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Impact of an educational intervention on risks associated with drug injection, and on psychosocial factors (PSF) involved in initiating and maintaining new health behaviors over time

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HIGHLIGHTS

- Educational sessions reduce risk behaviors among injection drug users.
- They also increase drug users' sense of competence.
- They maintain drug users' perception of how supportive of autonomy the social environment is.
- Educational sessions do not increase drug users' sense of autonomy.
- Specific drug user profiles limit the positive impact of educational sessions.

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ABSTRACT

Background/aims: In line with Self-determination Theory, individuals who feel they are able to adopt new behaviors autonomously, and who perceive their social environment as supportive of their autonomy and confident in their competencies, are more likely to engage in sustainable behavioral change over time. We aimed to study the impact of an educational intervention, which has already shown its effectiveness in reducing transmission-risk behaviors and injection-related complications among drug users (Roux et al., 2016), on three psychosocial factors (PSF) involved in initiating and maintaining new health behaviors over time, as follows: A) self-regulation of behaviors (autonomous vs. controlled regulation); B) perceived competence in adopting new behaviors (a feeling of being able or unable to adopt new behaviors) and C) perceived autonomy support (social environment perceived by drug users as supportive of autonomy vs. controlling).

Methods: This non-random clustered intervention study was conducted in 9 intervention groups (programs offering the intervention) and 8 control groups (programs not offering it). Each participant was followed up through a phone interview at enrolment, at 6 months and 12 months. Of the 271 participants, 113 received at least one educational session in the first six months. We used the "Health-Care Self-Determination Theory Questionnaire" to assess the impact of this intervention on the development of self-regulation, perceived competence and perceived autonomy support.

Results: Participants exposed to the intervention at least once were associated with a higher level of perceived competence and perceived autonomy support at M12. However, the intervention did not impact self-regulation (either autonomous or controlled). In addition, the study revealed that other factors, such as gender, age, drug use patterns and participants' healthcare pathways, also have an impact on these PSF.

Conclusions: This educational intervention significantly increases patients' perceived competence but has no impact on the factors specifically involved in maintaining new behaviors over time. This study also highlights the

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existence of user profiles whose socio-demographic characteristics, use patterns and care pathways can influence these FPS involved in motivation to change and maintain new health behaviors over time.

1. Introduction

The effectiveness of Harm Reduction (HR) services in France (such as needle syringe programs (NSP)) helped reduce HIV prevalence in the population of people who inject drugs (PWID) from 40% in 1988 to 11% in 2011 (Emmanuelli & Desenclos, 2005; Jauffret-Roustide et al., 2013). Nonetheless, the hepatitis C virus (HCV) epidemic remains an important public health issue among PWID, with a current prevalence of 64% (Blomé et al., 2011; Somaini et al., 2000). This reflects the persistence of risky injecting behaviors. Certain related practices, in particular the sharing of needles, syringes (Alter, 2007) and other paraphernalia (e.g., filter, swab, water, cup) (Palmateer et al., 2014), are recognized as the main cause for HCV contamination. As well as HIV and HCV transmission, other complications related to drug injection have been widely reported, including local cutaneous complications (e.g., bruises, abscesses, oedemas, burns, necrosis) and infection (e.g., venous disease) (Lloyd-Smith et al., 2010; Pieper, Kirsner, Templin, & Birk, 2007). These phenomena underline the importance of understanding the impact of HR services on users, and more specifically on the factors involved in changing and maintaining behaviors.

Research in the field of social psychology has identified processes by which an individual acquires the motivation to initiate and maintain new health behaviors over time. Self-determination Theory (SDT), developed by Deci and Ryan (1985), emphasizes the motivational difference at the origin of behaviors, by distinguishing intrinsically motivated behaviors (which refer to doing something because it is intrinsically interesting or pleasant) to extrinsically motivated behaviors (which refer to doing something to obtain a reward or to avoid punishment) (Ryan & Deci, 2000a). Intrinsic motivation refers to autonomous behavioral regulation. It is the most self-determined form of motivation and has always been associated with sustained behavioral changes and positive health care outcomes (Williams, McGregor, Zeldman, Freedman, & Deci, 2004). On the other hand, extrinsic motivation, which refers to controlled behavioral regulation, has been associated with non-adherence to treatment, negative health outcomes and poor well-being (Williams, Gagné, Ryan, & Deci, 2002 cited in Levesque et al., 2007).

In the context of behavior change research, SDT predicts that the development of a sense of autonomy and competence is essential to the processes of internalizing and integrating new behaviors, through which individuals come to self-regulate. Autonomy refers to the desire to be the regulator of one's actions and is associated with voluntary behavior. Competence describes the feeling of being able to achieve a desired outcome. Finally, SDT points out that a social environment conducive to the development of a sense of autonomy and competence is likely to improve compliance and health outcomes (Ryan, Patrick, Deci, & Williams, 2008). Individuals are more likely to regulate behaviors by themselves (autonomous regulation), and thus engage in sustainable behavioral change, if they perceive their social environments as supportive of their autonomy and their sense of competence, especially in contexts where health professionals are able to promote positive health behaviors (Williams et al., 2004). Therefore, according to a specific model based on SDT, 1) self-regulation of behaviors (autonomous vs. controlled), 2) perceived competence in adopting a new behavior (a feeling of being able or unable to adopt new practices), and 3) perceived autonomy support (social environment perceived as supporting or controlled) are all psychosocial factors (PSF) determining the initiation and maintenance over time of new health behaviors. SDT has been used to improve a variety of health behaviors, including tobacco abstinence (Williams et al., 2011), physical activity (Silva et al., 2010), and adherence to medication (Williams et al., 2009). However, studies evaluating the use of SDT with interventions targeting the field of addiction are much less common (Smith, 2011).

Our present study is based on the community-based AERLI (Accompagnement et Education aux Risques Liés à l'Injection) trial in France, which implemented a training and education based intervention shown to be effective in reducing the risk of transmission of HIV and HCV as well as local injection-related complications (Roux et al., 2016). The results of our present study highlight that the proportion of participants with at least one unsafe HIV–HCV practice in the intervention group of AERLI decreased significantly, from 44% at M0 to 25% at M6. A significant reduction in unsafe HIV–HCV practices at M6 was seen [coefficient, 95% confidence interval (CI) = −0.73 (−1.47 to 0.01)] in the intervention group compared with the control group of the trial.

Using the concepts of SDT, we aimed to study the impact of this educational intervention on the psychosocial factors (PSF) involved in initiating and maintaining new health behaviors over time. More specifically, we aimed to evaluate the impact of this alternative and innovative community-based face-to-face intervention which provided training and education about injection, on self-regulation, perceived competence and perceived autonomy support.

2. Methods

2.1. Study design

AERLI was a community-based multi-site intervention study designed in collaboration with two community-based organizations, AIDES and Médecins du Monde (MdM), with the INSERM UMR 912 SESSTIM-ORS PACA research laboratory. The study design is detailed in a previous publication (Roux et al., 2016). Briefly, of the 271 study participants, 144 were recruited in eight sites implementing the intervention (intervention group) and 127 in nine non-intervention sites (control group). Random assignment of HR services to intervention and control groups was not conducted because it was not possible to implement the intervention in all HR services, as a dedicated space and trained workers were necessary. A statistical model, adapted for longitudinal studies, was used in the analysis to take non-random assignment bias into account and to examine whether missing data were missing at random or not. AERLI was offered to participants in the intervention group who spontaneously asked for help or information related to injection. Eligibility criteria were as follows: over 18 years of age, having injected drugs at least once during the previous week, willing to be contacted for a telephone interview and able to provide written, informed consent. All participants were followed up for 12 months and filled in a questionnaire at baseline, 6 months, and 12 months.

The main aim of our present study was to investigate the impact of the AERLI training and education based intervention on PWID by examining self-regulation, perceived competence and perceived autonomy support.

The study received the approval of the National Scientific Research Ethics Committee in Paris (CEEI/IRB).

2.2. Description of the intervention

The intervention consisted in providing training and education to voluntary participants about how to reduce HIV and HCV transmission risk, in terms of drug injecting practices and other injection-related

complications. It was organized as a series (or at least one) of participant-centered face-to-face educational sessions by trained NGO staff or volunteers, which took place in a dedicated room in each intervention group unit. Each session included the following: direct observation of participants' self-injecting the psychoactive product they habitually used; identification of injection-related risks and explanation of safer injecting practices; a discussion and Q&A session between the participant and the educator about the participant's injection practices. All the participants were followed for one year. Those in the intervention group had to receive at least one educational session during the first 6 months. Participants enrolled in the control group were followed by their usual service (in accordance with the latter's care guidelines).

2.3. Data collection

To limit desirability bias, data were collected using computer-assisted telephone interviews (CATI) conducted by a trained, external, non-judgmental interviewer not involved in the educational sessions. These interviews were scheduled at inclusion (M0), 6 months (M6) and 12 months (M12) after study enrollment. Interviewers collected socio-demographic data (gender, age, education level, living in a couple or not, employment status, housing situation), drug use (age at first drug injection, drug use in the previous month and alcohol use using the short version of the Alcohol Use Disorders Identification Test AUDIT). Behavioral data related to the risk of HIV and HCV transmission during the previous month were collected using the validated Blood-Borne Virus Transmission Risk Assessment Questionnaire – Short Version (BBV-TRAQ-SV) (Fry & Lintzeris, 2003). The variable 'Unsafe HIV HCV transmission practices' was defined as reporting at least one risky practice during the previous 4 weeks. Risky practices were defined as follows: sharing needles or syringes, reusing needles or syringes, sharing other drug-injecting paraphernalia (e.g., filter, swab, water,

Table 1
Baseline characteristics (n (%) or median [IQR]), ANRS-AERLI study (n = 240).

	Control group (n = 127)	Intervention group (n = 113)	p-value	Total (n = 240)
Gender				
Male	99 (78)	88 (78)		187 (78)
Female	28 (22)	25 (22)	0.99	53 (22)
Age – years§	31 [26–37]	30 [25–37]	0.39	30 [26–37]
Education				
< Secondary Education Certificate	103 (82)	76 (68)		179 (75)
≥Secondary Education Certificate	23 (18)	36 (32)	0.01	59 (25)
Living in a couple				
No	97 (77)	80 (71)		177 (74)
Yes	29 (23)	32 (29)	0.33	61 (26)
Employment (paid activity)				
No	81 (64)	82 (73)		163 (68)
Yes	46 (36)	31 (27)	0.15	77 (32)
Precarious housing				
No	110 (87)	81 (72)		191 (80)
Yes	17 (13)	32 (28)	0.004	49 (20)
Age at first drug injection§	19 [17–23]	19 [17–23]	0.73	19 [17–23]
Harmful alcohol consumption ǂ				
No	58 (46)	49 (44)		107 (45)
Yes	69 (54)	63 (56)	0.77	132 (55)
Heroin use*				
No	95 (75)	67 (59)		162 (67)
Yes	32 (25)	46 (41)	0.01	78 (33)
Cocaine/crack use*				
No	77 (61)	58 (51)		135 (56)
Yes	50 (39)	55 (49)	0.15	105 (44)
Morphine sulfate use*				
No	91 (72)	53 (47)		144 (60)
Yes	36 (28)	60 (53)	< 0.001	96 (40)
Buprenorphine use*				
No	60 (47)	83 (73)		143 (60)
Yes	67 (53)	30 (27)	< 0.001	97 (40)
Frequent daily injection				
No	69 (54)	52 (46)		121 (50)
Yes	58 (46)	61 (54)	0.20	119 (50)
HCV screening				
No	19 (15)	29 (26)		48 (20)
Yes	108 (85)	84 (74)	0.04	192 (80)
Unsafe HIV-HCV transmission practices[1]				
No	92 (73)	63 (56)		155 (65)
Yes	34 (27)	49 (44)	0.01	83 (35)
Complications at the injection site[2]				
No	56 (44)	38 (34)		94 (39)
Yes	71 (56)	75 (66)	0.10	146 (61)
Self-reported HCV seropositivity	29 (23)	37 (33)		56 (28)
Perceived Competences Scale	2.7 [2 0.0–3.3]	2.3 [1.7–3.7]	0.136	2.7 [1.7–3.3]
Autonomous regulation	2.7 [2 0.0–3.0]	3.0 [2.0–3.3]	0.099	2.7 [2.0–3.3]
Controlled regulation	2.6 [1.8–3.2]	2.6 [1.8–3.2]	0.653	2.6 [1.8–3.2]
Self-regulation	−0.1 [−0.8–0.6]	0.1 [−0.5–0.9]	0.075	0.0 [−0.7–0.7]
Health-care climate	3.3 [3.0–3.8]	3.3 [3.0–3.8]	0.837	3.3 [3.0–3.8]

§ in years; ǂ AUDIT-C ≥ 3 for women and ≥4 for men; * during the previous 4 weeks.
[1] At least 1 unsafe HIV-HCV transmission practice during the previous month;
[2] At least 1 complication at the injection site during the previous month.

cup), rubbing the injection site, and helping someone else to inject/getting help from someone else to inject.

To assess the impact of the intervention on self-regulation, we used an adapted version of the Treatment Self-Regulation Questionnaire (TSRQ) introduced by Ryan and Connell (1989) that measures the degree to which a person's motivation to adopt a particular behavior or set of behaviors is relatively intrinsic or extrinsic. This scale has 8 items: 4 items assess intrinsic motivation, which refers to autonomous regulation of behaviors, and 4 items assess extrinsic motivation, which refers to controlled regulation of behaviors. Accordingly, we created two subscales – intrinsic and extrinsic - and associated subscores, by averaging the 4 items that make up each. An overall 'self-regulation score' was obtained by subtracting the average of the scores on the extrinsic motivation subscale from the average of the scores on the intrinsic motivation subscale. A positive score indicates overall autonomous regulation of behaviors, while a negative score indicates overall controlled regulation of behaviors. A sample item for controlled regulation is "People would be angry with me if I didn't inject myself safely", and a sample item for autonomous regulation is "I would feel bad about myself if I didn't inject myself correctly".

To assess the impact of the intervention on perceived competence, we used the Perceived Competence Scale (PCS) (Williams, Freedman, & Deci, 1998). The PCS includes 3 items, which we modified and adapted for injection practices (Williams et al., 1998; Williams & Deci, 1996). These scales assess the degree to which participants feel confident about being able to initiate (or maintain) a change toward a healthy behavior. A 'perceived competence score' was obtained by averaging the scores of the 3 items that make up the scale. The higher the score, the higher the perceived self-competence. A sample item from the scale is "I feel confident in my ability to inject myself safely".

To assess the impact of the intervention on perceived autonomy support, we used a modified version of the Health Care Climate Questionnaire (HCCQ) (Williams, Grow, Freedman, Ryan, & Deci, 1996; Williams, McGregor, King, Nelson, & Glasgow, 2005). This 6-item questionnaire measures patients' perceptions of how supportive of autonomy (versus controlling) NGO volunteers and staff members are. The 'health care climate score' is obtained by averaging the 6 items that make up the scale. The higher the average score, the higher the level of perceived autonomy support. A sample item is "CAARUD workers encourage me to ask questions". Items in both the PCS and the modified HCCQ used a typical five-level Likert response scale (from 0 "not at all" to 4 "completely agree").

2.4. Statistical analysis

We excluded the 31 participants in the intervention group who did not receive an educational session during the study, which left 113 in the intervention group and 127 in the control group. In this selected sample, we compared participants who received at least one intervention (n = 113) with those who did not, using a Chi-square or exact Fisher test for discrete variables, and a t-Student or Wilcoxon test for continuous variables.

In a second analysis, we used a multilevel mixed-effects linear regression to identify factors associated with each of the three scores described above. A threshold P-value < .20 was employed in the univariate analyses to identify variables eligible to enter the multivariable multilevel mixed-effects linear regression model. A backward procedure was then used to select the explanatory variables for the final multivariable model, with a P-value < .05. We also tested the interaction effect between follow-up time and receiving the intervention.

3. Results

3.1. Baseline sample description

Study sample (n = 240) characteristics at baseline are presented in Table 1. The main outcomes at baseline highlighted that participants were male (78%; n = 187) and median [IQR] age was 30 [26–37] years. Three-quarters of the sample (n = 179) did not have a secondary education certificate and more than two-thirds (68%; n = 163) were not employed. In terms of psychosocial factors, the median [IQR] scores and subscores in the sample were as follows: perceived competence 2.7 [1.7–3.3]; autonomous regulation 2.7 [2.0–3.3]; controlled regulation 2.6 [1.8–3.2]; self regulation 0.0 [−0.7–0.7]; health care climate 3.3 [3.0–3.8]. The median and the range of intervention sessions that participants in the intervention site received equaled 5 (1–53) (results not shown). In terms of the attrition rate in the intervention (n = 113) and control (n = 127) groups, 38 (34%) and 35 (28%) participants, respectively, were lost to follow-up at M6, and 69 (61%) and 56 (44%), respectively, at M12. To take into account this source of statistical bias, a two-step Heckman model, adapted for longitudinal studies - as in the original article (Roux et al., 2016) - was used. We computed the inverse Mills ratio (IMR), which is the index used to correct for selection bias. It was not significant, meaning that there was no selection bias associated with the missing data.

We compared the enrolled individuals with no follow-up assessment to those with at least one assessment (M6 and/or M12) and found no differences in the two groups for any of the 3 scores.

3.2. Comparison of participants exposed and not exposed to the intervention

Our analyses highlighted the fact that participants in the intervention group (Table 1) were more likely to have a secondary education certificate (32%; n = 36), precarious housing (28%; n = 32), to have used heroin (41%; n = 46) or morphine sulfate (53%; n = 60) and to have more unsafe HIV-HCV transmission practices (44%; n = 49) than the participants in the control group. With respect to PSF, the median scores and subscores of participants exposed to the intervention were as follows: perceived competence 2.3 [1.7–3.7]; self-regulation 0.1 [−0.5–0.9]; autonomous regulation 3.0 [2.0–3.3]; controlled regulation 2.6 [1.8–3.2]; healthcare climate 3.3 [3.0–3.8]. Conversely, analysis showed that participants not exposed to the intervention were more likely to report buprenorphine use (53%; n = 67). The median scores and subscores of participants not exposed to the intervention were as follows: perceived competence 2.7 [2 0.0–3.3]; self-regulation −0.1 [−0.8–0.6], autonomous regulation 2.7 [2 0.0–3.0]; controlled regulation 2.6 [1.8–3.2]; health care climate 3.3 [3.0–3.8].

3.3. Impact of the intervention on the variable "perceived competence"

The univariate and multivariate analyses (Table 2) show the factors associated with perceived competence in the whole study sample (n = 240). We found that participants who reported harmful alcohol consumption or cocaine/crack use had a significantly lower score for perceived competence. After adjusting for these associated factors, we found a significant interaction effect with follow-up duration (both control and intervention group), showing that perceived competence increased during follow-up. However, the analyses also highlighted that participants exposed to the intervention at least once were had a higher level of perceived competence at M12 [coefficient ^{intervention}, 95% CI = 0.34 (0.15; 0.53) vs. coefficient ^{control}, 95% CI = 0.26 (0.09; 0.43)].

3.4. Impact of the intervention on the variable "perceived autonomy support"

We found that younger age and employment were significantly associated with a stronger perception of autonomy support. After adjusting for these associated factors, we found a significant negative interaction effect with follow-up duration for the control group, showing that participants who did not receive the intervention had a lower level of perceived autonomy support from NGO staff members at

Table 2
Factors associated with Perceived competence score, Health care climate score and Self-regulation score and: Multilevel mixed-effects linear regression, univariate analysis, ANRS-AERLI study.

	Perceived competence score (n = 240, N = 503 observations)			Health care climate score (n = 240, N = 521 observations)		
	Univariate analysis Coef. [95% CI]	Multivariate analysis Coef. [95% CI]	*p*-Value	Univariate analysis Coef. [95% CI]	Multivariate analysis Coef. [95% CI]	*p*-Value
Gender						
Male	0			0		
Female	−0.15 [−0.39; 0.09]			0.03 [−0.12; 0.18]		
Age – years §	−0.001 [−0.01; 0.01]			−0.01[1] [−0.02; 0.00]	−0.01 [−0.02; −0.001]	0.047
Education						
< Secondary Education Certificate	0			0		
≥ Secondary Education Certificate	0.10 [−0.14; 0.34]			−0.02 [−0.17; 0.14]		
Living in a couple						
No	0			0		
Yes	0.14[1] [−0.05; 0.32]			0.10[1] [−0.03; 0.23]		
Employment (paid activity)						
No	0			0	0	
Yes	0.02 [−0.18; 0.22]			0.14[1] [0.02; 0.26]	0.13 [0.01; 0.25]	0.029
Precarious housing						
No	0			0		
Yes	−0.14 [−0.39; 0.10]			0.14[1] [−0.01; 0.30]		
Age at first drug injection§	0.002 [−0.02; 0.02]			−0.004 [−0.02; 0.01]		
Harmful alcohol consumption ł						
No	0	0		0		
Yes	−0.19[1] [−0.38; −0.01]	−0.17 [−0.35; 0.01]	0.061	0.01 [−0.11; 0.14]		
Heroin use*						
No	0			0		
Yes	−0.22[1] [−0.42; −0.02]			−0.03 [−0.14; 0.09]		
Cocaine/crack use*						
No	0	0		0		
Yes	−0.23[1] [−0.42; −0.05]	−0.20 [−0.38; −0.03]	0.025	−0.06 [−0.17; 0.05]		
Morphine sulfate use*						
No	0			0		
Yes	−0.02 [−0.20; 0.16]			−0.09 [−0.25; 0.08]		
Buprenorphine use*						
No	0			0		
Yes	−0.02 [−0.21; 0.16]			−0.07 [−0.21; 0.06]		
Frequent daily injection						
No	0			0		
Yes	−0.07 [−0.24; 0.10]			0.07 [−0.05; 0.18]		
Polydrug use						
No	0			0		
Yes	−0.25[1] [−0.47; −0.02]			−0.09[1] [−0.21; 0.02]		
HCV screening						
No	0			0		
Yes	−0.02 [−0.26; 0.21]			0.004 [−0.14; 0.14]		
Opioid Substitution Treatment						
No	0			0		
Buprenorphine	0.11 [−0.18; 0.39]			0.06 [−0.14; 0.26]		
Methadone	0.14 [−0.16; 0.44]			0.16 [−0.03; 0.36]		
Skenan	0.12 [−0.19; 0.44]			0.12 [−0.13; 0.36]		
Other	−0.30 [−0.87; 0.26]			−0.09 [−0.52; 0.33]		
Intervention/ Follow−up time						
M0	0	0		0	0	
Control group at M6/M12	0.27[1] [0.10; 0.44]	0.26 [0.09; 0.43]	0.002	−0.21[1] [−0.33; −0.09]	−0.20 [−0.32; −0.07]	0.002
Intervention group at M6/M12	0.34[1] [0.14; 0.53]	0.34 [0.15; 0.53]	0.001	−0.06 [−0.19; 0.07]	−0.06 [−0.19; 0.06]	0.329

§ in years; ł AUDIT-C ≥ 3 for women and ≥4 for men; * during the previous 4 weeks; [1]P-value ≤0.20.

	Self-regulation score (*n* = 240, *N* = 521 observations)		
	Univariate analysis Coef. [95% CI]	Multivariate analysis Coef. [95% CI]	*p*-Value
Gender			
Male	0	0	
Female	0.39[1] [0.12; 0.67]	0.29 [0.01; 0.57]	0.039
Age – years §	−0.01[1] [−0.03; 0.00]		
Education			
< Secondary Education Certificate	0		
≥ Secondary Education Certificate	0.08 [−0.19; 0.35]		
Living in a couple			
No	0		
Yes	0.06 [−0.15; 0.27]		

(*continued on next page*)

Table 2 (*continued*)

	Self-regulation score (n = 240, N = 521 observations)		
	Univariate analysis Coef. [95% CI]	Multivariate analysis Coef. [95% CI]	p-Value
Employment (paid activity)			
No	0		
Yes	−0.04 [−0.24; 0.16]		
Precarious housing			
No	0		
Yes	0.13 [−0.13; 0.39]		
Age at first drug injection§	−0.03[1] [−0.05; −0.01]	−0.03 [−0.05; −0.01]	0.002
Harmful alcohol consumption ǂ			
No	0		
Yes	−0.04 [−0.23; 0.16]		
Heroin use*			
No	0		
Yes	0.07 [−0.15; 0.29]		
Cocaine/crack use*			
No	0		
Yes	0.05 [−0.15; 0.24]		
Morphine sulfate use*			
No	0		
Yes	0.13 [−0.08; 0.35]		
Buprenorphine use*			
No	0		
Yes	−0.11 [−0.30; 0.08]		
Frequent daily injection			
No	0		
Yes	−0.01[1] [−0.19; 0.17]		
Polydrug use			
No	0		
Yes	0.05 [−0.18; 0.28]		
HCV screening			
No	0		
Yes	−0.01 [−0.24; 0.22]		
Opioid Substitution Treatment			
No	0	0	
Buprenorphine	−0.34[1] [−0.63; −0.05]	−0.36 [−0.64; −0.07]	0.013
Methadone	−0.14 [−0.46; 0.18]	−0.20 [−0.52; 0.11]	0.209
Skenan	−0.27[1] [−0.64; 0.10]	−0.34 [−0.71; 0.03]	0.069
Other	−0.56[1] [−1.28; 0.16]	−0.58 [−1.27; 0.12]	0.102
Intervention/ Follow-up time			
M0	0		
Intervention group at M6/M12	−0.08 [−0.28; 0.11]		
Control group at M6/M12	−0.09 [−0.33; 0.14]		

§ in years; ǂ AUDIT-C ≥ 3 for women and ≥ 4 for men; * during the previous 4 weeks.

M12 [coefficient, 95% CI = −0.20 (−0.32; −0.07)]. No difference was found between M0 and M12 in the intervention group in terms of perceived autonomy support from NGO staff members.

3.5. Impact of the intervention on the variable "self-regulation"

Female participants and younger participants at first drug injection were more likely to have a higher self-regulation score. We also found that participants who had substitution treatment had a significantly lower self-regulation score. Analyses showed that participants treated with morphine sulfate had a higher self-regulation score than those treated with buprenorphine. However, after adjusting for these correlates, we did not find any significant interaction effect either for the intervention or the follow-up duration [coefficient, 95% CI = −0.08 (−0.28; 0.11)].

3.6. Complementary analysis

To evaluate whether the results we obtained were attributable to a direct effect of the intervention on the three psychosocial factors of the SDT, we tested a model in which these PSF were examined as mediators of the impact of the intervention on key outcomes (i.e., various unsafe HIV-HCV transmission practices). A direct effect (i.e. no mediating effect) was found for self-regulation [coefficient, 95% confidence interval (CI) = 0.34 (0.15; 0.49)], perceived competence [coefficient, 95% CI = 0.31 (0.13 to 0.45)] and perceived autonomy support [coefficient, 95% CI = 0.32 [0.11; 0.47]). This shows that the intervention has a direct effect on injection practices without psychosocial factors (perceived competence in particular) mediating this impact. Although this result demonstrates the effectiveness of the intervention in reducing risky practices (Roux et al., 2016), it does not explain how the AERLI intervention influences injection practices. FPS (perceived competence in particular) has an independent effect on risky practices not related to the intervention.

4. Discussion

Our study provides some important results regarding the impact of an innovative educational intervention on psychosocial factors and motivation. With respect to the impact of the intervention on psychosocial factors, being exposed to the intervention was associated with greater perceived competence at 12 months of follow-up. This perceived competence is important to the adoption of new health-related behaviors by patients (Ryan et al., 2008). However, the result of the mediation analysis does not mean that the effectiveness of the AERLI intervention (Roux et al., 2016) can be explained by increased perceived competence.

Our results also showed that the intervention helped to maintain participants' existing perception of the autonomy support provided by NGO staff members. This is important because the literature suggests

that coercive behaviors by one's social environment do not affect a patient's decision to enter treatment or not (Wild, Cunningham, & Ryan, 2006). HR features and NGO staff members should incorporate a more motivational approach and promote autonomy support to promote behavioral change (Williams et al., 2002; Williams & Deci, 2001). In addition, interventions utilizing the clinical technique of motivational interviewing (MI) (Miller & Rollnick, 1991) in conjunction with the theoretical background of SDT (Williams et al., 2002) have been shown to be effective in increasing patients' motivation and healthy behaviors (Mahmoodabad, Tonekaboni, Farmanbar, Fallahzadeh, & Kamalikhah, 2017; Miller & Gramzow, 2016).

However, our analyses revealed that the intervention and follow-up had no impact on self-regulation (either autonomous or controlled). According to SDT, the autonomous regulation of behaviors is associated with an internalization of the motivations for adopting a behavior, which is an essential process for maintaining them over time (Ryan et al., 2008). Accordingly, we could not assert that safe behaviors would continue over time. This result is important because it provides a greater understanding of the persistence of risky behaviors in PWID despite the development of HR services. In the literature, self-regulation has been shown to be highly dependent on perceived autonomy support (Williams et al., 2004). Despite this finding, the results from our moderator analysis did not enable us to confirm this link (results not shown). Thus, the lack of any effect of the intervention on self-regulation (i.e., autonomous or controlled, measured with the Treatment Self-Regulation Questionnaire (TSRQ)) cannot be explained by professional practices as perceived by Drug Users (i.e., perceived autonomy support, measured with the Health Care Climate Questionnaire (HCCQ)). This lack of effect can be interpreted in different ways:

One hypothesis is that the items comprising the TSRQ do not evaluate the real motivation associated with the target behavior (i.e., safe injection practices). More specifically, the motivation for “injecting safely”, as assessed by our scale, may not cover what really motivates people to inject safely or not. For example, injecting safely may be associated with other more contextualized motivations (e.g., the motivation to avoid contaminating oneself or others; the motivation to preserve one's venous capital). A comprehensive approach to understand consumer practices and associated psychosocial issues would enable us to discover the real motivations underlying behaviors, and therefore the effective levers for implementing Harm Reduction strategies and systems which would guarantee long term success. Another hypothesis is that educational sessions are not designed to develop individuals' motivation (autonomous or controlled) but only their skills and competencies. The development of patient motivation in the context of educational interventions requires patients and health professionals (e.g., physicians, practitioners) to have a common health objective (Boyer, 1999). These findings suggest that stakeholders (i.e., patients and practitioners) need to work toward a common health goal by integrating PWID-specific issues and motivations into the content development of educational sessions, if they wish to increase motivation and therapeutic alliance. To do this, partnerships between users and researchers must be developed through collaborative and participatory research and community-based approaches.

In addition, this study highlighted the impact of patients' patterns of use, care pathways and socio-demographic characteristics on the psychosocial factors and motivations which can influence changes in injection behaviors (i.e., persistence or reduction of unsafe HIV–HCV transmission practices in PWID and local complications). More specifically, the results revealed the specific impact of drug (cocaine) and alcohol use and substitution treatments on perceived competence and the level self-regulation. The literature has already shown the association between drug and alcohol use and unsafe HIV–HCV transmission practices (De, Cox, Boivin, Platt, & Jolly, 2007; Le Marchand, Evans, Page, Davidson, & Hahn, 2013; Maher et al., 2006). With regard to substitution treatments, studies confirm that morphine sulfate users seek a reward effect more than buprenorphine users (Carrieri et al., 2006; Carrieri et al., 2010; Roux et al., 2017) while the latter seek report more the pleasure of the act of injecting (Roux et al., 2017). These results, together with our ours, suggest the existence of a relationship between sought and obtained effects of psychoactive products and the processes of motivation (i.e., sense of autonomy and competence) to change behaviors.

Moreover, our results indicate an impact of the socio-demographic characteristics of participants, suggesting that younger participants and females perceive greater autonomy support from field workers and have a higher level of self-regulation, respectively. This may explain women's greater capacity for behavioral change in the field of addiction (Rao, Czuchry, & Dansereau, 2009). These psychological predispositions may be explained by the heterogeneity of structures and differentiated professional practices according to user profiles. Indeed, Danzinger and Welfel (2000) highlighted the impact of user age on the attitudes and support offered by health professionals and social workers, whereby the professional attitude adopted in the management of older PWID was less than optimal because of the perception that older PWID are more resistant to change (Mellor et al., 1996; Tabisz et al., 1993 cited in Government of Canada, Health Canada, 2002). Other studies have also revealed the inadequacy of some HR programs in taking into account women's specific needs (United Nations Office on Drugs and Crime, 2004). This may be partly responsible for the overrepresentation of this specific profile of women (highly autonomous and motivated) in treatment and care facilities. These results confirm those from other studies which highlight the influence of structural factors on motivation and treatment seeking in the field of addiction (e.g., satisfaction with previous treatments, accessibility of services and availability of clinicians) (Bowers, Cleverley, Di Clemente, & Henderson, 2017). Further studies are also needed to explain why women and young users present more unsafe injection practices and complications at the injection site (Colón et al., 2001; Kral, Lorvick, & Edlin, 2000; Montgomery et al., 2002; Roux et al., 2016), despite their greater sense of autonomy and competence.

More in-depth research on these user profiles and/or patterns of use could allow us to work more specifically on psychological predispositions which impact the effectiveness of long-term HR measures and other healthcare interventions.

Some study limitations need to be acknowledged. First, because we used non-randomized clustering to compare the control and intervention groups, the two groups were different at baseline with a high degree of homogeneity inside and between clusters. However, using a two-step Heckman model to limit the bias due to non-random assignment (Carrieri et al., 2010), we were able to compare both groups and measure the effect of the intervention (Roux et al., 2016). Second, the three questionnaires were not initially designed to specifically measure unsafe injection practice behaviors among drug users. Even though we were able to adapt the scales used to our needs, further studies are needed to test these scales in this specific field and specific population. In addition, questionnaires in general are limited in scope when exploring a new phenomenon. Thus, qualitative interviews could help us to better understand some of the issues related to the existence and impact of user profiles on the effectiveness of health systems and HR programs.

In conclusion, this study empirically confirms the effectiveness of an intervention based on supervised educational sessions for the development of the psychosocial processes of motivation that contribute to the initialization of new health-related behaviors and the achievement of objectives. However, the absence of any impact of the intervention on self-regulation does not allow us to assert that safe injection practices are maintained over time. In addition, this study also highlights the existence of user profiles and associated psychological and social predispositions whose socio-demographic characteristics, patterns of use and care pathways can influence people's motivation to change their behavior, and consequently, the effectiveness of interventions. Public health policies need to integrate these diversities and to adapt

HR services and systems in order to reduce health inequalities.

Declaration of interests

All authors declare that they have no conflicts of interest.

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Contributors

Authors PR designed and wrote the protocol. KN conducted the data analysis. LD and NK conducted literature searches and wrote the first draft of the manuscript. All authors contributed to subsequent revisions and have approved the final manuscript.

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Appendix A. Supplementary data

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