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Illness perceptions and coping strategies among individuals diagnosed with HIV

A. Norcini Pala[1] · **P. Steca**[2]

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Abstract Illness perceptions can influence the coping strategies used in response to HIV-related stressors, and ultimately patients' clinical status. With this work, we aimed to: (1) identify illness perception-related profiles of HIV-positive patients; (2) evaluate the association between the profiles, illness-related coping strategies, HIV-progression biomarkers (CD4+ cell counts and viral load) and antiretroviral therapy use. Data about illness perceptions, HIV-related coping strategies and HIV-progression biomarkers (CD4+ and viral load) were collected from 248 Italian HIV-positive patients. Three latent classes ("high," "moderate" and "low" influence perception) that differed on consequences, emotional representation, personal control and identity were identified. A greater perception of illness influence was associated with dysfunctional coping strategies (e.g., passive coping and alcohol use), and greater viral load was observed among patients with high and moderate influence perception. In conclusion, patients with detectable or high viral load may show a greater perception of illness influence (i.e., consequences), which is associated with dysfunctional coping strategies in response to HIV-related stressors.

Keywords Illness perceptions · Coping strategies · Alcohol use · Antiretroviral therapy · HIV progression

✉ A. Norcini Pala
norcini@nyspi.columbia.edu

[1] HIV Center, 3rd Floor, Room 339, New York State Psychiatric Institute and College of Physicians and Surgeons, Columbia University, 1051 Riverside Drive, Unit 15, New York, NY 10032, USA

[2] Department of Psychology, Milano-Bicocca University, Milan, Italy

Background

Psychological adjustment to the diagnosis of HIV infection can be difficult and extremely demanding (Stanton et al., 2007). Medical factors alone cannot account for the differences in patients' adjustment to HIV. Moreover, HIV self-care [e.g., the daily use of antiretroviral therapy (ART)], essential to improving patients' physical health (e.g., Mocroft et al., 2003), may represent a burden. Psychological aspects play an important role, particularly the representations of HIV infection, which are linked to patients' health outcomes (Reynolds et al., 2009; see also Broadbent et al., 2006). In effect, there are many aspects of HIV infection that generate stress (Moskowitz & Wrubel, 2005), and illness perceptions might determine the ways patients cope with it (Leventhal et al., 1980, 1984). The strategies adopted to cope with the illness can ultimately predict patients' health outcomes (e.g., Cole, 2008; Moskowitz et al., 2009; Mulder et al., 1995; Temoshok et al., 2008). With this work, we aimed to identify configurations of HIV-positive patients' illness perceptions (profiles) using a person-centered perspective. Second, we evaluated the associations between illness perception profiles, coping strategies, the use of ART and HIV-progression biomarkers (e.g., viral load and CD4+ cell counts).

In line with Leventhal's self-regulatory model (Leventhal et al., 1980), individuals who try to make sense of a threat by developing a cognitive representation of the threat (the illness) are considered active problem solvers. Patients' illness representations can be structured around six main illness-related cognitive dimensions (Broadbent et al., 2006): *Identity* refers to the name of the illness and its associated symptoms. *Timeline* reflects the perception of how long the illness will last. The *consequences* consist of patients' perception of how serious the illness is in terms of

physical, emotional, and social consequences. *Emotional representation* refers to the negative reactions such as fear, anger, and distress, c*ure/controllability* is a belief about whether the illness can be cured or managed, and *comprehensibility* is an evaluation of whether the illness makes sense (Broadbent et al., 2006; Leventhal et al., 2001).

The ways patients perceive their own illness can determine the strategies adopted to cope with illness-related stressors (cf. Leventhal et al., 1980, 1984). For instance, lower perception of consequences and greater controllability may predispose patients to adopt functional coping and develop a positive psychological adjustment (Reynolds et al., 2009; see also Broadbent et al., 2006; Leventhal et al., 1984; McCorry et al., 2013). Reynolds et al. (2009) found that illness perceptions (i.e., perceived control and consequences) are linked to self-care frequency and effectiveness in the context of HIV care. Because HIV is a chronic condition whose management requires great and constant efforts, illness perception is an important psychological factor to evaluate in relation to coping strategies (cf. Leventhal et al., 1980, 1984). The construct of coping is very relevant because patients' reactions to stress have been demonstrated to affect mental and physical health of HIV-positive patients (e.g., Cole, 2008; Moskowitz et al., 2009; Mulder et al., 1995; Temoshok et al., 2008). Two main categories of coping strategies can be identified: *functional* coping, which leads to a more favorable outcome, and *dysfunctional* coping, which causes further distress (e.g., avoidance; cf. Culver et al., 2002). Effectively, the strategies adopted to cope with HIV-related stressors determine the resulting level of psychological distress (Pakenham & Rinaldis, 2001; see also Ironson et al., 2005; Mulder et al., 1995; Weaver et al., 2005). Functional coping, such as problem-focused coping (cf. Moos & Schaefer, 1993; Roth & Cohen, 1986; Skinner et al., 2003), produces more favorable outcomes than dysfunctional coping strategies, such as emotion-focused and avoidant coping (e.g., Carver et al., 1989).

In a sample of coronary patients, Hallas et al.'s findings (2011) supported the relationship between illness perceptions and coping strategies claimed by Leventhal et al. (1984). Interestingly, a greater perception of consequences was associated with dysfunctional coping strategies, whereas perception of personal control corresponded to functional coping strategies. These findings reinforce the potential clinical relevance of personal control and consequences.

ART medication has reduced HIV-related mortality and morbidity (Murphy et al., 2001), but in order to suppress the viral load and avoid development of resistance, patients must adhere strictly to an ART regimen (Chesney et al., 1998). Chesney (2000) suggested that ART use could represent a burden for HIV-positive patients, which can reduce the adherence to the medication. The fear of side effects, the need for patients to implement ART in their daily routine, higher perceived illness severity and lower perceived utility of ART (see Horne et al., 2007, 2004) are all relevant aspects since they reduce adherence (Johnson & Folkman, 2004; see also Horne et al., 2007). A better understanding of the differences in illness perceptions between patients treated with ART and naïve to ART may help clinicians to target patients at risk for poor adherence. Thus, with this study, we also tested such differences.

Overview of current study

The main aim of this work was to identify profiles of HIV positive patients based on their illness perception. The second aim of the study was to test profiles' difference on coping strategies, HIV infection clinical biomarkers and ART use. In order to form patients' profiles, we adopted the person-centered perspective, which Magnusson (2003) defined as "holistic" because it accounts for individuals' differences. The person-centered approach groups individuals into clusters that are homogenous *within* cluster but differ from other clusters (*between*) in terms of the dependent variables. In this paper, the dependent variables used were the illness perception items. Because of the lack of similar studies on HIV-positive patients, our hypothesis about the profiles was based on the results of McCorry et al. (2013), who investigated illness perceptions in oncologic patients using a person-centered approach. Overall, we expected to find profiles characterized by different illness perceptions as assessed through the six dimensions described by Broadbent et al. (2006); for instance, consequences, emotional representation, cure/controllability, and identity.

With respect to the coping strategies associated with the clusters, we expected profiles characterized with greater perceived control to be associated with functional coping strategies such as active coping (cf. Broadbent et al., 2009; Hallas et al., 2011). Conversely, we expected profiles characterized with greater perception of consequences, identity and emotional representation to be associated with dysfunctional coping strategies such as passive coping (cf. Zyrianova et al., 2011) and worse HIV-progression biomarkers (e.g., lower CD4+ count and greater viral load) (cf. Ironson et al., 2005; Weaver et al., 2005).

The relation between ART use and illness perception could be difficult to predict since HIV-positive patients may have different views about ART. According to Horne et al. (2004, 2007) patients may have concerns about ART, such as the expected side effects, or they may perceive ART as a necessity in order to improve their health status. Since no published studies to date have investigated illness

perceptions in relation to ART use, we were interested in exploring illness-perception differences between patients naïve to ART and currently treated with ART. Our hypothesis was that patients treated with ART would report less identity perception, because of the slowed infection progression. Nonetheless, we can expect patients treated with ART to report greater levels of consequences because of the daily ART regimen (cf. Chesney, 2000).

Methods

Participants and procedure

The 248 participants were predominantly men (80.242; 19.355 % women, .403 % missing data). Patients' mean age was 39.593 years ($SD = 8.980$) and educational attainment included elementary and junior high school completion (4.032 %), high school diploma (42.339 %), university degree (21.774 %), master's degree (13.306 %), and Ph.D. or other specialization (10.484 %; data missing: 8.065 %). Most of the participants were currently being treated with ART (72.581 %), whereas 25.806 % were naïve to ART (1.613 % missing data).

The total sample was composed of two samples of participants recruited independently using (a) non-probabilistic, web-based convenience sampling ($n = 158$) and (b) probabilistic randomized sampling ($n = 90$). The web-based sampling consisted of recruiting individuals through various Internet pages and forums related to HIV/AIDS. All participants stated that they were HIV-positive and over 18 years of age. In order to join the survey, participants had to read and agree to a web-based informed consent where the voluntary nature of the participation, the anonymity, and the confidentiality of the study were clearly stated. No participants provided personally identifying information, and all questionnaires were submitted anonymously online. The second sample was randomly collected from the daily lists of HIV-positive patients attending a blood screening at the Institute of Infectious Diseases in Bologna, Italy. For each daily list, five patients were randomly selected through a computer algorithm. None of the contacted participants refused to participate. Some selected patients were not reachable via phone (e.g., incorrect phone number); after a second unanswered call, they were excluded from the recruitment plan. Participants received, read, and signed informed consent forms on the day of the blood test. They were informed and agreed that we would have access to their clinical records to gather information on HIV-progression biomarkers. The study for the second sample was approved by the Ethical Committee at the clinic.

Measures

Illness perceptions

The Brief Illness Perception Questionnaire (Brief-IPQ; Broadbent et al., 2006; Italian version edited by Pain et al., 2007) was used to assess patients' cognitive representations of their illness (Leventhal et al., 1984). The six illness-related cognitive dimensions were assessed through eight items (emotional representation and control were assessed through two items each; see Broadbent et al., 2006). (1) "consequences" namely, patient's perception of the impact of the illness on his/her life ("*How much does your illness affect your life?*"); (2) "timeline," the illness's perceived duration ("*How long do you think your illness will continue?*"); (3) "personal control," one's perception of the degree of control exerted over the illness ("*How much control do you feel you have over your illness?*"); (4) "treatment control," the perception of the utility of the medications ("*How much do you think your treatment can help your illness?*"); (5) "identity," the intensity of the symptoms of the illness ("*How much do you experience symptoms from your illness?*"); (6) "concern," the patient's preoccupation with his/her illness ("*How concerned are you about your illness?*"); (7) "emotions," the influence that the illness has on a patient's emotions ("*How much does your illness affect you emotionally, e.g., Does it make you angry, scared, upset or depressed?*"); and (8) "comprehensibility," the patient's understanding of his/her illness ("*How well do you feel you understand your illness?*"). Items 3 and 4 assess the control dimension, and items 6 and 7 assess emotional representation. Each item was rated on a 10-point Likert scale.

Coping strategies

A 14-item instrument based on the COPE questionnaire (Carver et al., 1989) was used to assess illness-related coping strategies. Patients were asked to report how often they adopted each coping strategy in response to HIV-related issues. The answer scale ranged from *Never* (1) to *Very often* (4). In a large non-clinical Italian sample of men and women ($N = 955$), Norcini Pala and Steca (unpublished manuscript), in line with Miyazaki et al. (2008), identified seven coping strategies. These included five latent factors and two individual items. The 5-factor model was tested through a confirmatory factor analysis (CFA). The two individual items that assess alcohol use and religious coping were not included in the latent model (CFA) and were treated as observed variables in later analyses. Whereas, the five latent factors' scores were saved (through the SAVEDATA and FSCORES functions in Mplus 7.2) and used. The goodness

of fit and reliability coefficient confirmed the adequacy of the model (CFI/TLI = .942/.909, RMSEA = .051, χ^2 = 68.637, df = 44, p = .006, df χ^2/df = 1.560; factor determinacy >.803). The five latent factors were:

1. Active coping, assessed with 2 items (e.g., "*I've been taking action to try to make the situation better*"—loadings were .552 and .664), reflecting patients' attempts to actively confront stressors.
2. Seeking social support, assessed with 2 items (e.g., "*I've been searching for support from others*"—loadings were .533 and .832), referring to patients' attempts to cope with stressors by seeking support from persons other than their doctors.
3. Passive coping, assessed with 3 items (e.g., "*I admitted I cannot deal with the situation and gave up attempting to cope with it*"—loadings ranged from .526 to .872), referring to a lack of appropriate actions taken against the stressors.
4. Reappraisal, assessed with 3 items (e.g., "*I've been trying to see it in a different light, to make it seem more positive*"—loadings ranged from .356 to .593), reflecting patients' reinterpretations of the stressful events in a more positive light.
5. Avoidance, assessed with 2 items (e.g., "*I acted as if nothing had ever happened to me*"—loadings ranged from .762 to .796), reflecting patients' denial and disengagement when facing HIV-related stressors.

In addition to these five latent dimensions, alcohol use in response to HIV-related stressors was assessed with a single item ("*I drink alcohol to make myself feel better*") and religious coping was assessed with a single item ("*I've been trying to find comfort in my religion*").

Some of the seven coping strategies assessed were significantly intercorrelated (see Table 1). In particular, avoidance was inversely associated with seeking social support and active coping, and positively correlated with reappraisal. Passive coping was negatively associated with reappraisal and positively associated with alcohol use. The coping strategy of seeking social support was positively associated with reappraisal and active coping. On average, participants who adopted the reappraisal strategy scored higher on active coping and lower on alcohol use. Lastly, religious coping was significantly associated only with reappraisal and active coping strategies.

HIV-progression biomarkers and ART medication

CD4+ cell counts and viral load were available only for the patients recruited at the clinic. ART use was available for both samples (offline and online). Higher CD4+ cell counts indicated better immune system functioning, and high viral load refers to a greater quantity of HIV virus detectable in the blood, and therefore infection progression. CD4+ cell counts, viral load and ART use were gleaned from their clinical records. All patients recruited at the clinic treated with ART (the variable was coded as follows: 1-treated with ART/2-Naïve to ART) had an undetectable (suppressed) viral load. Participants recruited online self-reported if they were treated with ART. CD4+ cell counts and viral load were both recoded in line with Gauchet, Tarquinio, and Fischer (2007). CD4+ cell counts were recoded as follows: (1) >200 and ≤500 (n = 31), (2) >500 and ≤1000 (n = 44), (3) >1000 (n = 14; missing = 1). Viral loads ranged from 50 to 380,000 copies/L (the minimum detectable viral load was 50 copies/L) and were recoded as follows: (1) <50 (or "undetectable"; n = 49), (2) ≥50 and ≤1000 (n = 13), (3) ≥1000 and <10,000 (n = 5), and (4) ≥10,000 (n = 21; missing data = 2).

Data analysis

The analyses were performed with SPSS 20 (Statistical Package for the Social Sciences, Chicago, IL, USA) or

Table 1 Correlations among coping strategies—Pearson's r and polychoric coefficients

	1	2	3	4	5	6	7
1. Avoidance[a]	1.000						
2. Passive[a]	−.011	1.000					
3. Seeking social support[a]	−.402***	−.023	1.000				
4. Reappraisal[a]	.341***	−.569***	.356***	1.000			
5. Active[a]	−.369***	.033	.577***	.537***	1.000		
6. Alcohol use[b]	.015	.319***	.008	−.271***	−.138	1.000	
7. Religious[a]	.052	.08	.156*	.171**	.216***	−.081	1.000

n = 242

* $p < .05$; ** $p < .01$; *** $p < .001$

[a] Pearson's coefficients

[b] Polychoric coefficients

Mplus 7.2 (Muthén & Muthén, 1998–2012). Skewness and kurtosis were used to assess variables' distribution. CFA (maximum likelihood estimator—ML) and factor determinacy for the 5 factors representing coping strategies were performed with Mplus 7.2. Factor determinacy consists of the correlation between the items and the latent factor. Like Cronbach's alpha, it represents an estimation of internal reliability and ranges from 1 (excellent) to 0 (poor) (Muthén & Muthén, 1998–2012). To assess model goodness-of-fit, we used the Comparative Fit Index (CFI; Bentler, 1990), the Tucker-Lewis Incremental fit index (TLI; Tucker & Lewis, 1973), RMSEA, and the χ^2/df ratio (Crowley & Fan, 1997). CFI and TLI scores $\geq$.950 indicated good fit, and scores $\geq$.900 indicated sufficient fit. RMSEA score $\leq$.050 indicated a good fit, whereas a score $\leq$.080 indicated a sufficient fit of the model. A χ^2/df ratio $\leq$5 indicated a good fit for the model (Bollen, 1989; Crowley & Fan, 1997; Hu & Bentler, 1999; Schermelleh-Engel et al., 2003). The correlation between the coping strategies was tested with weighted least squares means and variance adjusted (WLMSV) estimator, because the alcohol use item was not normally distributed and thus treated as an ordinal variable; all the other variables were normally distributed and treated as continuous. The polychoric coefficient was used for correlations with the ordinal variable (alcohol use), and Pearson r coefficient was used for correlations among the continuous variables. Differences between the two samples (online/offline) on gender, education, and ART use were tested through χ^2 and cross-tabulation, because the variables were either ordinal or dichotomous. Adjusted standardized residuals >|2| were used to test the difference between the observed and expected counts (see Agresti, 1984). Samples differences on age, Brief-IPQ, and coping strategies were tested with the Student's t test, as the variables were treated as continuous.

Patients' Brief-IPQ related profiles were formed through latent class analysis (LCA), which grouped individuals based on their similarities on Brief-IPQ item scores. The fit of four models (1-Class, 2-Class, 3-Class and 4-Class solutions) was evaluated with the Bayesian information criterion (BIC), the sample-size adjusted BIC (BIC_N), the parametric bootstrapped likelihood ratio test (LRT), and the entropy (Muthén & Muthén, 1998–2012; Nylund et al., 2007). The model with the lowest BIC and BIC_N, and with entropy close to 1.00 (or more generally not lower than .80) was selected. LRT compares K clusters with the $K-1$ clusters solution, where K is the number of clusters. A statistically non-significant test indicates that the $K-1$ solution should be used. Additionally, class size was used to determine the number of latent classes to form.

The 3-step maximum likelihood method (Asparouhov & Muthén, 2013; Vermunt, 2010) implemented in Mplus 7.2 (Muthén & Muthén, 1998–2012) was used. Class membership was used as a predictor to test mean differences on coping strategies (DU3STEP function). Multinomial logistic regression was performed to test demographic, ART use and HIV-progression biomarkers variables as predictors of class membership (R3STEP function).

Results

Online and offline samples differences

The samples did not show a statistically significant difference with regard to participants' age ($t = 1.552$, $df = 241$, $p = .129$). Whereas, gender distribution differed between the two samples (Yates continuity correction $\chi^2 = 5.487, df = 1$, $p = .019$). Men were more likely to be recruited online and women were more likely to be recruited offline. Furthermore, significant differences were found with respect to patients' educational attainment ($\chi^2 = 48.357$, $df = 4$, $p < .001$; Table 2). Specifically, in the offline sample, patients were more likely to hold a university degree; in the online sample, patients were more likely to possess at least a high school diploma. No significant difference was found with respect to ART use (Yates continuity correction $\chi^2 = 2.179$, $df = 1$, $p = .140$). Online and offline samples' characteristics have been summarized in Table 2. The two samples differed on two of the 8 items of the Brief-IPQ and two coping strategies (see Table 2); specifically, the online sample showed higher scores on timeline ($t = 3.025, df = 238, p = .003$), comprehension ($t = 2.461$, $df = 238$, $p = .015$), seeking social support ($t = 2.541$, $df = 240$, $p = .012$) and active coping ($t = 1.982, df = 238, p = .049$).

Illness perceptions profiles: LCA

The LCA was conducted using the Brief-IPQ items as dependent continuous variables. In order to control for samples difference on Brief-IPQ, the ID variable (1-online/2-offline sample) was included into the model. That is, the categorical latent variable (latent classes) and the two Brief-IPQ items that differed between the two samples (timeline and comprehension) were regressed on the ID variable. The number of clusters to form was determined by comparing the BIC, Adjusted BIC, LRT, entropy and class size of four alternative models (Table 3). The 4-Class solution showed lower BIC and Adjusted BIC, greater entropy, and statistically significant LRT. However, the size of one of the four classes was too small (n = 10) compared to the other three classes. Thus, we decided to use the 3-Class model, which showed good fit indexes and larger class sizes (see Table 3).

To explore differences between the latent classes formed, we used the Wald test of parameter constraints to

Table 2 Online and offline samples' demographics characteristics, ART use, HIV-progression biomarkers, Brief-IPQ and coping strategies

	Online (n = 158)	Offline (n = 90)	Sig.
Gender (%)			
Men	85.350 %[a]	72.222 %	.020
Women	14.650 %	27.778 %[a]	
Age [mean (SD)]			
Education (%)	40.252 (9.387)	38.432 (8.136)	.129
Elementary or junior high school	6.293 %	1.299 %	<.001
High school diploma	57.343 %[a]	29.870 %	
University degree	10.490 %	50.649 %[a]	
Master's degree	18.881 %[a]	7.792 %	
Ph.D. or other specialization	6.993 %	10.390 %	
Viral load (%)			
Undetectable <50	–	55.682 %	
≥50 and ≤1000	–	14.773 %	
>1000 and ≤10,000	–	5.682 %	
>10,000	–	23.863 %	
CD4+ cell counts (%)			
>200 and ≤500	–	34.832 %	
>500 and <1000	–	49.438 %	
≥1000	–	15.730 %	
ART medication (%)			
Treated	77.273 %	67.778 %	.104
Naïve	22.727 %	32.222 %	
B-IPQ [mean (SD)]			
Consequences	6.333 (2.513)	5.750 (2.805)	.098
Timeline	8.658 (1.957)	7.727 (2.790)	.003
Personal control	6.137 (2.460)	5.659 (2.612)	.157
Treatment control	8.527 (1.906)	8.329 (2.383)	.492
Identity	3.137 (2.320)	2.616 (2.170)	.090
Concern	6.536 (2.529)	6.580 (2.681)	.900
Comprehensibility	7.289 (2.242)	6.523 (2.463)	.015
Emotions	6.413 (2.810)	6.227 (3.095)	.635
Coping [mean (SD)]			
Avoidance	−.055 (.705)	.097 (.714)	.111
Passive	.019 (.685)	−.033 (.723)	.584
Seeking social support	.086 (.683)	−.151 (.723)	.012
Reappraisal	.008 (.322)	−.013 (.323)	.617
Active	.030 (.299)	−.052 (.323)	.049
Alcohol use	1.344 (.622)	1.284 (.566)	.456
Religious	1.719 (.942)	1.682 (.929)	.767

Percentages (%) refer to counts within each sample

SD standard deviation

[a] Standardized adjusted residual >2

compare the mean differences on the Brief-IPQ items. The Bonferroni correction was used for the pairwise tests; for a p value of .05 and three comparisons: .05/3 = .017. Our aim was to understand which dimension of the Brief-IPQ best characterized the profiles. The results in Table 4 showed that consequences, which assessed the impact of illness perception on patients' lives, was the only dimension that differed statistically significantly across all the profiles. Therefore, we decided to label the three profiles as follows: Moderate influence perception (C1); Low

Table 3 Fit indices for LCA models with 1–4 classes

Model	BIC	BIC_N	LRT	Entropy	Class sizes			
					C1	C2	C3	C4
1-Class	9287.538	9230.478	–	1.000	241			
2-Class	8728.668	8646.668	$p < .0001$	.811	168	73		
3-Class	8667.308	8543.686	$p < .0001$	.853	124	62	55	
4-Class	8657.013	8501.693	$p < .0001$	.875	117	61	53	10

LCA latent class analysis, *BIC* Bayesian information criterion; BIC_N sample-size adjusted Bayesian information criterion, *LRT* parametric bootstrapped likelihood ratio test, *C1* Class1, *C2* Class 2, *C3* Class 3, *C4* Class 4

Table 4 Latent classes' means and difference (Wald test of parameter constraints) of the Brief-IPQ questionnaire

	C1-M Mean (SE)	C2-L Mean (SE)	C3-H Mean (SE)	C1 versus C2 Sig.	C2 versus C3 Sig.	C1 versus C3 Sig.
Consequences	6.819 (.258)	3.231 (.387)	7.888 (.303)	<.001	<.001	.011
Timeline	8.486 (.214)	7.720 (.415)	8.615 (.285)	.147	.871	.116
Personal control	5.722 (.242)	7.158 (.359)	5.121 (.324)	.001	<.001	.157
Treatment control	8.451 (.218)	8.887 (.255)	7.942 (.326)	.208	.022	.224
Identity	2.039 (.152)	1.619 (.205)	6.548 (.255)	.144	<.001	<.001
Concern	7.405 (.257)	3.778 (.395)	7.836 (.304)	<.001	<.001	.303
Comprehensibility	6.896 (.229)	7.259 (.318)	6.971 (.334)	.307	.388	.970
Emotions	7.382 (.268)	2.956 (.475)	7.975 (.354)	<.001	<.001	.206

C1-M Class 1-moderate influence, *C2-L* Class 2-low influence, *C3-H* Class 3-high influence, *SE* standard error

$p \leq .017$ was considered statistically significant (Bonferroni correction)

influence perception (C2); and High influence perception (C3). Exploring further the profiles' difference, moderate influence perception and high influence perception (C1 and C3, respectively; Table 4) showed a similar pattern of responses; in particular, greater scores on concern and emotional response were observed compared to the low influence perception profile. However, the score on identity item was significantly higher among patients with high influence perception compared to moderate and low influence perception profiles, which did not differ significantly. Interestingly, the three profiles did not show a statistically significant difference on timeline, treatment control, and comprehensibility. Lastly, the ID variable was not significantly associated with the classes (multinomial logistic regression: C1 vs. C2: $p = .703$; C1 vs. C3: $p = .258$; C2 vs. C3: $p = .340$).

Illness perception clusters and coping strategy clusters

Differences among the three clusters on coping strategies were evaluated using class membership as independent variable through the DU3STEP function, which provided overall and pairwise tests (Table 5). For the pairwise tests, Bonferroni correction was used. The overall tests were statistically significant with respect to avoidance, passive coping, reappraisal, and alcohol use. Avoidance coping strategy was adopted mostly by low and moderate (vs. high) influence perception profiles. Patients with high and moderate (vs. low) influence perception showed greater scores on passive coping and alcohol use (the difference between moderate and low influence perception on alcohol use was approaching the statistical significance). Conversely, patients with a low influence perception profile were characterized by greater reappraisal coping (Table 5).

Profiles' demographic characteristics, HIV-progression biomarkers and ART use

The association between the latent classes, demographic variables and HIV-progression biomarkers were tested as predictors of class membership (R3STEP function, multinomial logistic regression). A first analysis was performed to test the association of the latent classes with the demographic variables and ART use. The association with HIV-progression biomarkers was tested in a second analysis because we analyzed only the clinical data from the offline sample. In fact, the biomarkers of the online sample were treated as missing in the second analysis. Hence, the two analyses were performed separately in order to avoid the listwise deletion due to the missing data on the HIV-progression biomarkers in the online sample.

Table 5 Cluster differences on coping strategies—3 step method, R3STEP function

	C1-M Mean (SE)	C2-L Mean (SE)	C3-H Mean (SE)	Overall test Sig.	C1 versus C2 Sig.	C1 versus C3 Sig.	C2 versus C3 Sig
Avoidance	.032 (.067)	.174 (.106)	−.257 (.090)	.005	.285	.013	.002
Passive coping	.169 (.061)	−.578 (.058)	.284 (.099)	<.001	<.001	.350	<.001
Seeking social support	−.058 (.064)	−.027 (.103)	.165 (.104)	.188	.769	.074	.189
Reappraisal	−.031 (.032)	.166 (.033)	−.118 (.043)	<.001	<.001	.137	<.001
Active coping	.020 (.028)	−.069 (.052)	.028 (.037)	.241	.129	.905	.113
Alcohol use	1.310 (.060)	1.142 (.050)	1.551 (.114)	.001	.033	.087	.001
Religious coping	1.616 (.086)	1.843 (.144)	1.764 (.134)	.385	.199	.366	.689

C1-M Class 1-moderate influence, *C2-L* Class 2-low influence, *C3-H* Class 3-high influence, *SE* standard error

$p \leq .017$ was considered statistically significant (Bonferroni correction)

Table 6 Cluster differences on coping strategies—3 step method, R3STEP function

	C1-M	C2-L	C3-H	C1 versus C2 B	C1 versus C3 B	C2 versus C3 B
Gender (%)						
Men	78.862	87.097	76.364	.723	−.108	−.831
Women	21.138	12.903	23.636			
Age [mean (SE)]	38.593 (9.106)	40.883 (8.701)	40.630 (8.837)	−.025	−.025	−.001
Education (%)						
Junior high school	2.609	5.263	7.843	−.028	.011	.039
High school	48.696	43.860	43.137			
University degree	23.478	26.316	21.569			
Master's degree	13.913	12.281	15.686			
Ph.D. or other specialization	11.304	12.281	11.765			
ART (%)						
Yes	69.106	79.661	74.545	.346	−.052	−.398
No	30.894	20.339	25.455			
Viral load (%)						
<50	53.333	69.231	33.333	.624*	.004	−.620*
≥50 and ≤1000	6.667	19.231	33.333			
≥1000 and <10,000	6.667	3.846	6.667			
≥10,000	33.333	7.692	26.667			
CD4+ (%)						
>200 and ≤500	28.889	46.154	37.500	.319	.277	−.043
>500 and ≤1000	57.778	30.769	56.250			
>1000	13.333	23.077	6.250			

C1-M Class 1-moderate influence, *C2-L* Class 2-low influence, *C3-H* Class 3-high influence, *B* multinomial logistic regression coefficient

* $p < .05$

The results of the first analysis showed that gender, education, age and ART use were not significantly associated with the latent classes (see Table 6). The second analysis showed that the class membership was significantly associated with viral load but not with CD4+ cell counts (see Table 6). Greater viral load was observed among patients with high and moderate illness influence compared to the low illness influence perception profile.

Discussion

HIV infection is a chronic condition that requires great effort because of daily self-care (e.g., ART intake) and periodic medical screenings. Many different aspects of the infection affect patients' lives and may generate stress (Moskowitz & Wrubel, 2005), and patients' perception of their illness plays an important role because it can influence

daily self-care and responses to HIV-related stressors (Broadbent et al., 2009; Lazarus & DeLongis, 1983; Scharloo et al., 2000). Illness perceptions and coping strategies are significantly associated with patients' health outcomes (e.g., Ironson et al., 2005; Temoshok et al., 2008), and a better understanding of these relationships is of paramount importance in the clinical context of HIV care. For these reasons, we decided to verify if patients' illness perception profiles are associated with coping strategies adopted in response to HIV-related stressors, and ultimately to ART use and HIV-progression biomarkers (e.g., CD4+ cell counts and viral load). The three latent profiles identified differed on the dimension consequences, that is, the perception of HIV's influence on patients' lives. Thus, we labeled the three profiles as low, moderate and high illness influence perception. Further differences were observed with respect to emotional representation of HIV and perceived personal control. HIV-positive patients with a low perception of illness influence were characterized by a more positive emotional representation compared to those with moderate and high perception of illness influence. That is, a lower perception of HIV influence corresponds to a less negative emotional representation (i.e. lower concern) and greater perceived personal control. Overall, patients with moderate and high influence perception show what Devins et al. (1990) defined illness intrusiveness, namely the illness-induced interference with patients' lives that generates emotional distress and lower personal control (Devins, 1994). In addition, a significant difference between moderate and high influence perception profiles was related to symptoms perception; a greater identity score (that it, symptoms perception) was observed among patients with high influence perception. We hypothesize that a greater perception of HIV-related symptom intensity (identity) corresponds to greater perceived impairment in patients' lives and emotions (consequences and emotional representation). The difference between our results and those of McCorry et al. (2013) may be due to the different illnesses investigated (HIV vs. cancer) and the different analytic approach (latent class analysis vs. *k*-means cluster analysis).

Interestingly, of the illness perceptions tested, timeline, perceived illness duration, treatment control, the utility of the medications, and comprehensibility, the understanding of HIV illness, seem to not discriminate between patients. That is, patients do not differ significantly on their medical knowledge about HIV, the chronicity of the infection, or the need to use ART. However, greater variability was observed with regard to psychological aspects of HIV infection. We believe that these findings underline the need to assess and properly address the psychological aspects of HIV and not just the medical ones.

In line with our hypotheses, the patient profiles identified also differed on the coping strategies adopted in response to HIV-related stressors (cf. Leventhal et al., 1984). A low/moderate perception of illness influence corresponded to greater avoidance compared to the high influence perception profile. We hypothesize that a lower perception of HIV-related symptoms (identity) and illness influence (i.e., consequences and emotional representation) may lead patients to do less thinking about their condition. Accordingly, Mulder et al. (1999) suggested that avoidance in asymptomatic patients could be used to distract from the illness in order to elude illness-related difficulties. High and moderate illness influence perception, instead, correspond to passive coping, which consists of a lack of action in response to HIV-related stressors. This strategy might also be seen as patients' perception of helplessness or behavioral/cognitive disengagement because of their expectation of poorer coping outcomes (cf. Carver et al., 1989). In fact, lower perceived personal control, which characterizes both moderate and high influence perception profiles, might promote patients' expectations that their efforts at dealing with stressors will be unsuccessful. Furthermore, patients with a greater perception of illness influence could be at greater risk of using alcohol in response to HIV-related stressors. Conversely, a lower illness influence perception corresponds to lower alcohol use and greater adoption of positive reappraisal coping, which has a protective effect against psychological distress (van der Veek et al., 2007). We might expect lower illness influence perception to promote a more functional coping style, and ultimately to promote psychological well-being. Because of the cross-sectional nature of this study, we cannot establish the directionality of the relationships observed. Based on the literature discussed, we hypothesize that illness perceptions influence the strategies of coping adopted in response to HIV-related stressors. Further investigations are needed to determine the directionality of the associations found in our study.

An interesting result of our study is the association between viral load and the three profiles; overall, patients with greater (detectable) viral load are more likely to perceive the negative influence of HIV on their lives and emotions (consequences and emotional representation). Notably, only those who possess a high perception of illness influence also reported greater perception of HIV-related symptoms. This result might suggest that detectable viral load can be associated with a greater perception of influence on one's own life and emotions, regardless of the experience of the actual symptoms. No association between the profiles and CD4+ cell counts and ART use was observed, however, further investigation on a larger sample should be conducted in order to test these associations.

Taken together, our results support the association between illness perceptions and coping strategies. We believe that the relationships among between illness perception, coping strategies and health outcome in HIV-positive patients should be evaluated in a longitudinal study and with a larger sample of patients. We also hypothesize that the directionality and the effect of psychosocial factors might be better identified over time rather than cross-sectionally.

Our results regarding dysfunctional coping may be useful information for clinicians helping patients to optimize their coping and treatment outcomes (Ironson et al., 2005; Mulder et al., 1995; Reynolds et al., 2009; Temoshok et al., 2008; Weaver et al., 2005). In particular, the use of alcohol can be extremely harmful due to its negative effect on CD4+ cell counts and on the progression of HIV infection (Baum et al., 2010; Kiene et al., 2008; Pol et al., 1996). In conclusion, illness perceptions and coping strategies are two psychological aspects that care providers (e.g., physicians, nurses, psychologists and educators) working with HIV-positive patients can modify. The effect of interventions aimed at increasing personal control and restructuring patients' illness perceptions on coping, and ultimately on patients' well-being, should be evaluated.

Limitation and future direction

The main limitation of the study is the cross-sectional design; a longitudinal study might capture changes and the dynamic relations between illness perceptions and coping strategies. The use of convenience sampling (online sample) and self-reports may also limit the generalizability of our results. Lastly, the relatively small size of the offline sample might limit the findings about the association between illness perceptions and HIV-progression biomarkers.

Conflict of interest A. Norcini Pala and P. Steca declare that they have no conflict of interest.

Human and animal rights and Informed Consent All procedures followed were in accordance with ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2000. Informed consent was obtained from all patients for being included in the study.

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