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Health related quality of life and physical activity in prison: a multicenter observational study in Italy

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Background: Inmates have a poorer health status than the general population. The physical activity is well know that improve the wellness of the people. This multicentric cross-sectional study aimed to assess the relationship between Quality of Life (QoL) and physical activity levels among Italian prisoners. **Methods:** Inmates from eight prisons compiled a questionnaire. The *Metabolic* Equivalent of Task (MET) was used to measure inmates' weekly physical activity levels (MATwk). Their QoL was measured using two components of Short Form with 12 items (SF12): MCS (mental score) and PCS (physical score). **Results:** A total of 636 questionnaires were compiled. High level of MET was significantly ($P<0.05$) associated with both PCS (OR = 1.02) and MCS (OR = 1.03). The correlations between PCS, MCS vs. METwk scores were respectively significant: $r = 0.17$ and $r = 0.10$, $P < 0.05$. The number of years of detention was associated to higher MET (OR = 1.04 $P < 0.05$). The presence of Physical Exercise Areas (PEAs) within Jails did not improve the QoL level. **Conclusions:** Jails may not seem like the ideal place to fight sedentary behavior, but, in any case, health promotion can occur within its walls. The heterogeneity of Italian jails, and particularly relative PEAs therein (areas had different characteristics between jails), suggests that such spaces should be regulated or well defined. Furthermore, the implement of training schedules could be done in a standardized way. Despite this heterogeneity both the physical and mental components of inmates' quality of life were associated to a high level of physical activity.

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Introduction

Prisoners usually have a poorer health status than the general population.[1] Penal institutions are generally sickness-prone places, and are often overcrowded.[2] One aspect that afflicts penitentiary inmates is that they are at greater risk of unhealthy behaviors such as smoking, drug abuse, inactivity and irregular diet, factors that often lead to the development of a high rate of acute and chronic physiological and psychological disease. In particular, incarceration has been associated with sedentary habits, a known risk factor for diabetes mellitus, heart disease and other chronic disabilities.[3] The impact of the institution itself can contribute to an unhealthy living condition,[4] but it can also promote redemption.[1]

Concerning physical inactivity, it is now known that there is a connection between physical exercise and Health Related Quality of Life (HRQoL) in the general population. Exercise impacts not just physical mobility but its lack can also favor mental and sensory impairment.[5] Aerobic activities such as brisk walking, cycling, or even walking around the house or yard reduce the risks of developing coronary heart disease, hypertension, colon cancer and diabetes.[6] This association has also been seen in detention environments,[7–9] and two Italian studies suggest that physical activity in the prison population increases psychological wellbeing and reduces depression levels.[10,11]

The aim of this investigation was to extend a previous pilot study[11] in order to confirm the correlation seen between HRQoL levels and high levels of physical activity.

Methods

Participants

Participation was voluntary. All apparently healthy prisoners were invited to participate. The study excluded prisoners who had special regimes that did not permit them to have received outside visits, as outlined under the Italian law (as follows):

– regimens provided for by article 41bis/2O.P. (crimes of mafia, terrorism, exploitation of prostitution, criminal association);
– justice collaborators assigned to high security sections.

Materials and procedure

A cross-sectional design was adopted, and the STrengthening the Reporting of Observational studies in Epidemiology (STROBE) statement was applied to perform the study.[12]

The research protocol was approved by the ethical committee of Sapienza University of Rome.

This multicenter study was carried out in eight Italian prisons. The penitentiaries were selected on an opportunistic basis, and by consequence located in cities easily accessible by at least two researchers. In particular, three of them were houses of imprisonment. The other five were 'Casa Circondariale', which are detention homes where detainees await judgment or the inmates sentenced to a term of less than 5 years (figure 1).

Prison directors were contacted by the researchers and the aim of the study was explained. The educational and legal officers within
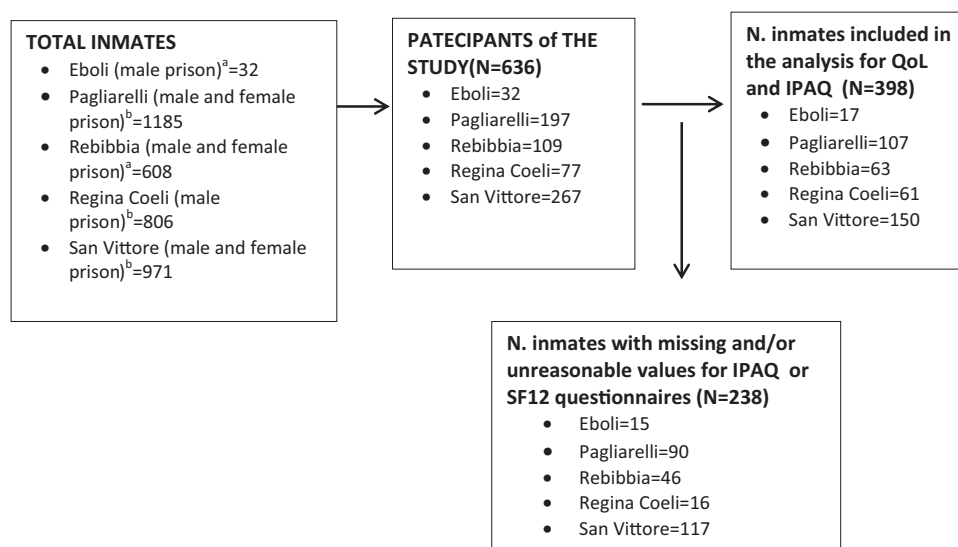
Figure 1 Flow-chart of inmates participating in the study and included in the analysis, divided by prisons (male and female structures were considered as the same jail)

jails were involved to support the researchers in the administration of the questionnaires with the aim of minimizing missing or inadequate answers. The questionnaire administration was conducted in small groups of about 25 inmates, an short introduction was given on the aims of the project and the importance of their participation. The study was conducted between September and December 2015.

The questionnaire

The questionnaire consisted of three sections: International Physical Activity Questionnaire (IPAQ),[13,14] QoL assessment using the Short Form 12 questionnaire (SF12)[15,16] and a demographic section.

The IPAQ questionnaire investigates the time spent carrying out vigorous and moderate intensity physical activity, walking and sitting. Total minutes per week was calculated by adding vigorous, moderate and walking activity, but only reasonable total sum were included in the analysis, which means the total minutes per week greater than 7980 (>19 h per day for week), or inferior than 420 min per week (<1 h per day per week) were excluded from the analysis.

The Metabolic Equivalent of Task minutes per week (MET-min/wk) was calculated. The MET is a physiological measure expressing the energy expenditure of physical activities, and it is established that the basal metabolic rate is typically 1.0 MET.[17]

The following formulas were computed:[18]

Walking MET-min/wk $=3.3$*walking minutes*walking days

Moderate MET-min/wk $=4.0$*moderate-intensity activity minutes*moderate days

Vigorous MET-min/wk $=8.0$*vigorous-intensity activity minutes*vigorous-intensity days

Total MET-min/wk= Walking MET-min/wk + Moderate MET-min/wk + Vigorous MET-min/wk

For each individual, the recorded activities were converted into *MET*-min/wk and then classified in three level of physical activity:[13]

– <3000 low;
– 3000–5999 moderate;
– ≥6000 high.

The SF12, with 12 questions, is a shorter adaptation of the Short Form Health Survey-36 (SF36). It is a measure of perceived health (HRQoL) that describes the domains of general physical and mental health status. Physical and Mental Composite Scales (PCS and MCS) are derived from an algorithm that combines the answers of the questions: the interpretation is that high scores correspond to high levels of health (range is: 0–100).[16]

The sociodemographic/anthropometric variables included in the questionnaires were: gender, age (years), nationality (Italian vs. non-Italian), civil status, educational level (illiterate, primary education, high school diploma, bachelor degree or third level education), children (yes/no), professional activity pre-reclusion, years of detention, smoking habits (yes/no), weight (kg) and Body Mass Index (BMI) (pre and post detection).

The outcomes examined were: PCS, MCS and MET-min/wk (METwk).

Statistical analysis

Descriptive statistics such as frequencies and percentages were reported for included qualitative variables, and recoded into dummies if needed. Continuous variables were described as mean, median, range, Standard Deviation (SD). For both types of variables, missing data were reported.

A univariate analysis was carried out for which the Kolmogorv-Smirnov Normality test was preliminarily applied. The test was then used to evaluate the mean difference between PCS or MCS, and METwk. The following statistical tests were used: Kruskall-Wallis and Mann–Whitney tests for non- normal distributions, and ANOVA and Student's *t*-test for independent samples for normal ones.

The correlation between continuous variables was evaluated using Spearman's coefficient. To evaluate the possible association between categorical covariates, the Chi-square test, or Fisher's Exact test whenever the sample size were rather small, was used.

Multivariate linear regression models were performed to study the relationship between quantitative outcomes; a multivariate logistic regression model was calculated for dichotomous outcomes 'MET-high': METwk was categorized into a two classes <6000 METwk = 0 and ≥6000 METwk = 1 in order to face with the possibility that maximum likelihood estimation of the logistic model suffers from small-sample bias. And the degree of bias is strongly dependent on the number of events in the less frequent of the two categories.

The inclusion of covariates within the model was decided on the basis of the univariate analysis: $P < 0.3$.

Table 1 Descriptive characteristics of the inmates studied

Qualitative variables		N	%	Missing
Gender	Male	498	78.3	0
	Female	138	21.7	
Civil status	Married	287	48.0	38
	Single	177	22.4	
	Divorced/separated/widower	134	29.6	
Having sons	Yes	397	64.4	0
	No	219	35.6	
Educational level	Illiterate/primary school	124	20.4	29
	Middle school	307	50.6	
	High school/university	176	28.9	
Working position before detention	Unemployed	90	17.0	108
	Employed	438	83.0	
Nationality	Italian	397	37.6	0
	Non Italian	239	62.4	
Continent	Europe	498	80.9	21
	Non-European	117	18.3	
Smoker	Yes	439	70.2	11
	No	186	29.8	
Number of cigarettes	No smoker	173	28.3	26
	1–10	128	20.9	
	11–20	209	34.2	
	>21	100	16.3	
Presence of Physical Exercise area	Yes	558	87.7	0
	No	78	12.3	
MET week groups	Low (<3000)	68	15.5	196
	Middle (3000–5999)	122	27.7	
	High (≥6000)	250	56.8	
Prison	San Vittore	221	34.7	0
	Palermo	197	31.	
	Regina Coeli	77	12.1	
	Rebibbia	109	17.1	
	Eboli	32	5.0	

Continuous variables	Median	min	max	mean	SD	Missing
Age	37.0	18.0	77.0	38.6	12.5	8
Years of detention	2.2	0.0	33.0	4.4	5.7	23
BMI at the beginning of detention	25.3	16.1	82.2	26.3	5.8	82
BMI at the time of the study	25.3	15.6	49.4	25.9	4.5	22
MET week[a]	6966.3	1386.0	43 146.0	8991.4	6597.3	196[a]
PCS	50.4	15.5	67.0	48.4	9.5	69
MCS	37.7	10.3	68.9	39.3	13.0	69

a: 99 were missing and 97 unreasonable values.

A Stepwise backward elimination procedure of non-significant variables (probability of entry $P < 0.05$) was subsequently used to generate a minimal model. The goodness of fit for the linear model was assessed with R^2 and the logistic model with Hosmer and Lemeshow's test.

Significance threshold was set at $P < 0.05$ (two-tailed) for all analyses.

The statistical analysis was carried out using Statistical Package for Social Science software (SPSS), version 21.0.

Results

Out of a possible 3602 prisoners from the eight jails approached. 636 were contacted to participate in the survey (18%).

The involved sample showed differences of composition in comparison to the total number of the prisoners in terms of gender and nationality ($P < 0.05$): 16% of the total males and 33% of total females were assessed; 21% of Italian inmates and 16% of the foreigners participated. There was no difference by age distributions between sample and population (data not showed) ($P > 0.05$).

The missing data did not present significant differences by educational level ($P = 0.210$). On the other hand, a significant difference with nationality was found: Italian inmates had a higher risk of missing the IPAQ items ($P = 0.015$; OR = 1.55) (data not showed).

The inmates that participated in the study are shown in figure 1, which also illustrates the number of prisoners taken into consideration for the MET and QoL analysis ($N = 398$).

The socio-demographic, anthropometric and attitudinal characteristics of the sample are described in table 1. Missing data for each variable are also reported. The mean age of inmates was 38.6 years (SD = 12.5; min = 18; max = 77), 498 were males (78.3%) and 397 were Italian (37.6%). The mean METwk was 8991.4 with SD = 6597.3 (min = 1386; max = 43 146), but 196 values were deemed as missing or unreasonable. Five of the eight jails (70%), corresponding to 87.7% of the prisoners, had at least one physical activity infrastructure or Physical Exercise areas (PEAs) (such as an outdoor fitness area or vegetable plot or soccer camp or volleyball camp).

The SF12 items and PCS and MCS summary scores are presented in table 1.

The mean PCS was 48.4 (SD = 9.5; 95%CI: 43.9–49.3), whereas the mean MCS was 39.3 (SD = 13; 95%CI: 34.8–40.2), respectively. In comparison, the mean PCS is close to the average value for the Italian general population (PCS = 48.6; 95%CI: 46.6–49.0), and the MCS is significantly lower (MCS = 49.9; 95%CI: 47.4–50.4).[16] The comparison of the prevalence in the sample of inmates and in Italian general adult population that meets recommended physical activity levels, shows that the two populations are similar, 63% (95%CI: 57.8–67.4) vs. 67%, respectively.[19,20]

Table 2 Multivariate linear regression models of the impact of demographic, anthropometric, jail characteristics on the Quality of Life and METwk

Covariates		PCS		MCS		METwk	
		B^b	P	B^b	P	B^b	P
Gender	Male[a]/female	–0.02	0.668	–0.124	0.011	–0.10	0.060
Civil status	Single[a]			c			
	Married	–0.003	0.964			–0.03	0.688
	Divorced/separated/widower	–0.12*	0.012*			–0.05	0.402
Educational level	Illiterate/primary school[a]						
	Middle school	0.02	0.779	0.02	0.740	0.03	0.565
	High school/university	0.05	0.297	–0.06	0.212	0.05	0.504
Number of cigarettes daily	No smoker[a]						
	1–10	–0.04	0.455	0.01	0.807	0.06	0.275
	11–20	–0.03	0.488	–0.05	0.344	0.02	0.68
	>20	–0.05	0.405	–0.14*	0.002*	0.05	0.360
Children	No[a]/yes	–0.034	0.573	c		c	
Nationality	Italian[a]/non Italian	0.09	0.091	–0.17*	0.001*	c	
Continent	European[a]/Non European	–0.06	0.410	0.04	0.531	c	
Physical exercise areas	No[a]/yes	0.04	0.909	–0.51	0.111	c	
METwk groups	Low <3000[a]					d	
	Middle 3000–5999	0.02	0.717	0.09	0.113		
	High >=6000	0.07	0.149	0.18*	<0.001*		
Jail	San Vittore[a] (Milan)						
	Pagliarelli (Palermo)	–0.12*	0.023*	0.04	0.479	–0.03	0.553
	Regina Coeli (Rome)	0.10*	0.047*	–0.10*	0.035*	0.03	0.55
	Rebibbia (Rome)	–0.07	0.208	–0.005	0.925	–0.03	0.599
	Eboli (Salerno)	0.009	0.860	0.03	0.503	0.06	0.279
Years of detention		–0.14*	0.007*	–0.06	0.287	c	
BMI at the beginning of the detention		–0.05	0.439	c		c	
BMI at the time of the study		–0.12*	0.014*	0.05	0.304	–0.04	0.448
Age (years)		–0.12*	0.030*	0.11*	0.021*	0.00	0.95
PCS		d		0.10*	0.052*	0.15*	0.003*
MCS		0.010*	0.04*	d		0.05	0.335
R^2 (Goodness of fit)		0.171		0.115		0.035	

a: Reference group.
b: Standardized coefficients.
c: Not included according to the univariate analysis.
d: The model considered this variable as outcome.
*: $P < 0.05$

The univariate analyses of PCS, MCS, METwk and MET-high are shown in Supplementary files. In particular having single civil status, no sons, Italian nationality, European continent origin, high METwk score and no presence of PEAs were all significantly associated with high values of PCS ($P = 0.001$, $P < 0.001$, $P < 0.001$, $P = 0.023$, $P < 0.001$ and $P = 0.002$, respectively). Having Italian nationality, European continent origin, lower number of cigarettes smoked and belonging to the high METwk group were associated to high MCS score ($P = 0.001$, $P = 0.031$, $P = 0.022$, $P < 0.001$, respectively). Moreover, METwk score was associated to gender ($P = 0.006$).

The correlation analysis (Supplementary files) shows significant direct associations between METwk and both PCS ($r = 0.165$; $P = 0.001$) and MCS ($r = 0.099$; $P = 0.048$). Furthermore PCS was inversely associated with age ($r = -0.231$; $P < 0.001$), BMI at the beginning of the detention ($r = -0.109$; $P = 0.015$), current BMI ($r = -0.106$; $P = 0.013$) and years of detention ($r = -0.136$; $P = 0.001$); MCS was directly associated with age ($r = 0.075$; $P = 0.045$), current BMI ($r = 0.100$; $P = 0.019$) and years of detention ($r = 0.076$; $P = 0.076$).

The first multivariate linear model studied PCS outcome (table 2). The covariates associated to lower PCS score were: being divorced, separated or a widower vs. being single ($b = -0.12$; $P = 0.01$), years of detention ($b = -0.14$; $P = 0.007$), being detained in Palermo vs. San Vittore ($b = -0.12$, $P < 0.02$), BMI at the time of the study ($b = -0.12$; $P = 0.01$) and age ($b = -0.12$; $P = 0.03$). The ones associated to higher PCS scores were: MCS ($b = 0.01$, $P = 0.04$) and Regina Coeli prison ($b = 0.10$, $P = 0.05$).

In the second model, the covariates were directly associated to MCS were: a total MET above 6000 ($b = 0.18$; $P < 0.001$) and age ($b = 0.11$; $P = 0.03$); whereas an inverse association was seen if: inmates were non Italian ($b = -0.17$; $P < 0.001$), smokers of more than 20 cigarettes ($b = -0.14$; $P < 0.001$) and Pagliarelli Jail vs. San Vittore Jail ($b = -0.10$, $P = 0.035$) (table 2).

In the third model, the outcome studied was METwk. It was directly associated to PCS ($b = 0.15$; $P = 0.003$) (table 2).

The R^2 ranged from 0.171–0.035 in the three models.

The table 3 shows the characteristics of the logistic regression model for MET-high outcome. The model suggested that the probability of having a higher MET score increased if inmates were: male (OR = 0.53, CI95%: 0.33–0.87); non Italian (OR = 1.78; CI95%: 1.14–2.78); older (see age: OR = 0.98, CI95%: 0.96–1); with many years of detention (OR = 1.04; CI95%: 1.00–1.09); and high PCS and MCS scores (respectively: OR = 1.02, CI95%: 1.00–1.05 and OR = 1.03, CI95%: 1.0–1.05).

Discussion

This investigation extends a previous pilot study[11] and strengthens the association found between the HRQoL and level of physical activity. More precisely it suggests that a consistent weekly level of physical movement (>600 METwk) is associated with a higher level of both mental and physical health components of the QoL scale.

Furthermore, the study identifies an association between these two components of the QoL too i.e. an increase of the physical

Table 3 Logistic regression model for MET-high

Covariates		MET-high[a]		
			CI95%	
		OR	inf	sup
Gender	Male[b]	1*		
	Female	0.53*	0.33*	0.87*
Educational level	Illiterate/primary school[b]	1		
	Middle school	1.11	0.74	1.70
	High school/university	1.26	0.68	2.32
Number of cigarettes per daily	Non smoker[b]	1		
	1–10	1.28	0.79	2.09
	11–20	0.92	0.55	1.55
	>21	1.17	0.65	2.10
Children	No[b]	1		
	Yes	0.92	0.58	1.46
Nationality	Italian[b]	1*		
	Non Italian	1.78*	1.14*	2.78*
Continent	Europe[b]	1		
	Non-European	0.82	0.42	1.61
Prison	San Vittore (Milan) [b]	1		
	Pagliarelli (Palermo)	0.69	0.43	1.37
	Regina Coeli (Rome)	1.32	0.69	2.49
	Rebibbia (Rome)	1.07	0.56	2.04
	Eboli (Salerno)	1.25	0.43	3.58
Age (years)		0.98*	0.96*	1.00*
Years of detention		1.04*	1.00*	1.08*
PCS		1.02*	1.00*	1.05*
MCS		1.03*	1.01*	1.04*
Hosmer and Lemeshow's test		0.095		

a: 'MET-high' categorizes the METwk score in a dichotomous variable: $\geq$6000 vs. <6000.
b: Reference group.
*: $P < 0.05$

wellbeing appears to be linked in some way to an increase in mental wellbeing.

Again, the years of detention and age were important aspects in the overall QoL assessment. In addition, the time spent on exercise, and the intensity of the bodily movement increased with age and years spent in prison. It is likely that inmates with long-term sentences and older individuals feel the need to organize interests/ activities in order to improve how to spend their time and to also achieve better life satisfaction: a systematic physical activity plan may help build a better social network.[21]

There are two main strengths of this study. First, the sample size was sufficiently large, and typically, in this type of research, the organization to collect data of the sample is complex and in addiction though the individuals involved very willing, they often found it difficult to talk and to express their opinion. Second strength of this study is that the missing data weren't statistically significant by gender, age and nationality when considering the overall characteristics of the sample studied.

Limitations

Substantial limits, however, were also present in this study.

There was a high rate of missing or unreasonable data. This problem was underlined in the pilot investigation.[11] In the present study, 'not speaking the Italian or English languages' or 'being unable to read' were contained with a large support of the researchers during the administration, this thanks to the past operating experience acquired. Nevertheless the investigation presented many missing values: the majority of missing data was found among Italian inmates. This is probably due to different causes such as the foreign prisoners asking more support during their compilation of the questionnaire and/or the researchers having paid more attention to those who doesn't speak Italian.

The goodness of fit in the models was low. It is probable that other covariates could better explain the QoL of inmates, although MET was still a significant predictor of the mental health component. In addition the questionnaire did not assess the presence of mental illness or comorbidities in the prisoner, and this could have an impact on the analysis due to a potential for unmeasured confounding.

Another limit is that although a sufficient percentage of total prisoners were covered, the sample had low representativeness to the overall prison population in Italy. The sample was built on a voluntary participation basis, and according to logistical and ethical reasons. It did, however, possibly raise awareness among the jail staff and prisoners, and this may be a way of increasing participation in future studies of this type. Much hard work was carried out in communicating the importance of the research and in the collection of questionnaires.

Furthermore the study design did not allow us to analyse whether a good level of physical activity led to a high quality of life or, on the contrary, whether a high quality of life stems from a good level of physical activity: the study cannot exclude the presence of reverse causality, especially due to the cross-sectional study design.

Another point of weakness is that the measurement of HRQoL was done using the SF12; the version Short Form 36 Health Survey with 36-item (SF36), could perhaps point out other components not examined in this study.

Some data could be affected by recall bias, such as initial weight or BMI measurement. Other shortcomings could also e present, such as educational biases linked to the different organization of school systems in other countries.

Finally, the presence of PEAs too is to be interpreted with caution. In fact, though the presence of spaces dedicated to physical activity is clearly important, no description of the characteristics of such spaces is collected (i.e. presence of training equipment, or how big a PEAs

was in terms of m^2). However, it is known that the PEA within the jails studied here was very different from prison to prison: in some cases, this was represented by a simple room or an open space without any fitness equipment, in other jails by a real gym, or playing fields, and one even had a vegetable plot. Ideally, the hope is that the space dedicated to physical activity acquires a clearer definition. A proper regulation based on accepted and appropriate measurement of these spaces should be imposed so that all prisons could follow such guidelines.

In view of these considerations, it suggests that physical exercise could be used as an important component of a multifaceted approach to reducing psychological ill health in prison populations. Increased exercise volume is correlated with decreased hopelessness.[22] Though correlation was statistically significant but weak, due to the complex nature of prisoners health, the potential to decrease rates of self-harm and improve mental health provides further impetus to include exercise regimens as an integral factor within inmate health management plans. There is a definite relationship between supervised exercise and improved mental health among sentenced prisoners. It is likely that a complex interaction and sense of efficacy and mastery, or perhaps simple distraction, may lead to a change in self-conception.[10] Physical activity teaches discipline, record keeping, goal-setting, and employs inmates' leisure time thus reducing boredom and 'burns off' tension.[23]

According to the Italian Constitution 'punishments must aim at rehabilitating the condemned'[24] in order to return healthy and renewed persons to the community, the physical activity could be confirmed as a major positive aspect for inmates' detention.

Jails could be the ideal place for physical activity promotion, through the creation of training programs that are simple, effective and cost effective ways.[11]

Conclusions

The findings underline that physical and mental components of QoL are linked to physical activity and, in particular, to a more intense physical activity level. The cross-sectional study did not establish clear casual relationships, but it is likely that investing in fitness areas, implementing programs promoting physical activity, with due precautions and consideration of the variability of cases, could allow for better health conditions in Italian prisons, as well as decreasing the rates of potential self-harm and support rehabilitation of inmates.[25]

However, it is observed that the prevalence of recommended level of physical activity and mean of PCS were not significantly different from those of the Italian general adult population; on the other hand, the mental health score was significantly worse. It would be worthwhile to conduct other experimental studies to investigate this causal relationship, because knowing how to achieve and maintain a good quality in one's own life is a prerequisite to a better social reintegration at the end of detection.

Key points

- The physical and mental components of inmates' Quality of Life were associated to a high level of physical activity.
- The quality of life is directly proportional to time spent in physical activity.
- High heterogeneity was found in the Jails concerning the physical exercises areas and fitness equipment.
- The models studied indicated that the Quality of Life is associated to several aspects of the prisoner's life and the physical activity would seem an aspect currently not essential.

Supplementary data

Supplementary data are available at *EURPUB* online.

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