

Effectiveness and Organization of Addiction Medicine Training Across the Globe

Astri Parawita Ayu^{a, d} Arnt F.A. Schellekens^{b, d} Shelly Iskandar^c Lucas Pinxten^d
Cor A.J. De Jong^d

^aAtma Jaya Catholic University of Indonesia, School of Medicine, Jakarta, Indonesia; ^bRadboud University Medical Centre, Department of Psychiatry, Nijmegen, The Netherlands; ^cPadjajaran University/Hasan Sadikin Hospital, Department of Psychiatry, Bandung, Indonesia; ^dRadboud University, Nijmegen Institute for Scientist-Practitioners in Addiction (NISPA), Nijmegen, The Netherlands

Key Words

Addiction training · Medical education · Curricula · Substance abuse · Addiction medicine

Abstract

Background: Over the past decade, addiction medicine training curricula have been developed to prepare physicians to work with substance use disorder patients. This review paper aimed at (1) summarizing scientific publications that outline the content of addiction medicine curricula and (2) evaluating the evidence for efficacy for training in addiction medicine. **Methods:** We carried out a literature search on articles about addiction medicine training initiatives across the world, using PubMed, PsychINFO and EMBASE with the following search terms ‘substance abuse, addiction medicine, education and training.’ **Results:** We found 29 articles on addiction medicine curricula at various academic levels. Nine studies reported on the need for addiction medicine training, 9 described addiction medicine curricula at various academic levels, and 11 described efficacy on addiction medicine curricula. **Conclusions:** Several key competences in addiction medicine were identified. Efficacy studies show that even short addiction medicine training programs can be effective in improving knowledge, skills and attitudes related to addiction medicine. A more uniform approach to addiction medicine training in terms of content and accreditation is discussed.

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Introduction

Over the past decades, the medical concept of substance use disorders (SUDs) has become more prominent [1]. SUDs are nowadays considered a chronic relapsing brain disease involving biological, psychological and social factors [2]. Moreover, alcohol abuse and SUDs have become one of the world’s leading causes of health problems [3]. The annual prevalence of (illicit) drug use and abuse among the adult population worldwide is estimated at up to 4–5% for alcohol, 5% for cannabis, 1% for opioids and amphetamine type stimulants and 0.5% for cocaine, and substance use is reported as the cause of death in about 1 among every 100 deaths [4]. Similarly, abuse of prescription has also increased rapidly over the past decade, particularly in the United States (US) and the United Kingdom (UK) [5, 6]. Degenhardt reported that illicit substance use caused 20 million Disability Adjusted Life Years (DALYs) in 2010 (0.8% of global all-cause DALYs) [7].

SUDs are often complicated by other conditions, including other psychiatric disorders and physical complications [3, 4, 8, 9]. The most common co-occurring psychiatric disorders are mood disorders (25–42%), attention deficit hyperactivity disorder (26–41%), conduct disorder (60%), psychotic disorders (28%) and anxiety disorders (17–23%) [3, 8–11]. Commonly reported phys-

ical complications include hepatitis C (47%), HIV (20%) and hepatitis B (15%) among injecting drug users [4], and liver cirrhosis (6–41%) [12], cardiac complications (2.5–5.3%) [13, 14] and neurological complications (10–21%) among alcohol-dependent patients [15–17].

Given the extensive range of medical complications and comorbidity that often accompany SUDs, all medical doctors need some basic competence in the assessment and management of SUD patients [18, 19]. Moreover, it is highly important that medical doctors recognize the abuse of prescription drugs, and their role in degrading the health of the population [5]. Moreover, a subset of SUD patients will need medical attention from well-trained specialists in addiction medicine, like addiction specialists or addiction psychiatrists.

However, not all medical doctors consider SUDs a medical condition, and as such do not consider treatment of these patients as their domain of treatment [18, 20–28]. Moreover, it has been shown that negative perceptions of patients with SUDs, for example, considering them as criminals, dangerous or treatment resistant, fuel negative attitudes toward these patients [20–22, 29]. Indeed, stigma toward these patients among medical doctors as well as the general public, is a major challenge in dealing with SUD patients [30, 31]. Furthermore, medical doctors often lack knowledge and skills required for the assessment and treatment of SUD patients [22, 32]. These factors undermine the quality of care for these patients with often high treatment needs.

Appropriate training can help to prepare medical doctors for working with SUD patients [25, 26, 33–35]. Several studies have shown that even short courses could increase knowledge on addiction medicine [36–40]. Moreover, courses have also been shown to induce more professional perceptions of and attitude toward patients with SUDs [36–39, 41–44]. These studies cover the full range of undergraduate level [32, 36, 38, 40], general physician level [37, 39, 40, 42–45] and addiction specialist level [41]. However, several questions remain unanswered: What teaching methods are most effective in improving knowledge, skills and attitude related to addiction medicine and what should an addiction medicine curriculum comprise? What addiction medicine competencies are required at the undergraduate and postgraduate levels?

The objective of the current study was to provide an overview of scientific publications on existing initiatives on the development of addiction medicine curricula at different educational levels worldwide. More specifically, our review papers aimed at (1) summarizing scientific

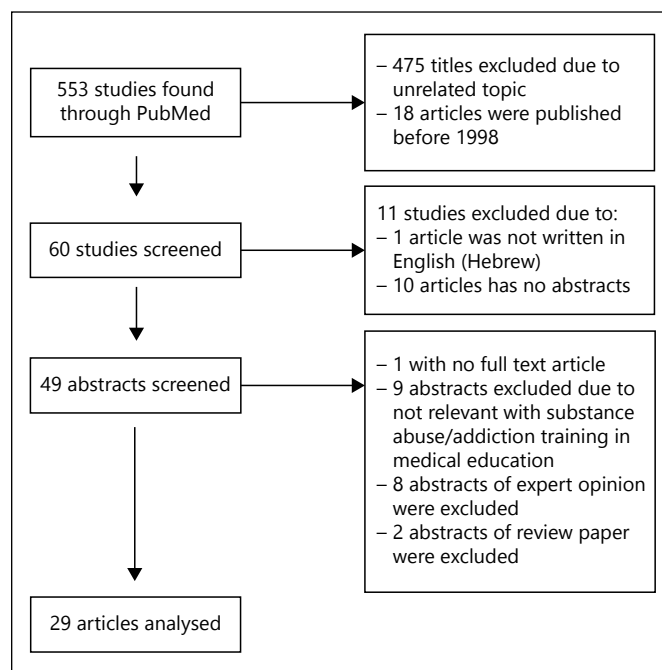


Fig. 1. Flowchart of the process of literature search.

publications that outline the content of addiction medicine curricula and (2) evaluating the evidence for efficacy for training in addiction medicine. Lessons learned from these experiences will be discussed, as well as recommendations for the development addiction medicine training at different academic levels.

Methods

Design

We performed a narrative literature review, following the ESRC Narrative Synthesis Guidance [46]. We used Pubmed, PsychINFO and EMBASE as search engines.

Search Strategy

We searched Pubmed, PsychINFO and EMBASE for articles on addiction medicine training published between 1998 and 2013, in English language. The following search terms were used: ‘substance abuse, addiction medicine, education and training.’ All articles about addiction medicine training initiatives across the world at any educational level within the medical curriculum were included.

Selection of Papers

The process of the literature research is summarized in figure 1 (flow chart). The search resulted in 553 results. The first author (AA) excluded articles with a title unrelated to substance use disorders or medical training. Titles referring to non-medical education were also excluded. This resulted in 60 articles for our review.

The first and second author (AA and AS) screened the abstracts of these 60 articles. Of these, 21 articles had to be excluded: 1 article was written in Hebrew, 9 articles were not related to addiction medicine training, 10 articles had no abstract, and from 1 article we could not obtain a full text version. Eight papers were opinion statements from experts in the field related to addiction medicine training. In line with the Narrative Synthesis Guidance, we considered these papers not scientific evidence. Hence, these papers were excluded. Two papers were review papers [18, 19] and so they too were excluded, in line with the guidelines for narrative reviews. Finally, we were left with 29 articles for analysis.

Results

Of the 29 articles included in this review, nine studies reported on surveys on the need for addiction medicine training (table 1) [23, 24, 27, 47–52]. These studies did not relate directly to the specific objectives of our study. However, these studies did emphasize the need to develop addiction medicine curricula. Therefore, we summarized these papers shortly in table 1 and in the Results section later in this article. In line with objective 1, nine descriptive studies outline initiatives on addiction medicine curricula at various academic levels [53–61]. These studies are summarized in table 2 and discussed later in this article. Efficacy studies on addiction medicine curricula (n = 11) answer objective 2 and are summarized in table 3 [32, 36–45].

Over the past fifteen years, the number of publications related to addiction medicine training has increased gradually. Six of the 29 published articles on training in addiction medicine included in this review were published between 1998 and 2003, ten between 2003 and 2008 and 13 between 2008 and 2013. Of particular interest is the special issue on training in addiction medicine published by Substance Abuse in 2011, where several addiction medicine curricula from various countries were outlined [23, 52, 59–61].

Survey Studies on the Need for Addiction Medicine Training

The nine papers that describe the training needs for training in addiction medicine cover a broad range of survey studies from undergraduate to postgraduate level (table 1). These papers point out a lack of addiction medicine teaching at the undergraduate level. At the postgraduate level, addiction medicine training is generally available within psychiatry and family medicine [47]. However, in almost half of other postgraduate medical training curricula, no time is allocated to topics related to addiction medicine [47]. All studies found that faculties

consider addiction medicine training highly relevant, but at the same time report a lack of availability of adequate training programs [23, 24, 27, 47–52].

Two studies surveyed knowledge, skills and attitudes of medical students and clinicians to provide treatment for patients with SUDs [24, 27]. The results of these studies suggest that addiction medicine training at undergraduate level can still be improved, in order to improve care for patients with substance use disorders by general physicians.

A cross-sectional survey among 1st–5th year medical students (n = 19,526) in 27 of 36 medical schools in Germany showed that students scored high on knowledge about addiction medicine, but most (40–60%) reported that they did not know how to treat substance use disorder patients [27]. This survey included a comparison with other chronic conditions (hypertension and diabetes mellitus). Students were more self-confident treating these conditions than patients with SUDs. This survey also showed that teaching hours allocated for addiction medicine training are half compared to topics like diabetes and hypertension. A limitation of this study was the low response rate among the students (49.6%). This may have induced a bias in the results, reducing generalizability of findings.

A cross-sectional survey among family physicians (n = 150) and medical students (n = 206) from three medical schools in Florida indicated poor knowledge on addiction medicine, as indicated by low scores on a written exam about alcohol use disorders [24]. The sample of family physicians and students was not described in detail. Therefore, it is hard to interpret the results and assess generalizability. Yet, the authors do emphasize that family physicians are particularly relevant in early detection and treatment of SUDs and should do better on the exam.

Four studies explored addiction medicine training needs in specialist training. All studies described limited time allocated for training in addiction medicine in postgraduate medical specialist training (preventive medicine, family medicine, emergency medicine, osteopathy medicine, internal medicine, obstetric and gynecology, pediatric, psychiatry, and child adolescent psychiatry) [47, 48, 50, 51].

Fleming et al. conducted a national survey in the United States about resident training in addiction medicine [47]. The study involved 1,831 residency directors from 7 specialist training programs (family medicine, psychiatry, internal medicine, pediatrics, obstetric and gynecology, emergency medicine, and osteopathy). They filled in a questionnaire regarding the availability of addiction medicine training, including the name and telephone number

Table 1. Training need and survey

Author	Year	Country	Topic	Methods	Academic level	Conclusion
Fleming et al. [47]	1999	United States	Assessment of availability of addiction medicine training among faculty member teaching residency programs	National survey among faculty directors and faculty members of 7 specialties	Postgraduate	Addiction medicine training is available in most residency programs: 96% of psychiatry programs, 75% of family medicine programs, 55% or less for other residency programs. Less than 10% of the faculty member who teach addiction medicine did clinical works in addiction field and 19% were certified addiction medicine specialists
Kraus et al. [48]	2001	United States	Assessment of the level of training offered to residents in seven medical specialties in the care of addicted incarcerated persons in the United States	Survey among residency directors, including a mailed questionnaire and telephone interview	Postgraduate	Only 14% of the residency programs offered lectures or conferences on the care of incarcerated addicted persons, yet 44% of the programs had residents caring for these patients in a clinical setting
Kahan et al. [49]	2001	Canada	Rating of learning objectives related to AM by faculty members from internal medicine, surgery, emergency medicine, anesthesia (Group 1) and family medicine, psychiatry, pediatrics (Group 2)	Survey among faculty members in five medical schools in Ontario	Undergraduate	AM learning objectives: Group 1: attitudes, epidemiology, screening and assessment, nonmedical interventions, specific populations (woman, elderly, adolescents). Group 2: physician substance abuse problems, withdrawal, and medical complications
Abrams Weintraub et al. [50]	2003	United States	Assessment of availability of AM training in preventive medicine residency	Telephone survey among program directors of preventive medicine residency in the US	Postgraduate	While 78% reported interest in AM training, for 68% it was not a high educational priority. Only 29% felt that residents were well prepared in AM, while 60% felt that residents were prepared in AM research. The most commonly reported barriers to AM training were lack of resident interest and defined competencies (64% each), followed by limited faculty time (59%)
Frost-Pineda et al. [24]	2004	United States	Assessment of knowledge on alcohol dependence related topics, and preparedness to treat patients with alcohol use disorders	Survey by questionnaire and telephone interview among MDs and medical students in state of Florida	Undergraduate and postgraduate	Knowledge on alcohol dependence related topics among MDs and medical students was limited, as well as their willingness to treat these patients
Waldbaum et al. [51]	2005	United States	Assessment of availability of AM training in child and adolescent psychiatry residency programs in the US	Survey by mail to program directors of accredited US CAP residency programs	Postgraduate	Lectures and clinical supervision are the most common methods to teach about AM, and are available in various forms. Specific rotations in substance use disorders are lacking
el-Guebaly et al. [52]	2011	International	Description of the international certification of addiction medicine by the International Society of Addiction Medicine (ISAM).	Historical overview of the development of the international certification, including minimum performance criteria, criteria of eligibility and a psychometric analysis of the examination	Postgraduate	An international certification examination is possible, although the experience so far focuses on Canada and the middle east. The questions show good discriminatory performance; the examination has good validity and reliability
Pinxten et al. [23]	2011	Indonesia	Using systematic training needs assessment (TNA) to develop an AM course in Indonesia	Descriptive study of AM curriculum development and training needs assessment in Indonesia	Postgraduate	The most important skills to be trained in Indonesia are in the domains of diagnosis and starting treatment of patient with SUD, reflecting an early stage of AM development
Strobel et al. [27]	2012	Germany	Assessing availability of undergraduate medical training on AM, and medical students' perceived knowledge on AM compared to other chronic conditions (diabetes and hypertension)	Cross sectional survey among medical students of medical schools in Germany	Undergraduate	Half as many teaching hours were allocated for AM as compared to diabetes or hypertension. Students reported high levels of knowledge of consequences of all three conditions. Students reported to know how to treat diabetes and hypertension, but only 20% reported to know how to treat substance dependence

Table 2. Description of the addiction medicine curricula

Author	Year	Country	Topic	Methods	Academic level	Conclusion
Galanter et al. [53]	2002	United States	Assessment of the development of addiction psychiatry residency in US between 1990 and 2000	Survey among program directors of general psychiatry residency in 1990 and 1999 on resources and activities regarding AM training	Postgraduate	The number of addiction psychiatry training sites increased from 19 to 38, non-accredited addiction psychiatry trainings increased from four to seven. The principal portion of trainees' time was devoted to patient care (56%), with research second (14%), followed by instructional time (13%).
Renner [54, 55]	2004 and 2005	United States	Description of AM training program in psychiatry residency at Boston University	Descriptive overview of the addiction-training program	Postgraduate	The addiction-training program is a competency based training program, regarding knowledge, attitude and professional responsibility, including seminars and clinical rotations.
Lubman et al. [56]	2008	Australia	Description of AM educational activities of the Royal Australian and New Zealand college of psychiatrists	Descriptive historical overview	Postgraduate	Basic trainees are required to have either a 3-month supervised experience in an addiction setting, or 10 addiction cases signed off. In 2003 a one-year curriculum in addiction psychiatry was launched resulting in an addiction psychiatry certificate. There also is ongoing education for addiction psychiatrists.
Iannucci et al. [57]	2009	United States	Description of an addiction psychiatry curriculum into general psychiatry training in the Massachusetts General Hospital/McLean hospital	Review of addiction psychiatry training at the annual faculty retreat of Massachusetts General Hospital/McLean hospital	Postgraduate	The training program includes among others a 1 month full-time inpatient addiction psychiatry rotation in year 1, a substance abuse consultation rotation in year 3 (10 h/week; 2 months) and a substance abuse research elective.
Rigotti et al. [58]	2009	37 countries in Europe, US, Western Pacific, Southeast Asia, Africa	Description of tobacco treatment training programs in 37 countries	Cross-sectional web-based survey	Undergraduate/postgraduate	Tobacco training programs started in 1980s (Europe and US), 1990s (Western pacific and east mediterranean), and after 2000 (Southeast Asia and Africa). Median h of the training is 16 h (1.5->100 h). Teaching methods include lectures (98%), small group discussion (94%), observed practice with clients (70%), one on one teaching (48%) and online training (25%). Most of the training offered certification to graduates (74%) and had end program examination (52%).
De Jong et al. [59]	2011	Netherlands	Description of the development of the dutch master in AM program	Descriptive overview	Postgraduate	The dutch master in AM is a two-year competency-based training program, integrating theoretical courses with clinical practice under supervision, covering seven core competencies (evidence-based medicine, basic psychotherapeutic skills, neurobiology, addiction medicine, psychiatry and public health).
Tontchev et al. [60]	2011	United States	Description of availability of AM training for non psychiatrists in the US	National survey on AM fellowships among (associate) deans of 133 medical schools and 37 independent teaching hospitals in the United States (between 2009-10)	Postgraduate	Of the 40 accredited addiction psychiatry programs, 7 offered AM training to 15 non-psychiatrists. There were 14 non-accredited AM fellowships, with 25 participants.
Haber et al. [61]	2011	Australia	Description of the Australian AM training curriculum	Descriptive historical overview	Postgraduate	The training curriculum comprises 3 years of basic general medical training post internship, followed by 3 years of discipline-specific supervised training. The training includes experience in both ambulatory care and inpatient care; physical as well as mental health. Assessment is continuous and competency based.

Table 3. Basic addiction medicine competence for general physicians

Competences	Topics
Screening, prevention, and brief intervention	Detect risk of alcohol and substance use, abuse, and addiction Interview of alcohol and substance use history Education and communication of the consequences of alcohol and substance use (patient, family, and public) Brief intervention to stop or reduce alcohol and substance use
Assessment and diagnosis	Interview of alcohol and substance use history Physical examination of intoxication and withdrawal symptoms
Management	Management of intoxication and withdrawal symptoms Develop relevant treatment plans (from initial treatment until relapse management) Prescribing drugs (including drugs with abuse potential) Referral
Complications	Assessment, management, and referral of medical, surgical, and psychiatric complications related to SUDs
Special populations	Screening, brief intervention, assessment and diagnosis, management of SUD problems in special populations
Epidemiology and scientific aspects	Epidemiology Neuroscience and genetics

of the responsible faculty member. Those faculties with clear addiction medicine training (769) were interviewed by telephone in a semi-structured interview.

Addiction medicine training was mostly available in residency programs for psychiatry (96%) and family medicine (75%). For other residency training programs, 55% or less had training in addiction medicine. Less than 10% of the faculty members who taught addiction medicine did clinical work in the addiction field and 19% were certified addiction medicine specialists. The faculty members interviewed in this study were identified by faculty directors. There was no further description of the participating institutions, faculty directors and faculty members. Moreover, the number of respondents from each specialism is highly variable (28–270). Therefore, a selection bias cannot be ruled out. There is also no clear description of the questionnaire and telephone interview, making interpretation of the results difficult.

The part of the interviews that focused on incarcerated SUD patients was published in a separate paper by the same group [48]. Only 14% of the residency programs offered lectures or conferences on the care of incarcerated addicted persons, yet 44% of the programs had residents caring for these patients in a clinical setting. Twenty two percent of the interviewed faculty members provided the opportunity for their residents to have clinical experiences in correctional facilities.

Another telephone survey among preventive medicine residency program directors in the United States ($n = 41$), showed a scarcity of addiction topics, especially about alcohol and other drugs [50]. While 78% reported interest in addiction medicine training, for 68% it was not a high educational priority. Only 29% felt that residents were well prepared in addiction medicine. Most of the existing addiction topics focused only on tobacco. Though the study had a 100% response rate, the methodology applied has some limitations. First, the telephone interview was unstructured. Second, no descriptive data were available on the participants (faculty members, preventive medicine programs).

A cross-sectional survey, using self-report questionnaires, was performed among program directors ($n = 79$) of child and adolescent psychiatry training in the United States [51]. This study showed that almost all child and adolescent psychiatry training programs had lectures and clinical supervision as the most common methods to teach about addiction medicine. However, specific rotations in addiction medicine were mostly lacking. The response rate of the study was rather good (70%), but the authors did not report any characteristics of responders and non-responders. This may have induced a bias, in a way that program directors who did not return the survey may have had programs lacking addiction medicine training.

In the four studies summarized earlier, several barriers in developing addiction medicine training in medical education were identified [47, 48, 50, 51] with the most important being limited availability of curricular time, poor coordination of the addiction medicine theme between different departments involved in the medical faculty, lack of addiction treatment facilities that can be used as education sites for clinical experiences and insufficient faculty members interested and qualified in teaching about addiction medicine.

One survey study evaluated the perceived relevance of a list of learning objectives related to addiction medicine among faculty members ($n = 68$) in five medical schools in Ontario, Canada [49]. The set of learning objectives used was developed by the medical educators and addiction medicine specialists from the project Curriculum Renewal and Evaluation of Addiction Training and Education (CREATE) and represents knowledge, skills, and attitudes [49]. The learning objectives considered most important were professional attitudes toward SUD patients, epidemiology of substance use disorders, screening and assessment of patients with substance use disorders, non-medical interventions in substance use disorder patients, specific populations with substance use disorders (woman, elderly, adolescents), physician substance abuse problems, dealing with withdrawal and medical complications of substance use [49]. Since only faculty members of five medical schools in Canada were assessed, the results may not be generalized to medical schools in general. Moreover, the perspective of students and patients was lacking in this study.

One study described the results of a systematic training needs assessment (TNA) in Indonesia [23]. The TNA questionnaire had three professional domains modeled on the National Institute of Drug Abuse (NIDA) training needs assessment tool [23]. The most important skills to be trained in Indonesia identified in this study were in the domains of diagnosis and starting treatment of patient with substance use disorders. The authors suggest that this may reflect an early stage of addiction medicine development, since skills required for long-term management of these patients were rated less important.

Finally, one paper described the process of international examination on addiction medicine [52]. The International Society of Addiction Medicine (ISAM) gave a great impulse for development of addiction medicine curricula worldwide, by the initiative for an international addiction medicine examination. This examination comprises a test of knowledge and clinical judgment, consisting of 200 'culture-neutral' multiple-choice questions

[52]. The results from the first batch of candidates revealed that formulation of international examination standards is possible. However, these results are mainly based on experiences in Canada and the Middle East, reducing generalizability.

Description of Addiction Medicine Curricula

We found nine articles describing national initiatives on the development of addiction medicine curricula. These curricula vary widely in terms of organization, certification and content, and are summarized in table 2.

Two papers describe the development of the addiction medicine curriculum at the University of Boston [54, 55]. These articles present the model for enhanced addiction psychiatry training developed at Boston University Medical Centre. They chose to integrate addiction medicine training with general psychiatry residency. The cornerstones of the addiction medicine curriculum are adequate knowledge, a positive attitude toward SUD patients and their treatment, and professional responsibility [54, 55]. It includes skills training labs, followed by a long-term rotation in an addiction psychiatry unit to acquire clinical competencies, such as motivational interviewing, cognitive behavioral therapy, pharmacotherapy and assessment [54, 55].

A similar four-year psychiatry residency program is offered by the Massachusetts General Hospital [57]. The number of formal addiction psychiatry training sites in United States has increased to about forty in 2011 [53, 60]. Moreover, these training programs offered addiction medicine training to non-psychiatrist in some cases [60].

In Australia, addiction medicine training is offered as a three-year course, after a three-year basic training in internal medicine [61]. In the Netherlands, a two-year national curriculum on addiction medicine has been developed [59]. This training program is unrelated to psychiatric training and is open to all medical doctors.

The formal legislation of addiction medicine is highly variable among countries, ranging from none, to formal expert registrations. Addiction medicine is recognized as a medical specialty in Australia and New Zealand [56, 61]. In the United States, addiction psychiatry has been formally acknowledged as a subspecialty of psychiatry [53]. In the Netherlands, completion of the addiction medicine curriculum results in registration as an addiction medicine expert by the Dutch Society of Medicine [59].

One paper reported a description of training programs on tobacco treatment for medical doctors in 48 countries [58]. Only 37 of the 48 responding countries had training in tobacco treatment. Most of the trainees in

those training programs were physicians and medical students (90). Teaching methods used were lectures (98%), small group discussions (94%), one-on-one teaching (48%) and online training (25%). The median duration of these programs was 16 h. The tobacco treatment training programs were mostly available in the middle and upper income countries. The survey recommended that similar training programs be developed for low-income countries [58]. The authors emphasized that their results may have been biased, because participating country representatives were selected based on previous surveys in this topic and people from the network of the others. Moreover, only 48 of 69 countries surveyed responded in this study.

The papers describing addiction medicine curricula summarized earlier also outline competencies that medical doctors should acquire during (undergraduate) training. Based on all of those studies, the addiction medicine competencies cover the following four domains: screening, prevention and brief interventions of substance use disorders; assessment and diagnosis of substance use disorders; management and treatment of substance use disorders; assessment, management, and referral of medical, surgical, and psychiatric complications related to alcohol and substance use disorders (see table 3 for further details).

Effect of Studies of Training in Addiction Medicine

The eleven studies that investigated the efficacy of addiction medicine training programs generally showed that most courses could increase knowledge and skills related to addiction medicine. Moreover, courses also induced more professional perceptions of, and attitudes toward patients with SUDs. Those papers are summarized in table 4.

Three studies assessed the effect of addiction medicine training at undergraduate level [32, 36, 38]. Christison et al. evaluated the perception and attitude among third-year medical students toward alcohol dependence, major depressive disorder, and severe emphysema using a self-report questionnaire, before and after a psychiatric clerkship rotation (5 weeks psychiatry and 1 week SUDs). They observed that a one-week rotation at an SUDs treatment site led to a more professional perception of SUDs, as indicated by an increase in perceiving SUDs as a treatable condition, that requires medical treatment [36]. Similar changes were observed with regard to major depression, but not emphysema. No difference was found between students who took their psychiatric rotation in the first or second part of their clinical year. It is unclear

whether the observed changes toward SUD patients really reflect a change in clinical behavior of these students toward SUD patients. Moreover, it is unknown how long these effects of clinical rotations endured.

Similarly, Barron et al. observed that participants of a summer school for recently graduated medical students ($n = 245$) had an increased perception that they ($n = 140$) could help patients with SUDs, that they were more self-confident in talking to and treating of patients with SUDs, that SUDs is a disease and that working with patients with SUDs is satisfying, compared to students who did not attend the course ($n = 105$) [38]. The authors emphasized that their results may have been biased, since the summer school SUDs program was elective and students who followed the program might already have had more positive attitudes compared to other students. Moreover, given the cross-sectional design the observed difference between the two groups could not be attributed directly to an effect of the training.

A 4-year prospective cohort study followed medical students from all 4 New Zealand schools of medicine (Auckland, Wellington, Christchurch and Dunedin), during their undergraduate training [32]. Knowledge, attitudes and skills related to addiction medicine were assessed, using a questionnaire adapted from the questionnaire developed by Roche et al. [62]. The measurement was carried out during the second year and was repeated at year four and six. The students showed an increase in their knowledge, skills and competences in addiction medicine throughout their tenure in medical school, but their interest in working with addicted patients decreased over the same period.

Importantly, the response rate decreased during follow-up (98 second-year, 75 fourth-year, and 34% sixth-year). There may be a selection bias, since those with an interest in addiction medicine may be more likely to respond. In addition, self-report measures on skills and attitudes may tend to over-evaluate personal skills [32]. As a result, these findings may be an overestimation of competencies and interest in addiction medicine among students. Finally, the paper lacks a clear description of addiction medicine topics and training methods covered in the curriculum, as well as a description of the amount of hours spent on addiction medicine training.

Four studies investigated the effects of addiction medicine programs for residents. One study assessed the effect of addiction medicine training in the internal medicine residency [40] and one in psychiatry [41], one study assessed addiction medicine training for chief residents from various residency training programs [37], and

Table 4. Effect of studies of training in addiction medicine

Author	Year	Country	Academic level	Topic	Methods	Intervention	Outcome measure	Conclusion
Christison et al. [36]	2003	United States	Undergraduate	To test the effect of a rotation in addiction treatment during psychiatry clerkship on attitudes toward SUD patients	Pre-post clerkship examination among 3rd year medical students (n = 153), using the medical condition regarding scale	1 week of a 6-week psychiatry clerkship on an addiction treatment site	Attitudes, measured by medical condition regard scale	Mean regard scores increased significantly for patients with alcoholism and for patients with major depression but did not change for patients with emphysema (control condition)
Cape et al. [32]	2006	New Zealand	Undergraduate	Assessment of the development of knowledge, skills, and attitudes related to SUDs in medical students in New Zealand	A longitudinal, prospective, cohort study of medical students (n = 637)	Lectures at undergraduate level (4 medical schools) and a 2-week block of addiction medicine at clinical level (1 medical school)	Knowledge assessed by 43 multiple choice questions; skills and attitude assessed by a 25-item questionnaire	Knowledge on AM increased during medical school, whereas the perception that students could treat patients with SUDs decreased (21% in the 2nd year vs. 51% in the 6th year)
Parish et al. [45]	2006	United States	Postgraduate	To evaluate AM competencies using a clinical examination procedure among postgraduates	Internal and family medicine residents (131) completed five exams, during 2 years of postgraduate rotations	Administration of an Objective Structured Clinical Exam (OSCE) that includes different SUDs using immediate feedback	Examination results and perceived educational value during an interview	Perceived educational value of the OSCE was high. Skills for assessing and managing SUD patients increased over time
Strang et al. [44]	2007	United Kingdom	Postgraduate	To evaluate the effect of a 6-month training program in AM for general practitioners	Randomized controlled trial comparing a training and waiting list group	A 6-month, part time, AM training	Knowledge: assessed by a list of 31 statements of fact about clinical care for SUD patients. Attitude measured by drug and drug problems perceptions questionnaire (DDPPQ), drug problems occupationally perceived questionnaire (DPOPQ), opiate prescribing confidence questionnaire	The intervention group showed greater improvement in knowledge, attitudes, and prescribing confidence
Ballon et al. [41]	2008	Canada	Postgraduate	To investigate the effect of training reflection techniques in addiction psychiatry rotation on self-awareness of attitudes, values, and beliefs related to working with SUD patients	Qualitative analysis of 28 reflection papers of addiction psychiatry residents to determine key factors and constructs related to the development of attitudes and professionalism	Writing reflection papers and keeping reflection diaries during a 1-month rotation in addiction psychiatry (during the 1st year of psychiatry residency training program)	Qualitative assessment of reflection papers and reflection diaries	Reflection techniques were endorsed as extremely valuable by students, especially in the development of professional attitudes to engage with the care for patients with SUDs

Table 4. (continued)

Author	Year	Country	Academic level	Topic	Methods	Intervention	Outcome measure	Conclusion
Alford et al. [37]	2008	United States	Postgraduate	Evaluation of the effect of the chief resident immersion training (CRIT) program in addiction medicine on knowledge, skills, and self confidence in addiction medicine	Measurement of knowledge, attitudes and skills related to addiction medicine before participation in a 4-day CRIT program (2003–2005) for chief residents (n = 64) in internal medicine, family medicine, and emergency medicine, compared to residents without the training (n = 22)	4 days chief residents immersion training in addiction medicine consisting of a keynote on scientific developments on addiction, case-based presentations, small group discussions, journal clubs, role-plays, visit to AA meetings, small group conversations with individuals in recovery	Knowledge, skills, confidence, specific clinical and teaching practices assessed by self-assessment questionnaires	The intervention group showed significant improvement ($p < 0.05$) in self-reported knowledge of SUDs and confidence in diagnosing and using screening tools, compared to the control group at 6 months follow-up. The intervention group improved significantly on self-reported knowledge on SUD neurobiology, screening, readiness to change assessment, referral options, pharmacotherapy and relapse ($p < 0.001$), self-confidence in diagnosing SUDs, using screening tools, counseling SUD patients and referring SUD patients to treatment ($p < 0.05$), and overall CRIT knowledge exam scores ($p < 0.001$)
Allan [42]	2011	Australia	Postgraduate	An evaluation of placement in a SUD treatment unit, for general practice registrars	Interviews with general practitioner registrars (n = 5) after placement in SUD treatment unit	6 months placement in a non-governmental treatment center for SUD treatment	Subjective evaluation of the training experience: what they wanted to learn, what they learned	Registrars evaluated the placement in a SUD treatment center as positive with positive influence on their daily practice as a general practitioner
Barron et al. [38]	2012	United States	Undergraduate	Evaluation of a 1-week summer school AM program for recently graduated medical students	Comparison of beliefs, attitudes, and practices related to AM between physicians who participated in the summer school (n = 140) and physicians matched for year of graduation who did not participate (n = 105)	1 week summer school program on addiction medicine for recently graduated medical students	Beliefs, attitudes, and practices related to SUDs, as assessed by self-report questionnaires	The participating physicians were more likely to believe that they could help SUD patients, find working with addicted patients satisfying, be confident in talking about substance use with patients, and be confident in knowing available resources for addicted patients, and believe that addiction is a disease

Table 4. (continued)

Author	Year	Country	Academic level	Topic	Methods	Intervention	Outcome measure	Conclusion
Herie et al. [39]	2012	Canada	Postgraduate	Evaluate the effect of a smoking cessation training (Training Enhancement in Applied Cessation Counselling and Health: TEACH)	Pre and post training evaluation among professionals from 15 disciplines (n = 741) participating in TEACH assessing the extent to which the learning objectives were achieved and implemented in clinical practice	A three-day classroom based course on evidence based smoking cessation treatments	Intention to use the clinical tools and approach in clinical practice, assessed by a 7-item questionnaire (1 week after the course). Dissemination of knowledge and training materials to colleagues; assessed by online survey (3 and 6 months post training)	6 months post training: 55% professionals were implementing the intervention. 91% engaged in knowledge transfer activities
Srivastava et al. [43]	2012	Canada	Postgraduate	Evaluation of the feasibility and effectiveness of an opioid prescribing course for family physicians	In a pre-post design knowledge, attitude, and perceptions related to opioid prescribing were assessed among general and family physicians (n = 18) participating in a 1-year course on safe opioid prescribing	1 year study of a series of educational interventions on safe opioid prescribing	Knowledge, concerns, and practices about opioid prescribing; evaluated by a questionnaire (baseline and 1 year follow-up) and telephone interview (6 months follow-up)	13 out of 18 (65%) physicians completed and returned the follow-up survey at 1 year. After training physicians were more comfortable and confident in prescribing opioids (p = 0.028), were less concerned about getting patients with chronic pain addicted to opioids (p = 0.028) and reported less difficulties with dosing (p = 0.041). Participants increased using treatment agreements and urine drugs screening. They were more aware of the addictive potential of oxycodone and had started using lower potency opioids for chronic pain
Brown et al. [40]	2013	United States	Undergraduate and Postgraduate	To study the effect of a 4-week addiction medicine training for internal medicine residents and medical students	Evaluation of knowledge on SUDs among internal medicine residents and medical students who participated in 4-week structured addiction medicine training pre and post training	4 weeks of lecture series (2 h/week) on addiction medicine topics, including a general introduction, opioids and chronic pain, benzodiazepines and illicit stimulants and alcohol	Knowledge, as assessed by an online survey	There was a significant improvement of overall knowledge on addiction medicine and SUDs after the training

another study was about the effect of a Substance Abuse Objective Structured Clinical Examination (OSCE) for residents [45]. These studies generally show that training residents in addiction medicine can have positive effects on knowledge, skills, and attitudes related to SUDs.

Brown et al. found that a four-week structured addiction medicine curriculum significantly increased knowledge on addiction medicine among internal medicine residents ($n = 20$) [40]. Addiction medicine knowledge was assessed using a 20-item questionnaire in a repeated measures design. Psychometric properties of this instrument (reliability and validity) are unknown. This study was also underpowered with only 20 of 36 participants completing all questionnaires and lacked a control group. Moreover, besides residents, medical students also participated in the course. No separate analyses were performed for these groups. Therefore, it is not possible to draw firm conclusions about the efficacy of this training program for internal medicine residents.

Ballon et al. reported on the effectiveness of reflection methods in addiction psychiatry training in order to develop professional attitudes toward SUD patients [41]. In a qualitative analysis of reflection papers of the residents at the end of a 1-month addiction psychiatry rotation ($n = 28$), they observed that the residents endorsed reflection techniques as extremely valuable to develop professional attitudes and help to effectively engage with addicted patients [41]. The qualitative analysis fits well with the focus on reflection skills and attitudes. However, it remains to be studied whether these observations relate to more professional attitudes to SUD patients in real life and contribute to improved care for these patients.

Alford et al. reported on an addiction medicine training program for chief residents. The program focused on assessment and management of SUDs. The program was effective in improving clinical and teaching practices in chief residents ($n = 64$) from various residency training programs (internal medicine, family medicine, emergency medicine) as assessed by self-assessment questionnaires [37]. However, the study lacked statistical power, since the sample size, especially in the control group not receiving the integrated training program ($n = 22$), was rather small.

Parish et al. studied the performance of third-year residents with a prior training in addiction medicine ($n = 131$), from internal medicine ($n = 107$) and family medicine ($n = 24$) in SUDs OSCE [45]. The OSCE consisted of 5 stations with addiction cases (alcohol dependence, methadone maintenance treatment, cocaine dependence, poly drug use). The case scenarios were developed by ex-

perts in primary care and addiction medicine, based on substance use competencies recommended for primary care physicians [63]. The evaluators were faculty members from internal medicine, family medicine, and psychiatry. They also gave direct feedback during the examination. In all 5 stations, all the participants performed better in general communication rather than assessment or management. Participants who had completed some training in addiction medicine ($n = 64$) and who had attended the 12-steps meeting ($n = 83$) performed better compared to those without any experience with the care for SUD patients. Moreover, participants improved their performance during the OSCE over time. The authors emphasized the moderate reliability of the clinical ratings, given the differences in styles of the raters, and the wide range of skills assessed at the different stations. On the other hand, these clinical assessments may be more suitable to assess clinical skills and competencies than written assessments, which mainly test knowledge.

Four studies assessed the effect of addiction medicine training for general practitioners. Allan et al. reported on the effect of a skills training program for general practitioners registrars [42]. The participants were offered the opportunity for placement in a community drug and alcohol treatment unit, comprising a detoxification unit and rehabilitation program. At the evaluation, the participating registrars ($n = 5$) perceived the training program as useful. However, a more systematic assessment of an effect of the training program was lacking and the sample size was rather small.

Strang et al. evaluated the effect of a 6-month training course in addiction medicine on attitudes toward substance use disorder patients among general practitioners ($n = 112$) [44]. General practitioners interested in the training were randomized into a training group ($n = 63$) and a waiting list group ($n = 49$). The training consisted of regional, tutor-led, conferences in small groups. Knowledge was assessed two times (first and final day of training) using 31 true/false statements. Attitudes were evaluated using the Drug and Drug Problems Perceptions Questionnaire. Self confidence in prescribing opiates (methadone, buprenorphine, lofexidine) was also assessed by questionnaires. The study showed that the training group felt less constraints in treating SUDs as compared to the waiting list group [44].

One article described the effect of a smoking cessation program for health care workers (Training Enhancement in Applied Cessation Counseling and Health: TEACH) [39]. The program consisted of online and classroom-based courses and addressed advocacy, individual cogni-

tive behavioral treatment, group treatment, motivational interviewing, pharmacotherapy, and harm-reduction strategies. Participants ($n = 741$) were health care professionals (including dentists, dietician, general practitioners, family physicians, occupational therapists, pharmacists, physiotherapists, psychologists, nurses, respiratory therapists, social workers, specialist physicians). After training, over 50% of the participants who responded to the 6 months follow-up survey ($n = 455$) reported they implemented the knowledge and skills they got from the course in their clinical work. More than 90% of the participants reported that they shared their knowledge with colleagues, students, friends or family [39]. The study lacked a randomized controlled design and relied fully on self-report. Moreover, the participants of this study were from various professional backgrounds. Therefore, these results may be biased and should be interpreted with caution.

Srivastava et al. reported on the effectiveness of a training program on improving skills and practices of prescribing opioids for general or family physicians. The training program was a one-year training program, consisting of workshops, lectures and case discussions, accompanied by video case conferences and clinical support. They assessed the knowledge, concerns, and practices regarding opioid prescribing using self-assessment questionnaires (confidence, comfort, satisfaction, and expectation of a positive outcome) and a telephone interview [43]. The questionnaire was delivered 2 times (before and after the training) and the telephone interview at 6 months. They found that after a 1-year course on opioid prescribing, participants ($n = 13$) were less concerned that patients would develop opioid dependent, were more confident in prescribing opioids, and were more aware of the addictive potential of oxycodone, than at baseline [43]. From the telephone interview, the participants reported a change in their clinical practice (increased use of treatment agreements and urine drug screening). Similar to the other studies, the design of this study was not randomized or controlled, the study relied on self-report and was largely underpowered.

Taken together, these studies on the effect of addiction medicine training showed that training in addiction medicine can be effective in improving knowledge, attitudes and skills related to addiction medicine at various academic levels (undergraduate, postgraduate resident and general practitioner level). Though the results of these studies are encouraging, most of these studies are hampered by a lack of methodological rigor. For example, most studies did not have randomized controlled designs

and lacked long-term assessments and assessment of real clinical behavior and competencies. Moreover, we did not encounter any studies on the effect of addiction medicine training at the specialist level.

Discussion

The current review summarizes scientific publications on the development of addiction medicine training over the past fifteen years. There has been a gradual increase in the number of published papers on addiction medicine training over the past fifteen years. Of special interest is the special issue of Substance Abuse in 2011. This may suggest an increased international interest and activity in the development of addiction medicine training and increased availability of addiction medicine curricula.

Indeed, the need for development of addiction medicine training programs is internationally recognized (see table 1). Given the high prevalence of substance use disorders and its commonly co-occurring physical and psychiatric disorders and complications, all medical doctors should have basic competences in addiction medicine [18, 19, 58, 60]. The nine papers that describe the training needs for training in addiction medicine cover a broad range of survey studies from the undergraduate to the post-graduate level. These papers indicate that there is generally a lack of addiction medicine teaching at undergraduate level and addiction medicine teaching hours are half of that of other chronic disorders like hypertension or diabetes [27]. Moreover, most students that graduate indicate that they do not know how to treat addicted patients, whereas they report that they do for these other chronic conditions. At the postgraduate level, addiction medicine training is generally available within psychiatry and family medicine [47]. However, in almost half of other postgraduate medical training curricula, no time is allocated to topics related to addiction medicine [47]. This is in line with a number of expert opinion statements published over the past couple of years, arguing that there is a lack of high standard addiction medicine training programs at various academic levels of medical education [64–71].

Several studies describe the development of such training programs at various levels (table 2). The nine articles describing national initiatives on the development of addiction medicine curricula indicate that these curricula vary widely in terms of organization, certification and content (see also table 2). The learning objectives of undergraduate addiction medicine training are recom-

mended to include: (1) to improve knowledge of addiction medicine, (2) to induce a positive attitude toward SUDs and SUD patients, and (3) to develop a sense of responsibility to treat SUD patients [54, 55]. Addiction medicine curricula should therefore have a competency-based approach [18, 19, 23, 50, 54, 55, 59, 64, 65, 67, 68]. The addiction medicine competencies that are outlined in these papers commonly cover the following four domains: screening, prevention and brief interventions of substance use disorders; assessment and diagnosis of substance use disorders; management and treatment of substance use disorders (e.g. emergency situations including intoxication and withdrawal, continuing treatment including relapse prevention and rehabilitation); assessment, management, and referral of medical, surgical, and psychiatric complications related to alcohol and substance use disorders, the care for special populations and neuroscience and genetics [54, 55, 69, 71, 72] (see also table 3).

The topics outlined here are indeed in line with a UK-initiative on undergraduate training in addiction medicine [73–75]. Within this project, a consensus guideline was first developed on how to integrate addiction medicine training into the undergraduate curriculum. Second, an implementation guideline was developed. By doing so, basic addiction medicine training has been established in all medical schools in the United Kingdom [74, 75].

Previous work by Miller et al. [18] and Polydorou et al. [19] identified several barriers in the development of addiction medicine training curricula in medical education: a lack of uniformity between universities and countries, a lack of continuous training from undergraduate to postgraduate levels and finally several barriers to implementation, once a curriculum is designed (e.g. competition for time slots, lack of well-trained trainers, lack of role models). Based on these barriers, they recommended the development of a guideline for establishing addiction medicine curricula for different academic levels. Miller and Polydorou also mention the need of physician role models in addiction medicine.

The publications on initiatives on the development of addiction medicine curricula included in this review mostly come from Western countries (predominantly from the United States) where addiction medicine training is commonly embedded within psychiatric training programs at the undergraduate level and at the postgraduate level during psychiatric rotations and psychiatric residency [18, 19, 36, 41, 47, 48, 51, 54, 55, 57, 60]. For example, undergraduate medical students in the United States should follow 1 week rotation in addiction treat-

ment facility during their psychiatric clerkship [36]. In Canada, there is a one-month required rotation in addiction for the first-year postgraduate psychiatric residents [41]. Surveys in the United States also found that addiction medicine training is usually provided by the department of psychiatry [47, 48]. In several countries, such as the United States and Australia, addiction psychiatry is the medical specialty dedicated to the care for substance use disorder patients [53, 56]. However, in other countries, addiction medicine is a specialty by itself and in several countries care for addicted patients is carried out by general practitioners or other medical specialists. Whether a country needs addiction medicine as a specialty will likely depend on the local situation and organization of the health system.

A more universal approach to the legislation of addiction medicine specialists or addiction psychiatrists could further improvise the functions of this field and boost career perspectives for doctors specializing in addiction medicine and contribute to higher standards of care for addicted patients. International invitational conferences, such as the European Conference on Addiction Medicine Training organized by the Radboud University in September 2014, are needed in order to achieve a more universal approach internationally.

Several experts in the field of addiction medicine have suggested how to move the field forward. First, addiction medicine should get the same priority as other chronic diseases do [64, 70, 71]. As such, it must be integrated into the core of medical curricula [64, 65, 67, 68, 70, 71]. Second, faculty members should enhance their competencies in addiction medicine both in clinical teaching and practice [64, 66, 70]. Third, it is suggested that academic medical centers should develop specialized addiction medicine divisions or programs [67–70]. This will increase attractiveness and career perspectives for young professionals. Moreover, it will contribute to professionalization of the field. Fourth, collaboration between addiction specialist and other medical specialist is crucial to further the field of addiction medicine [64, 67–69]. Finally, special attention should be given to substance abuse screening and management at the level of primary care [65, 66, 68, 70, 71].

Several studies included in this review show that addiction medicine training programs at all academic levels (undergraduate, postgraduate, specialist) can be effective in increasing knowledge about, improving professional attitudes toward and clinical care for SUD patients (table 4). Moreover, addiction medicine training may also increase physician's interest to become involved in the

field of addiction medicine and work with these patients [36, 38]. Though the results of these studies are encouraging, most of these studies did not have a randomized controlled design and lacked long-term assessments and assessment of real clinical behavior and competencies. Moreover, we did not encounter any studies on the effect of addiction medicine training at specialist level. Therefore, well-designed effect studies are needed in order to clarify the most effective way of training addiction medicine at various academic levels, in order to efficiently improve knowledge, skills and attitudes of medical doctors at all academic levels. Such studies could provide input to develop international guidelines for the development of more uniform addiction medicine curricula.

Several instruments have been developed to customize addiction medicine curricula to local situations. For example, the TNA (as developed by the NIDA) can be used to prioritize training needs, in order to tailor the curriculum to local situations [23]. Similarly, the assessment of perceptions on addiction can provide input for reflection and development of professional attitudes toward addicted patients [36, 76, 77].

The current review should be seen in the light of its limitations. It is important to note that not all international initiatives on the development of addiction medicine curricula are published in the international scientific literature. Most of the published studies included here, come from Western countries, mainly the United States,

Canada, Australia and some European countries (the United Kingdom, Germany, and Netherlands). As such, the current review should not be considered a complete overview of all international curricula on addiction medicine.

To summarize, the current review provides a summary of publications on addiction medicine training programs established over the past fifteen years. The topics and competencies, as well as the evidence for the effect of such training programs are summarized and can be used to further improve existing initiatives on addiction medicine training and help establish new addiction medicine training programs. It is important that training in addiction medicine will get the same priority as other chronic diseases in medical curricula. Faculty development and a clear policy concerning (international) certification of addiction medicine curricula are essential to further improve addiction medicine training and improve the care for addicted patients.

In line with the limited number of (well-designed) studies on the development addiction medicine training, it is important that new and existing initiatives on developing addiction medicine training are properly monitored and results are published. This would further the field and help to establish addiction medicine training worldwide. One of the challenging questions remains as to how to adapt addiction medicine curricula to different settings by taking into account the local context and training needs.

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