; Patient Health Questionnaire (PHQ) for Depression; family history of SUD; current smoking	Sensitivity and specificity both 0.77 with COMM score of 13	Cross-sectional
Knisely and colleagues, 2008	POMI	74 (40 known opioid abusers; 34 pain patients) Recruited from community substance abuse treatment programs, regional jails, pain clinics & private internal medicine practices	Structured interview to establish substance abuse & dependence using DSM-IV checklist. Modified version of Addiction Severity Index 5th Edition (ASI)	Score of ≥ 2: sensitivity 0.820 and specificity 0.923	Cross-sectional

questions about previous discharge from treatment, taking extra medication, illicit use, alcohol and mental health and reading level and forensic history. Validation against other more established tools (but not laboratory testing) was conducted in a consecutive sample of patients referred to a psychology practice who were being considered for treatment with opioids.

Tools measuring current aberrant drug related behaviours or current prescription opioid misuse

Three tools were identified and were reported by five studies,[45–49] summarised in Table 3.

To identify the factors contributing to the risk of prescription opioid abuse among patients with chronic, non-malignant pain, 107 consecutive pain clinic patients known to have problems

Table 4 4 studies of 2 tools screening for and predicting both current *and* future aberrant drug related behaviours or prescription opioid misuse

Study	Tool	Sample size & population	Other methods used to assess pain, problem use of opioids or ADRBs	Sensitivity & Specificity	Follow up
Compton and colleagues, 1998	PDUQ	52 Opioid treated chronic pain patients referred for psychiatric evaluation. All had "problem narcotic use" or "drug-seeking behaviours"	Addiction medicine specialist made DSM-IV diagnosis of opioid abuse or dependence, (ASAM criteria)	Not given	1 interview, data collected over 3 yr
Compton and colleagues, 2008	PDUQ(p)	135 Veterans in chronic pain clinic	Medication agreement violation-related discontinuations (MAVRD). VAS used to assess pain. HADS; OSWESTRY pain disability questionnaire index	Sensitivity of 66.7% when using criteria that were more specific to opioid use, and 51.4% when less so. Corresponding specificities were 59.7% and 59.8%	1 yr
Jamison and colleagues, 2014	OCC	157 Patients with chronic non cancer pain recruited from pain management centre	Urine toxicology Patient characteristics questionnaire; BPI; Pain Disability Index; HADS; SOAPP-R; COMM; ABC; PDUQ. Drug Misuse Index (DMI) created: required a positive on any 1 of 4 measures	Cut-off value of one positive response: sensitivity 0.56 & specificity 0.71	Repeat questionnaires 6 months All tracked for 1 yr after end
Jamison and colleagues, 2015	OCC	253 Recruited from 8 primary care centres	Patient characteristics questionnaire; BPI; Pain Disability Index; HADS; SOAPP-R. At 6 months: HADS; PDI; COMM. At end of study, patient's physician asked to complete ABC.Urine toxicology.DMI (Drug Misuse Index)	Cut-off of one positive response at baseline: sensitivity 0.597 & specificity 0.653	6 months

with abuse were compared with 103 in a control group.[50] This resulted in an un-named tool that was later subject to prospective validation.[45] Three items were identified with odds ratios of more than 100, hence thought to have value in identifying misuse. The authors proposed a simplified tool based on these three items (extreme requirements for opioids, lying to acquire opioids, and "doctor shopping").

The *current opioid misuse measure* (COMM) was developed in a study of acceptable quality, and was initially validated in a sample of 227 pain management centre patients.[46] This tool was designed to be used for regular monitoring, and screened for misuse of prescribed opioids over the past 30 days. Like the SOAPP, which was developed by the same team, it was based on concept mapping, with input from both pain and addiction specialists and primary care health professionals. It was reduced down from an original 579 items to six clusters, each with between one and five layers. A 40-item alpha version of the COMM was then derived, which was later reduced down to 17 items. The COMM was then validated against a number of other measures shown in Table 4, notably the *aberrant drug behaviour index* (ADBI) (calculated from PDUQ, POTQ and toxicology), which was also used in the studies validating the SOAPP. It showed good test-retest reliability (ICC 0.86, 95% CIs 0.77–0.92), and internal reliability (coefficient alpha 0.86). ROC curve analyses were used to evaluate cut-off scores, 9 giving a sensitivity of 0.77 and specificity of 0.68. 86 subjects were reassessed and data reanalysed after three months, and the AUC, using COMM *vs* ADBI, was 0.92 (95% CIs 0.86–0.98), with a sensitivity of 0.94 and specificity of 0.73. Positive and negative predictive values were also calculated, and were 0.66 and 0.95 respectively, with positive and negative likelihood ratios of 3.48 and 0.08.

The COMM was subsequently further validated in two studies, both of acceptable quality. The first study was carried out on a larger sample of 226 subjects recruited from five separate pain management centres.[47] The authors used the 17-item version of the COMM, and similar comparison measures as in the initial derivation study. This study showed similar internal consistency (coefficient alpha 0.83), and ROC analyses gave an AUC of 0.79 (SE 0.031; 95% CI: 0.73 – 0.85; $P<0.001$), with a sensitivity of 0.712 and specificity of 0.713 at the previous cut-off of 9. The other study tested the COMM on a different population, this time of 238 subjects with chronic pain recruited from primary care.[48] This study used the *composite international diagnostic interview* to make DSM-IV diagnoses, for both prescription drug use

disorder (PDD), and also for other substance use disorders.[51] All subjects in this study had high rates of posttraumatic stress disorder (48% for those with PDD and 35% for those without), and a majority were in receipt of disability payments (59% for those with PDD and 50% for those without). This may in part reflect the fact that they were recruited from "safety-net" practices, and likely to be disadvantaged with no or minimal insurance. In this population, a cut-off of 13 appeared to be optimal, with sensitivity and specificity both 0.77, positive and negative predictive values of 0.30 and 0.96, and positive and negative likelihood ratios of 3.31 and 0.30.

The final study in this group tested the POMI (*prescription opioid misuse index*).[49] The questions pertained largely to use of pain medication, including increased and more frequent use, more frequent requests, experience of intoxication, use for reasons other than analgesia, and using more than one doctor. Subjects were selected from a larger study investigating oxycontin (modified release oxycodone) dependence.[52]

Tools screening for and predicting both current and future aberrant drug related behaviours or prescription opioid misuse

Two tools were identified and reported by four studies[53–56] as shown in Table 4.

The PDUQ (*prescription drug use questionnaire*) was developed based on a literature review and on review and evaluation of patient records.[53] This tool enquired about personal and family history of pain, personal and past history of substance use, mental health, and family and social aspects. Three items were identified that were particularly useful in identifying those with addiction, distinguishing 92.9% of this group (patient belief that they are dependent, increasing opioid medication, and preferring to take medication by a specific route). The PDUQ was later adapted to create a self-report tool, the PDUQp.[54]

The OCC (*opioid compliance checklist*) with versions of this tool have been reported, using different numbers of items.[55] They have different utility depending on time available for assessment and the clinical population.[56]

Studies comparing different tools

Three studies[57–59] were found which compared different tools, as shown in Table 5. The DIRE (*diagnosis intractability risk and efficacy*) score, included here, was excluded from this review as it was retrospective.[60]

Tools used to monitor/document aberrant drug related behaviours or prescription opioid misuse

Two further papers were identified[61 62] for this purpose, both clinician administered, and are summarised in Table 6. The

Table 5 3 studies comparing different tools

Study	Tool	Sample size & population	Other methods used to assess pain, problem use of opioids or ADRBs	Sensitivity & Specificity	Follow up
Jones and colleagues, (2012)	SOAPP-R, PMQ & ORT	Study 1: 132 pain clinic patients Study 2: 263 pain practice patients (unclear how many excluded)	Semi-structured interval (not blind to results of other tools)	Study 1: not given Study 2: all outcomes rated against discharge to produce sensitivities & specificities: Interview: 69% & 62% SOAPP-R: 41% & 71% PMQ: 36% & 78% ORT: 18% & 88% No confidence intervals	
Ferrari and colleagues, 2014	PMQ & DIRE (DIRE developed & validated in retrospective study (Belgrade et al., 2006) (excluded)	75	Numbers of aberrant drug related behaviours to validate the tools, and the VAS for pain, STAI Y2, BDI-2, PRSS (Pain related Self-Statement Scale - rated catastrophizing & coping) and MMPI-2	Total PMQ score correlated significantly with aberrant drug related behaviours at 2 months ($r = 0.58$, $P<0.001$); 4 months ($r = 0.67$, $P<0.001$); 6 months (r 0.52, $P<0.001$) DIRE: demonstrated significant correlations with aberrant drug related behaviours at each of these time points ($r = -0.37$, -0.35 and -0.34, $P<0.001$)	
Moore and colleagues, (2009)	SOAPP, DIRE & ORT	48 pain clinic patients (347 potential subjects)	Semi-structured interview	Sensitivities: Clinical interview 0.77, SOAPP 0.73, ORT 0.45 DIRE 0.17 No specificities or confidence intervals	

Table 6 Two studies of tools used to monitor/document aberrant drug related behaviours or prescription opioid misuse

Study	Tool	Sample size & population	Other methods used to assess pain, problem use of opioids or ADRBs	Sensitivity & Specificity	Quality & follow up
Passik and colleagues,(2004)	PADT	388 patients on opioids for at least 3 months, treated by 27 clinicians	Not applicable	Not applicable	
Wu and colleagues,(2006)	ABC	136 veterans from a chronic pain clinic (94% male). All on opioids	PDUQ, global clinical judgment by the treating clinician at each monthly visit, and discontinuation of opioids because of poor compliance or use of alcohol or illicit drugs. VAS pain scores	A cut off score was selected using comparisons with global clinical judgement, giving a sensitivity of 87.50% and specificity of 86.14%, but confidence intervals were not given Mean PDUQ scores were also compared with mean ABC scores, and were higher if ABC $\geq$3 (mean 11.77, SD 3.99) as opposed to $<$ 3 (mean 8.52, SD 4.05, t(86) -2.97, P=0.004).	1 yr

PADT (Pain *assessment and documentation tool*) included sections regarding analgesia, activities of daily living, adverse events and aberrant drug related behaviours and recording current analgesia and a specific analgesic plan.[61]

The other tool was the ABC (*addiction behaviours checklist*) and it remained unclear whether it would be best used for regular monitoring or screening purposes.[62]

Systematic reviews

Three systematic reviews were identified. The first included both screening tools and studies that examined predictors of misuse in clinical practice.[17] The second identified studies that both predicted and identified aberrant drug related behaviours before and during opioid prescribing.[18] The final reviewed instruments assessing opioid misuse, and also safety and efficacy in chronic pain.[20] The tools identified in these reviews are listed in Table 1, and include a number of additional tools that were excluded from this review as the relevant studies did not fit our inclusion criteria: the SISAP (*screening instrument for substance abuse potential*)[63]; an unnamed six-item instrument[50] that was further developed into an unnamed four-item instrument[45]; psychiatric items from the PDUQ[64]; the mPMQ[65]; and the PODS (*prescribed opioids difficulties scale*).[66] All the systematic reviews were of acceptable or higher quality. The data extracted and conclusions drawn were assessed as being reliable.

Discussion

This review identified a number of instruments, all of which were developed and validated in populations with chronic pain and prescribed opioids in the US. Two studies have undergone validation in other languages.[58 43] There have been no studies validating English language tools in European patient populations. This likely reflects the greater prominence that prescription opioid abuse has achieved in North America. The need to assess risk before and during prescribed opioid therapy is important given the rising number of deaths associated with these medications.[67] In order that opioids and non-opioid medications be preserved as part of a clinician's treatment options, the dangers of their use need to be carefully considered and responded to appropriately.

There was variability in how misuse of prescribed opioids was defined. Some applied already codified criteria such as the DSM-IV criteria for substance dependence or explicit reference to Portenoy's criteria.[44] Where study authors described a non-standardised definition, this included common recognisable features such as inappropriate requests for prescription refills, unauthorised dose escalation and seeking care from multiple providers. Some authors also used laboratory testing for use of opioids that had not been prescribed. Whilst the overlap in definitions is clear, the heterogeneity of the final definition makes comparison of results challenging and is a limitation inherent in this review. Clearly this is an area where consensus amongst researchers and clinicians would be of significant value.

Abuse of other classes of prescribed analgesic medication is increasingly recognised, with a particular emphasis on gabapentinoids,[22] and this may be a particular risk in patients who misuse other substances, or who are prescribed opioid substitution therapy.[68–70] Amitriptyline and some other tricyclic antidepressants are also liable to misuse in some patient groups.[71] This is of relevance as these drugs are considered amongst first line options for pharmacological treatment of neuropathic pain.[72] Gabapentinoids are being identified in drug related death reports in the UK,[67] with high levels of problem use in prisons.[73] The most recently published data on drug-related deaths in Scotland reported the presence of gabapentin in 17% of post-mortem samples and concluded that it was implicated in the death of 11% of cases.[67] Although gabapentin is not currently scheduled as a controlled drug, the Advisory Council on the Misuse of Drugs has recommended that this should change, and that appropriate risk assessment should be carried out before prescribing.[74] It is disappointing that no tools have been identified to assist in risk assessment in this area, and does highlight an area of unmet need.

Most of the tools identified were derived from reviews of the literature, and choice of tool may depend on the population being screened, and resources available. Of the tools that claim to predict prescription opioid misuse, the *pain medication questionnaire* (PMQ)[28] stands out for being evaluated in several studies of acceptable quality. It is relatively long, with 26 items, but quick and easy to complete, and has been validated against multiple outcome measures. It appears to be a useful tool, dividing subjects into low and high-risk groups.

The SOAPP (and SOAPP-R) is another potentially useful tool, developed and validated[33 35 36] using a rigorous process, providing a strong attempt to counter some of the difficulties alluded to regarding concurrent validity. The other studies that attempted further validation had methodological problems.[34 37]

Neither the *opioid risk tool* (ORT),[38] the *brief risk interview* (BRI)[40] or *brief risk questionnaire* (BRQ)[42] could be recommended on the basis of the studies reviewed. Development of the ORT showed methodological difficulties, with lack of evidence of blinding. Both the ORT and the SOAPP-R were used in the studies aiming to develop and validate the BRI and BRQ, but these all showed methodological flaws, with concerns about blinding and lack of confidence intervals. The high performance of the BRI and BRQ compared with the other tools could not, therefore, be supported from these studies alone.[40–42]

The *current opioid misuse measure* (COMM) appeared to perform best amongst tools aiming to screen for current misuse.[46 47]

The *opioid compliance checklist* (OCC), developed recently,[55] is a promising tool which may offer more functionality for both screening and predicting, being shorter, and having been developed and further validated in good quality studies.[56]

Several features are common across the tools identified. There is no single clear factor that identifies opioid misuse, and caution must be exercised, particularly where decisions are being made regarding whether to prescribe. Previous substance misuse appears important, with differing emphasis on personal or family histories, and whether it pertains to misuse of prescribed or illicit substances, or alcohol. A smoking history may be relevant.[34] Another aspect is that of deception, including lying to clinicians, and using drugs belonging to others. How best to elicit this remains a challenge. In some circumstances, patients may be loath to admit to such practices if they fear their prescription will be at risk. It is easier to obtain a history of psychiatric or psychological disorders, or to enquire about patient characteristics, including disability or employment, or legal problems. Increasing drug requirements and craving, or requests for specific drugs or mode of administration may also be more easily obtained.

Strengths of the present review are the wide range of databases searched, our attempt to identify specific tools of clinical utility and the expansion of our evidence search beyond opioids. The lack of literature regarding screening tools for non-opioid medication abuse and our inability to do a meta-analysis because of heterogeneity of studies are the principle weaknesses.

Conclusions

There is moderate quality evidence to support the use of several tools to either predict increased risk of, or aid in identification of, prescription opioid misuse. However, care must be taken if considering using these tools in different populations from that in which they have been developed and validated. Further studies would be improved by working with an agreed definition of prescription opioid misuse. Accurate information about the extent of prescription opioid misuse is needed, with routine use of a validated risk assessment tools potentially assisting with this aim. Given the recent increase in gabapentinoid misuse, development of specific measures to assess this risk will be of importance as no tools are currently available. Ideally, we envisage the development of a tool that predicts and monitors the emergence of aberrant drug-related behaviours in a population of chronic pain patients who are being considered for, or currently receiving, opioid or adjunct pharmacological treatment.

Authors' contributions

Study design/planning: R.L., L.C.Study conduct: R.L., D.M.Writing paper: R.L.Revising paper: all authors

Supplementary material

Supplementary material is available at *British Journal of Anaesthesia* online.

Declaration of interest

R.L. has received funding from Indivior (previously a division of Reckitt Benckiser) and Astellas Pharma to attend educational meetings, and has contributed to a virtual advisory board on opioid painkiller risk assessment tools (Indivior) within the last five yr.

L.C. has received consultancy/lecturing fees and travel support to non-promotional meetings from: Pfizer, Napp Pharmaceuticals, Grunenthal and Astellas within the last five yr. She is an Editor for the BJA.

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