

# Resilience Role between Parental Psychological Control, Youth Problematic Internet Use and Depression: Mediation And Moderation Models

Loladze T.<sup>1</sup>, Okribelashvili N.<sup>1</sup>

## Abstract

**Background:** Various studies showed association between parental psychological control and students problematic internet use as well as depressive symptoms. It is known also protective role of resilience in behavioral addictions. Although it isn't clear the path and relationship (interplay) between adverse factor such as psychological control and resilience in developing mental health outcomes.

**Objective:** we aimed to understand the path through which students who undergo parental psychological control develop depressive symptoms and problematic internet use patterns. We proposed mediating model through which resilience mediates such a relationship.

**Methods:** We conducted a population-based cross-sectional survey of 1170 university students in Tbilisi. The data were collected by a self-administered questionnaire. Multivariate Logistic regression was used to estimate the mediation of resilience.

**Results:** The findings revealed that Resilience partially mediated the relationship between parental psychological Control (PPC) and Problematic Internet Use (PIU). Also Resilience moderated the relationship between Parental Psychological Control (PPC) and depression.

**Discussion, Conclusion:** The findings of the present study suggest that resilience acts as protective factor in preventing PIU through mediation and also through reducing depressive symptoms among Georgian students.

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**Keywords:** Students; Problematic internet use; Resilience; Depressive symptoms; Parental psychological control; Mediation; Moderation.

## Introduction

Last 20-25 years scientific research shows that adolescents' internet use and the psycho-social risks linked to it increased significantly (2,3,4,5,14,16,26,46). It is well documented that major problematic internet users are youth, adolescents and students (2,3,4,16). Some study evidences that 98-99% of youth are using internet(2). and problematic use of internet varies from 0,8% in Italy, western Europe 6%, in Asian countries: China, Taiwan, South Korea up to 30% (2,4,7).

There isn't yet commonly accepted conceptual frame for PIU (2,5,7,26) among researchers. Ferrante L. in her recent study categorized PIU into 2 groups: 1) Components model or behavioural addictions 2) CBT model or independent disorder(1,5,7,10,26).

der(1,5,7,10,26).

Significant part of the clinicians considers PIU as a behavioural addiction. Specifically, Internet gaming disorder(IGD) is enlisted in DSM-V as a condition for further study. Such an approach primarily was used by Yung K., who described Internet Addiction as an impulse control disorder the same way like gambling disorder. In describing Internet Addiction (IA) and IGD some research is based on the characteristic components of behavioural addictions(1,7,16).

On the other hand Cognitive-behavioral theory doesn't see PIU as a part of behavioral addictions. This model has as its foundation unique communicative characteristics of internet as medium. In consistence with this theory development of PIU is caused by distorted cognitions which is followed by compulsive use if internet and its negative consequences(1,2,7).

Within these two categorical groups researchers developed several psychosocial theoretical models. Within behavioural addictions: Social Displacement, the Mood Enhancement, Self-Medication, Distress Escapism, Bio-Ecological, Bio-Psycho-Social models(7).

Within CBT theory: social skills; Self-regulation; Compensatory Satisfaction models(2,7,13). Interesting model was proposed by the researchers Kardefelt- Winther – compensatory model. From this perspective PIU is considered as a coping mechanism in certain situations with negative conse-

From the <sup>1</sup>Faculty of Medicine, Iv.Javakishvili Tbilisi State University, Tbilisi, Georgia.

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Address requests to: Tamar Loladze

E-mail: tamar.loladze836@med.tsu.edu.ge

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quences. Study suggests that adolescents satisfy their psychosocial needs via online activities which seem easy to access and attractive. This motivation could explain excessive use in spite of negative consequences for health and wellbeing. For better understanding of this model we need more mediation studies as well as to consider more life context (13).

Through the years of the research there are accumulated data about the association of PIU with different psychological problems as: ADHD, Depression, impulsivity, obsession (3,4,5,18,32). Although there is not enough data about the direction and mechanisms of such associations. We need still additional studies in this direction. It isn't well known are there independent parallel processes or is there causality between them (5). For example some study indicates that PIU could aggravate depressive symptoms and other mental conditions. Another group of research showed that depression could act as a predictor of PIU (20,22,27,41,45,48).

Recent research trend of PIU is inclined more towards contextual understanding of PIU by which PIU should be understood as a consequence of an interplay of complex social processes (2,35,42,47). It is important to consider cultural context as well. More studies pay attention to social aspects of the internet use as well as the psycho-social developmental age of the users and the need for self-determination (39,40). This view is condoned by a biopsychosocial approach, where PIU can be considered as a result of the interaction of these factors. (7, 13).

As it is already known adolescence is the age of increased challenges. Early adolescents need to develop peer relationships and sense of belonging. In late adolescence, students need to adapt to changing environment such as leaving home and adapt to the University life. In this difficult periods environment and students ability to overcome stress and difficulties has great importance.

In the literature it is well documented the association of these environmental factors with PIU, particularly family factors (2, 35,42,47). Although it is lack of studies related to underlying mechanisms. We need to know these mechanisms to understand more the PIU. Also it will give us the possibility to implement correct prevention and treatment programs with the focus on the relevant factors. Parental psychological control (PPC) is one of the most important environmental factors, though less studied (17), which impacts youth PIU. (4,26,20). We can define PPC as a negative parenting type which seriously harms adolescent's well-being. PPC is defined as: deprivation of love, devaluation of feelings, blame inducing (39,40). The purpose of psychological control is to keep adolescents dependence from the parents and interfere autonomy and self-determination. These needs are frustrated and consequently, internalized and externalized problems develop (17,38). It is well documented association of PPC with such psychological problems as: depression, anxiety, addiction (4, 18,23,36,45,39,40).

Although we need to know more about underlying mechanisms of these associations, how protective factors contribute to these processes.

Present study aims to investigate the relationship between parental psychological control (PPC) and problematic internet use (PIU) and underlying mechanisms, specifically, the role of resilience in developing of PIU in students (45,48).

Resilience is studied in developmental psychology. Active research began in 60's. In the beginning it was linked with attachment theory. Research reached its peak in the 80's (30,32,25,43,49). Masten defines resilience as coping with distress and challenges so that in this process individual organism maintain satisfactory level of functioning. Resilience is a

“multidimensional concept, including process, dynamic, capacity, and outcome dimensions” (25,32). In the beginning Resilience was considered as an ability of an individual which develops during the adaptation process to the stressful life events. According to this theory resilience consists of several different characteristics. Researchers separated internal qualities – abilities and external – resources which can be activated when individual is exposed to stressful event. More contemporary view condones an idea of resilience as a process, dynamic adaptation to the challenges. Its activation depends on the strength and a type of stressful event.

Besides there is an amount of studies about protective role of resilience for organism against different psychopathologies. Particularly, it is well known its role in the prevention and rehabilitation from the substance use dependence (30,32,33). Research shows that resilience operates as a buffer between risk factors and PIU as well (37).

Considering this we aimed to explore the role of resilience in developing PIU in Georgian students which suffer from the PPC. PPC here can be considered as a chronic prolonged stressor. We suggest that students with low functioning resilience because of the Parental Psychological Control, develop internalized and externalized problems, such as depression and PIU.

Also we suggest that resilience could mitigate the negative impact of PPC. From the above we developed several hypotheses:

- H1. the effect of PPC on PIU is mediated via resilience (model 1)
- H2. the effect of PPC on Depression is mediated via resilience (model 2)
- H3. resilience moderates the path between PPC and PIU (model 3)
- H4. Resilience moderates the path between PPC and depression (4)
- H5. resilience mitigates the effect of PPC on PIU (model 5)

## Method

### Sample

A purposive sampling method was performed in students of Tbilisi State University. This technique consists in recruiting all available units who are willing to participate and meet the inclusion criteria in the study. Students were eligible to select following the criteria: (1) Age range 17-25; (2) being volunteer; (3) living in Georgia; A total of 1349 participants were recruited. The participants with missing values were excluded. There were 1170 participants for the main analysis.

### Procedure

Study was conducted from the December of 2021 to January of 2022. Students were asked to complete demographic form and 4 instruments: Depression Scale, Resilience Scale, PIU Questionnaire and Parental Psychological Control Scale. Data were collected online. Participants were informed about the purpose of the study, voluntarily participation and confidentiality. Institutional Review Board approval was obtained from the Ethics Committee of Center for Mental Health and Prevention of Addiction.

## Instruments

Demographic form: This form was developed by the researchers to obtain information about participants personal information including sex, age, education, Internet use profiles including years of use internet, most common Internet use type, and information about Covid-19 and related limitations impact on the participants.

All 4 instruments were previously translated in Georgian language and adapted. We performed Internal reliability analysis and EFA for the instruments. They demonstrated good reliability and validity.

### Dependency oriented and Achievement oriented Psychological Control Scale(DAPCS):

This measure was developed by B. Soenens et al.(Dependency-Oriented and Achievement-Oriented Psychological Control Scales (DAPCS; Soenens, Vansteenkiste, & Luyten, 2010). The scale consists of two subscales: dependency oriented psychological control and Achievement oriented psychological control. Each of them 10 items which are assessed by 5-point Likert scale ranging from 1(strongly disagree) to 5(strongly agree). The cronbach alpha value calculated in this study was 0.95

### The nine-item version Problematic Internet Use Questionnaire (PIUQ-9) in different languages

Measure was developed by Z. Demetrovic et al. it demonstrated good psychometric properties during different studies. Questionnaire measures 3 factors: obsession, neglect, control disorder and comprises of 9-item. 5-point Likert scales with answers from 1(never) to 5(always/almost always). Cronbach alpha for this scale was 0.84.

### Connor-Davidson Resilience Scale 10 (CD-RISC-10)

It is widely used scale to assess resilience. First it was developed 25-item scale, then

Shorter 10-item version which demonstrated better psychometric properties. Answers were assessed by 5-point Likert scale from 0(not true at all) from 4(true nearly all the time). Cronbach alpha for this study 0.87

### 6-ITEM Kutcher Adolescent Depression Scale

– was developed by S. Kutcher, 2008. It demonstrated good psychometric properties for this sample. Cronbach alpha was 0.87. Answers were assessed with 4-point Likert scale from 1(hardly ever) to 4(all of the time).

## Data analysis

Firstly, descriptive statistics were summarised using the means and standard deviations for continuous variables and frequencies for categorical variables. Further, independent samples t-test and one-way analysis of variance (ANOVA) were used to investigate the associations of sex and purpose of internet use with mean scores of problematic internet use and depression. Similarly, one-way ANOVA was utilised to investigate the relationships of the effect of COVID19-related restrictions (ordinal exposure) with PIU and depression (continuous outcome), and the post-hoc Tukey test was used to explore which specific exposure group's mean was significantly different.

We used mediation analysis to investigate whether the indirect effect of parental psychological control on problematic internet use (model 1) and depression (model 2) was mediated via resilience. Similarly, we used mediation analysis to investigate whether the indirect effect of parental psychological control on problematic internet use was mediated via depression (model 5). Figures 1 to 3 show conceptual diagrams of the above mediation models. Next, we used moderation analysis to investigate whether the resilience moderated the effect of parental psychological control on depression (model 3) and problematic internet use (model 4). Figures 3 to 4 show conceptual diagrams of the above moderation models. Finally, we used moderated mediation analysis to investigate whether the indirect effect of parental psychological control on problematic internet use via depression was moderated by resilience (model5). Figure 5 shows a conceptual diagram of this moderated mediation model. The mediation models quantify the indirect effect as the product of the exposure to the mediator and the mediator to the outcome effects. Ordinary least squares regression models with a continuous outcome, continuous predictor and mediator, and continuous moderator were used to produce direct and indirect effect estimates with 95% percentile bootstrap confidence intervals based on 5000 bootstrap iterations. The effect is significant if the 95% CI does not include zero. We modelled several models as presented below.

We used IBM SPSS statistics 25.0 (IBM, Chicago, Illinois, United States) and PROCESS macro, model 4 to model mediation analyses, model 1 to model moderation analyses, and model 7 to model moderated mediation analysis.

Figures and models you can see in Appendix 1.

## Results

### Descriptive Statistics

Table 1 shows the descriptive statistics and their relationships with problematic internet use and depression. The mean age was 19.49 (SD=1.73) years, and 78.2% were females. The majority of participants (49.1%) used networks for study or work, followed by social networking (33.0%) and musical videos/films (12.6%). The average scores for parental psychological

control, resilience, depression and problematic internet use were 36.68 (SD=18.05), 26.65 (SD=8.12), 15.96 (SD=4.85), and 24.91 (SD=7.70), respectively. Further, 11.6% of participants had high-risk problematic internet use. Females had significantly higher mean scores for problematic internet use and depression compared to males. Participants who used the internet for social networking, watching music videos, or films had significantly higher mean scores of problematic internet use compared to the participants who used the internet for study/work. However, there was no significant difference between the purpose of internet use and depression.

### Association of COVID-19 related restrictions and worries with problematic internet use and depression

Table 3 shows the associations of the effects of COVID-19 related restrictions and worries with problematic internet use or depression. The COVID19 related restrictions significantly affected the problematic internet use and depression. Specifically, the participants with changes in the frequency of fast-food intake, sleep regime, frequency of physical activity, frequency of alcohol intake, tobacco and substance use had significantly higher mean scores in problematic internet use and depression than those without such changes. Next, compared to the participants who had severely worsened economic and financial conditions due to COVID-19, the participants with less and moderately worsened/no change or improved economic and financial conditions had significantly lower mean scores in problematic internet use and depression. Further, participants very much worried about maintaining social connections, discontinuation of the learning process, domestic violence or aggression, and limiting fun and other recreation activities had significantly higher mean scores in problematic internet use compared to the participants who did not worry about such areas of life. However, the participants who were little/quite and very much worried about domestic violence or aggression had higher mean scores in depression compared to the participants without such worries.

### Mediation analysis

Figure 6 shows the statistical diagram of model 1. It shows whether the effect of parental psychological control on problematic internet use was mediated via resilience. There was a positive direct effect of parental psychological control on problematic internet use (beta=0.105, 95% CI 0.082, 0.128; 88% of the total effect), and a positive indirect effect of parental psychological control on problematic internet use mediated via resilience (beta= 0.014, 95% CI 0.007, 0.022; 12% of the total effect).

This model indicated that parental psychological control increased problematic internet use directly and indirectly via resilience. Specifically, with regard to indirect effect, the parental psychological control increased problematic internet use through its effect on the reduction of resilience (because 'a' was negative, meaning those with higher parental psychological control scores had lower resilience scores), which in turn was related to increased problematic internet use scores (because 'b' was negative; those

with low resilience scores had higher problematic internet use scores).

Figure 6. Statistical diagram of model 1-mediation analysis: parental psychological control (PPC) as a continuous predictor, problematic internet use (PIU) as a continuous outcome, and resilience (RES) as a continuous mediator. Both results were significant.

Figure 7 shows the statistical diagram of model 2. It shows whether the effect of parental psychological control on depression was mediated via resilience. There was a positive direct effect of parental psychological control on depression (beta= 0.092, 95% CI 0.078, 0.105; 87% of the total effect), and a positive indirect effect of parental psychological control on depression mediated via resilience (beta= 0.014, 95% CI 0.008, 0.021; 13% of the total effect).

This model indicated that parental psychological control increased depression with its direct effects and indirectly via resilience. Specifically, with regard to indirect effect, the parental psychological control increased depression through its effect on the reduction of resilience (because 'a' was negative, meaning those with higher parental psychological control scores had lower resilience scores), which in turn was related to increased depression scores (because 'b' was negative; those with low resilience scores had higher depression scores).

Figure 8. Statistical diagram of model 5-mediation analysis: parental psychological control (PPC) as a continuous predictor, problematic internet use (PIU) as a continuous outcome, and depression (DEP) as a continuous mediator. Both results were significant.

### Moderation analysis

Figure 9 shows the statistical diagram of model 3. It shows whether resilience moderated the effect of parental psychological control on problematic internet use. The parental psychological control significantly increased the problematic internet use (beta= 0.092, 95% CI 0.020, 0.164). However, parental psychological control X resilience interaction term was not significant (beta= 0.005, 95% CI -0.002, 0.003).

Therefore, the model indicated that parental psychological control increased problematic internet use, but resilience did not moderate the effect of parental psychological control on problematic internet use.

Figure 9. Statistical diagram of model 3-moderation analysis. Parental psychological control (PPC) as the predictor, problematic internet use as the outcome (PIU), and resilience (RES) as the moderator. Both results were significant.

Figure 10 shows the statistical diagram of model 4. It shows whether resilience moderated the effect of parental psychological control on depression. The parental psychological control significantly increased the depression (Beta=0.050, 95% CI 0.009, 0.091). The parental psychological control X resilience interaction term was significant (beta= 0.002, 95% CI 0.001, 0.003). Further, the conditional effect of parental psychological control on depression was significant at all the levels of resilience (mean-1 SD = 18.53: beta= 0.079, 95% CI 0.062, 0.097; mean = 26.65: beta= 0.092, 95% CI 0.079, 0.105; mean + 1 SD = 34.77: beta= 0.105, 95% CI 0.087, 0.123).

Therefore, the model indicated that parental psychological control significantly increased depression. Further, resilience moderat-

ed the effect of parental psychological control on depression. Interestingly, the magnitude of the moderation effect of resilience was increased with the level of resilience. Specifically, individuals with higher resilience scores (mean+1SD) had lower depression scores for the same parental psychological control scores compared to individuals with lower resilience scores (mean-1SD) (Figure 10).

Figure 10. Statistical diagram of model 4-moderation analysis. Parental psychological control (PPC) as the predictor, depression as the outcome (DEP), and resilience (RES) as the moderator. Both results were significant.

Figure 11. Simple regression lines of parental psychological control on depression under different resilience levels.

## Moderated mediation analysis

Figure 12 shows the statistical diagram of model 5. It shows the ability of depression to mediate the effect of parental psychological control on problematic internet use with resilience moderating the effect of parental psychological control on depression. There was a positive direct effect of parental psychological control on problematic internet use (beta=0.046, 95% CI 0.023, 0.070). The parental psychological control X resilience interaction term was significantly predicted the depression (beta= 0.002, 95% CI 0.001, 0.003). There was a significant moderated mediation effect of parental psychological control on problematic internet use via depression (index of moderated mediation: beta= 0.001, 95% CI 0.001, 0.002). Further, the conditional indirect effects of parental psychological control on problematic internet use were significant at all the levels of resilience (mean-1 SD = 18.53: beta= 0.054, 95% CI 0.043, 0.066; mean = 26.65: beta= 0.063, 95% CI 0.052, 0.074; mean + 1 SD = 34.77: beta= 0.072, 95% CI 0.057, 0.087).

This model indicated that parental psychological control increased problematic internet use directly and indirectly via depression. Specifically, with regard to indirect effect, the parental psychological control increased problematic internet use through its effect on the increase of depression (those with higher parental psychological control scores had higher depression scores), which in turn was related to increased problematic internet use scores (those with higher depression scores had higher problematic internet use scores). However, the indirect effect of parental psychological control on problematic internet use was moderated by resilience, by moderating the effect of parental psychological control on depression.

Figure 12. Statistical diagram of model 6 - moderated mediation analysis: parental psychological control (PPC) as a continuous predictor, problematic internet use (PIU) as a continuous outcome, depression (DEP) as a continuous mediator, and resilience (RES) as a continuous moderator.

## DISCUSSION

### Resume

This study explored the role of Resilience in the relationship between Parental Psychological control and PIU, depression. More specifically we investigated if PIU and depression in Georgian students are caused by Parental Psychological control via resilience and if the ability of the youth to adjust to stressful events could impact on the strength of these relationships.

## Descriptive analysis

Findings we can divide in two parts: epidemiological analysis and mediation analysis. In present sample more risky internet users were among females which is consistent with studies(2,14,6,29) also study revealed that significant part of users with higher risk of problematic internet use were social networking and watching videos. In recent years more attention is paid to social networking. These data are different from some studies where more problematic users were males playing games(20,28,47) or sex is not significant factor (22,26). These findings could indicate that online activities are more attractive to students than offline entertainment.

Findings show stronger correlation between covid-19 related restrictions and PIU than with depression. One possible explanation could be shorter time of impact of these restrictions which evoked only behavioral changes in students. In comparison with PPC which acts as a prolonged stressor able to evoke deeper emotional impact on students' health and well-being.

## Mediation analysis

First we investigated the association between Parental Psychological control and Problematic Internet use. Results indicate that PPC has direct as well as significant indirect effect on PIU through resilience.

Next we examined the mediation between Parental Psychological control and depression. Results were consistent with previous studies, specifically PPC was negatively associated with resilience and resilience was negatively associated with depression. We also did moderation analysis as we suggested that change in resilience scores could impact on the strength of the relationship between risk factor and outcomes(PIU, depression). Our results showed that resilience has moderating effect in the second case only.

## Interpretation of the results

Most studies of protective factors are correlational (18,28,29,48), We wanted to explore moderating and mediating role of resilience in the face of the risk factor, PPC.

In line with our first hypothesis findings showed that resilient students have lower risk to develop PIU when they experience parental psychological control.

Changing in resilience scores doesn't increase significantly its impact on this relationship which contradicts to our hypothesis 3. Meanwhile higher scores of resilience revealed significant negative association with PPC and significant negative association with depression. Higher scores of resilience can reduce depressive symptoms with same scores of PPC. which means that in students with depressive symptoms resilience can impact on PIU by reducing depression. These findings we demonstrated in model 5, fig. 5.

This model is coherent with the theory of PIU as a coping with negative feelings, Compensatory model. In this model resilience acts as protective-compensatory factor. According to our findings resilience is protective factor in the path with depression as an outcome (our model 4) and a compensatory factor with PIU as an outcome (model 3) (6,8).

In the compensatory model of resilience protective factor neutralizes the impact of the risk factor. Its impact on the outcome varies

able is contrary of the risk factor. This impact is partially independent and direct. Compensatory factors have additional influence on predicting the outcome as in our study(49).

Protective model of resilience shows that protective factors change the relationship between risk and outcome. It has two mechanisms: risk protective and protective-protective. In our study resilience moderates the relationship between PPC and depression by reducing depressive symptoms. This models can be tested with SEM as we did(45).

Interestingly, we've found out with this study that resilience in specific situations could act as mediator and as a moderator in the same time. Particularly, in the association between PPC and depression. In another words it can explain the relationship between independent and dependent variables and can change the strength of this relationship.(9,12) Some authors point out that mediator can begin to function as a moderator, can change the strength of the relationship in realization of which it takes part at the same time.

## Implications

From the research of risk factors authors agree that family factors are among the most significant in developmental process(11). Specifically, Parental Psychological control inhibits autonomy and interferes development of individual's psychological resources. (39,40). Studies show that aversive effect of PPC is stronger in adolescence because of the increased need in autonomy, it inhibits adolescents sense of self and adaptive abilities to the challenges(40), which can lead to develop depression and PIU (39).

Our findings suggest that environmental factors play significant role in developing internalized and externalized problems in youth. These factors interact differently with students adaptive capabilities. Present study shows that development of PIU in students more likely proceeds with compensatory mechanisms(2,7,13). If we consider PIU as a coping mechanism, it seems as a part of a continuum where internet use becomes problematic when it interferes students functioning (7).

In our investigation, interestingly PPC acts as an important environmental risk factor which is associated with development of psycho-social consequences even in late adolescence and young adults. (18,23). Studies show that PPC impacts adolescents mental well-being beginning from the early adolescence, it's impact increases and reaches it's maximum by the age of 17 and than stops augmenting. (31), as authors of this study point perceived PPC doesn't decreases even after that and is quite strong in emerging adulthood. It is coherent with the findings of our study as well. Result's show that negative impact persists over the years.

Present study shows PPC significance for the students well-being even when this factor possibly stops it's direct impact and can be revealed as perceived interiorized risk factor. This suggestion could explain existence of problems in late adolescence such as: depression, lack of motivation, skipping study, isolation (17,38).

Our study findings could allow us to interpret PPC as culturally sensitive phenomena which is coherent with other researches. In more collectivist societies its harm can be even more strong as it is somehow considered as normal part of educating adolescents(21). Interesting data can be obtained with comparative or crosscultural studies. In these conditions it's even more important to encourage students autonomy(40).

Researchers agree that resilience is complex construct. it isn't a static number of qualities or abilities which is available in every stressful situation for the individual, but as a process as well(25). In this case resilience appears to be momentary answer to the concrete situation, which is activated in given present moment. Such view creates possibilities to develop more adaptive answers to challenges by contrast with static view of resilience. In process view more significance has choice made by the individual in given situation and linked with the personal autonomy. It seems more important to enhance autonomy in youth which are vulnerable because of the increased need. And the psychological control inhibits autonomic decision making in adolescents. From this study results we can say that higher scores of resilience enhance better adaptation to the chronic stressor such is psychological control and reduces the risk of developing internalized and externalized problems.

The study results about resilience mediating/moderating role add clearer understanding to our knowledge about mechanisms of resilience. It's important to understand in which circumstances which coping mechanisms uses adolescent to overcome challenges and maintain satisfactory level of functioning. In our case, resilience can be enhanced in youth with PIU considering existence of depressive symptoms. As we can see enhancing resilience can reduce depressive symptoms which can be beneficial for problematic internet users too. There is different data about PIU students who also have depressive symptoms.

There is no consistent data about relationship between PIU and depression. Several studies demonstrated this association. Some data confirms the idea of depression being predictor of PIU, depression as a consequence which aggravates PIU(15,41,22,27,20,45,48), or it can be independent parallel process within individual. Present study highlights the relationship between PIU and depression under interesting angle. Specifically, in students who undergo parental psychological control more likely depression predicts PIU. Though high resilience can reduce depressive symptoms and thus influence PIU. These findings are coherent with the Escapism and Compensatory theory of PIU with Protective-Compensatory role of resilience.

Our findings suggest that while evaluating students risky behavior clinicians should pay attention to depressive symptoms in order to timely refer to the specialists and to choose relevant treatment or prevention strategies.

## Limitations:

We need to interpret our results with cautions for several reasons. First, cross sectional design is limiting us to deduce causality of presented models. Second limitation is non representative sample in spite of it's size, the study was carried out on the students of Tbilisi State University which may limit the generalizability of the results of the study. Future studies may be carried out on a different age and cultural groups. Also for our research we used self-report scales and cut-off points for the data analysis, and data should be interpreted with caution in comparison with clinically diagnosed PIU and depression.

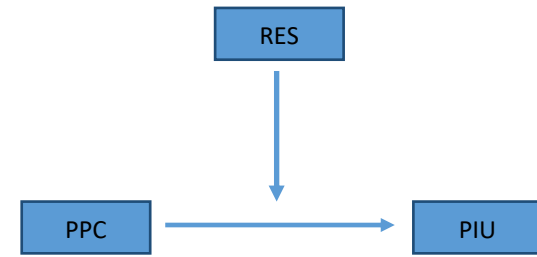
## CONCLUSION

We explored the role of resilience in the relationship between parental psychological control in late adolescents and PIU. In this study resilience protects students from the risk of PIU mediating the

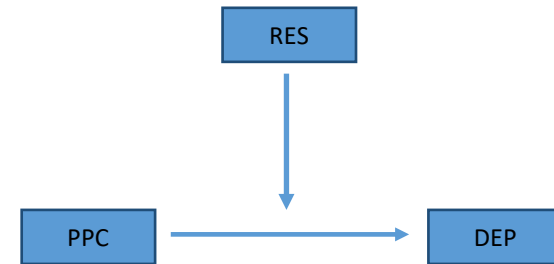
relationship between PPC and PIU and also by reducing depressive symptoms. Interesting fact is perceived strong impact of parental psychological control in late adolescence and young adults. Future studies should be conducted using structured interviews and prospective designs. Development of PIU seems to be compensatory and in this model depression predicts PIU. Also present study demonstrates gender difference between problematic internet users. There are more female risky users. And there are more risky users among social networking and watching entertaining videos. Covid-19 related restrictions found to impact students risk of develop PIU more than depression.

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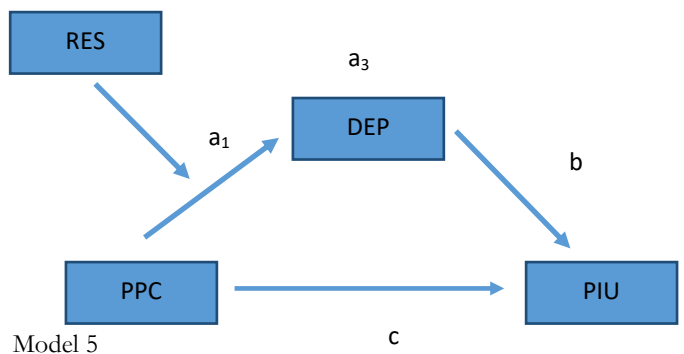
**Competing interests.** The authors have declared that no competing interests exist.



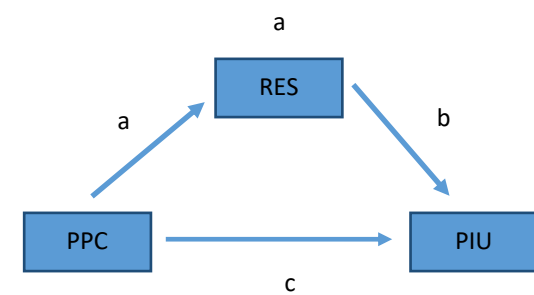
Model 3



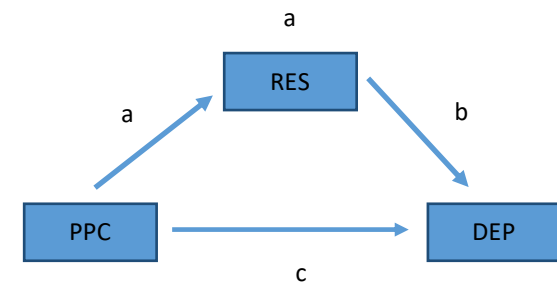
Model 4



Model 5



Model 1



Model 2

**Table 1. Descriptive statistics and their relationships with problematic internet use and depression.**

Variable	n =1170	Problematic internet use		Depression	
		Mean (SD)	Mean difference (95% CI)	Mean (SD)	Mean difference (95% CI)
Age, mean (SD)	19.49 (1.73)				
Sex, %					
Male	21.8	21.89 (7.02)	Ref	14.06 (4.78)	Ref
Female	78.2	25.75 (7.67)	<b>3.86</b> (2.81, 4.90)	16.50 (4.73)	<b>2.43</b> (1.77, 3.09)
Purpose of internet use, %					
Study/work	49.1	23.66 (7.50)	Ref	15.66 (4.97)	Ref
Gaming	2.3	23.18 (6.74)	-0.48 (-4.54, 3.58)	15.44 (4.96)	-0.21 (-2.82, 2.38)
Social networking	33.0	26.85 (7.78)	<b>3.19</b> (1.83, 4.54)	16.30 (4.62)	0.64 (-0.22, 1.51)
Music videos/films	12.6	25.76 (7.29)	<b>2.10</b> (0.20, 4.00)	16.76 (4.73)	1.10 (-0.12, 2.31)
Shopping and other	3.0	21.54 (7.37)	-2.12 (-5.71, 1.47)	14.31 (5.06)	-1.34 (-3.64, 0.95)

SD: standard deviation; CI: confidence interval Ref: reference.

Mean differences and 95% confidence intervals for sex were derived from independent samples t-test, and for the purpose of internet use were derived from analysis of variance (ANOVA) with post-hoc test Tukey. Bold results were significant.

Variables	N=1170
Parental psychological control, mean (SD)	36.68 (18.05)
Resilience, mean (SD)	26.65 (8.12)
Depression, mean (SD)	15.96 (4.85)
Problematic internet use, mean (SD)	24.91 (7.70)
High-risk problematic internet use (35-45), %	11.6
SD: standard deviation	

Questions	Response	n (%)	Problematic internet usage		Depression	
			Mean (SD)	Mean difference (95% CI)	Mean (SD)	Mean difference (95% CI)
<i>Covid-19 and restrictions connected with it changed your life</i>						
Frequency of fast-food intake	Did not change at all	530 (46.2)	23.86 (7.75)	Ref	15.34 (4.95)	Ref
	Slightly changed	344 (30.0)	25.42 (7.33)	<b>1.56</b> (0.32, 2.80)	15.91 (4.51)	0.57 (-0.21, 1.34)
	Significantly changed	274 (23.9)	26.15 (7.78)	<b>2.29</b> (0.96, 3.62)	17.30 (4.81)	<b>1.95</b> (1.12, 2.79)
Sleep regime	Did not change at all	242 (20.9)	21.52 (7.33)	Ref	14.25 (5.10)	Ref
	Slightly changed	295 (25.5)	23.12 (6.91)	<b>1.60</b> (0.12, 3.09)	14.65 (4.59)	0.41 (-0.54, 1.35)
	Significantly changed	619 (53.5)	27.00 (7.47)	<b>5.48</b> (4.18, 6.78)	17.24 (4.50)	<b>2.99</b> (2.16, 3.82)
Frequency of physical activity	Did not change at all	144 (12.4)	21.12 (7.38)	Ref	13.96 (5.29)	Ref
	Slightly changed	214 (18.4)	22.59 (7.29)	1.47 (-0.41, 3.35)	14.23 (4.77)	0.26 (-0.92, 1.45)
	Significantly changed	803 (69.2)	26.13 (7.48)	<b>5.01</b> (3.43, 6.59)	16.76 (4.56)	<b>2.80</b> (1.80, 3.79)
Frequency of alcohol, tobacco and substance use	Did not change at all	809 (72.1)	24.18 (7.56)	Ref	15.28 (4.80)	Ref
	Slightly changed	167 (14.9)	26.16 (7.34)	<b>1.98</b> (0.45, 3.50)	16.95 (4.34)	<b>1.67</b> (0.73, 2.61)
	Significantly changed	146 (13.0)	27.23 (8.30)	<b>3.04</b> (1.43, 4.65)	18.67 (4.57)	<b>3.39</b> (2.40, 4.38)
<i>Covid-19 changed your economic and financial condition</i>	Quite worsened	158 (13.5)	27.27 (8.25)	Ref	18.05 (4.44)	Ref
	Moderately worsened	298 (25.5)	25.14 (7.34)	<b>-2.13</b> (-4.18, -0.07)	16.56 (4.57)	<b>-1.49</b> (-2.77, -0.21)
	A little worsened	293 (25.1)	24.54 (7.37)	<b>-2.73</b> (-4.79, -0.67)	15.50 (4.70)	<b>-2.55</b> (-3.83, -1.27)
	Didn't change	343 (29.4)	24.20 (7.67)	<b>-3.07</b> (-5.07, -1.06)	15.16 (4.89)	<b>-2.89</b> (-4.14, -1.64)
	Improved	76 (6.5)	23.51 (8.32)	<b>-3.75</b> (-6.67, -0.84)	14.63 (5.52)	<b>-3.42</b> (-5.23, -1.61)
<i>How worried are you about the changes caused by Covid-19 and its associated limitations in each area of life</i>						
Health of yourself or loved ones	Do not worry at all	20 (1.7)	22.25 (10.65)	Ref	15.50 (5.34)	Ref
	A little worried	82 (7.0)	24.38 (7.22)	2.13 (-3.12, 7.38)	16.20 (4.99)	0.70 (-2.61, 4.00)
	Quite worried	248 (21.3)	24.39 (7.81)	2.14 (-2.75, 7.03)	15.58 (4.78)	0.08 (-3.00, 3.16)
	A very much worried	789 (67.7)	25.17 (7.67)	2.92 (-1.84, 7.68)	16.07 (4.82)	0.57 (-2.43, 3.57)
	I find it hard to say	27 (2.3)	24.78 (6.54)	2.53 (-3.67, 8.74)	15.59 (5.54)	0.09 (-3.81, 4.00)
Maintaining Social Connections	Do not worry at all	106 (9.1)	22.78 (8.82)	Ref	15.91 (5.31)	Ref
	A little worried	215 (18.5)	23.76 (7.55)	0.98 (-1.48, 3.43)	15.51 (5.16)	-0.40 (-1.96, 1.16)
	Quite worried	297 (25.6)	23.98 (6.76)	1.19 (-1.15, 3.54)	15.10 (4.41)	-0.81 (-2.30, 0.67)
	A very much worried	522 (45.0)	26.13 (7.72)	<b>3.35</b> (1.14, 5.55)	16.58 (4.79)	0.67 (-0.73, 2.07)
	I find it hard to say	21 (1.8)	27.43 (8.36)	4.64 (-0.30, 9.59)	16.81 (4.49)	0.89 (-2.25, 4.04)
Discontinuation of the learning process	Do not worry at all	93 (8.0)	23.50 (8.41)	Ref	15.98 (5.58)	Ref
	A little worried	107 (9.2)	23.05 (8.12)	-0.46 (-3.40, 2.48)	15.45 (4.99)	-0.53 (-2.40, 1.34)
	Quite worried	249 (21.3)	23.66 (7.07)	0.16 (-2.37, 2.68)	15.18 (4.78)	-0.80 (-2.40, 0.80)
	A very much worried	675 (57.8)	25.85 (7.60)	<b>2.34</b> (0.04, 4.64)	16.28 (4.70)	0.30 (-1.16, 1.76)
	I find it hard to say	43 (3.7)	24.33 (7.42)	0.82 (-3.01, 4.64)	16.63 (5.03)	0.65 (-1.78, 3.08)
Domestic violence or aggression	Do not worry at all	390 (34.4)	23.64 (7.78)	Ref	15.03 (4.83)	Ref
	A little worried	141 (12.4)	25.35 (7.20)	1.71 (-0.35, 3.77)	16.94 (4.42)	<b>1.90</b> (0.61, 3.20)
	Quite worried	156 (13.7)	25.54 (7.56)	1.90 (-0.09, 3.88)	16.45 (4.62)	<b>1.42</b> (0.17, 2.67)
	A very much worried	348 (30.7)	25.52 (7.83)	<b>1.88</b> (0.33, 3.42)	16.30 (5.01)	<b>1.27</b> (0.29, 2.24)
	I find it hard to say	100 (8.8)	25.71 (7.47)	2.07 (-0.28, 4.42)	16.35 (5.02)	1.32 (-0.16, 2.80)
Limiting fun and other recreational activities	Do not worry at all	130 (11.2)	22.88 (8.48)	Ref	16.57 (5.28)	Ref
	A little worried	225 (19.3)	23.21 (7.21)	0.32 (-1.95, 2.60)	15.32 (5.14)	-1.25 (-2.70, 0.20)
	Quite worried	305 (26.2)	24.76 (7.06)	1.88 (-0.29, 4.04)	15.52 (4.44)	-1.05 (-2.43, 0.33)
	A very much worried	467 (40.1)	26.31 (7.76)	<b>3.42</b> (1.37, 5.48)	16.42 (4.71)	-0.15 (-1.46, 1.15)
	I find it hard to say	37 (3.2)	25.19 (7.97)	2.30 (-1.55, 6.16)	15.49 (5.50)	-1.08 (-3.53, 1.37)

SD: standard deviation; CI: confidence interval Ref: reference. Mean differences and 95% confidence intervals were derived from analysis of variance (ANOVA) with post-hoc test Tukey. Bold results were significant.



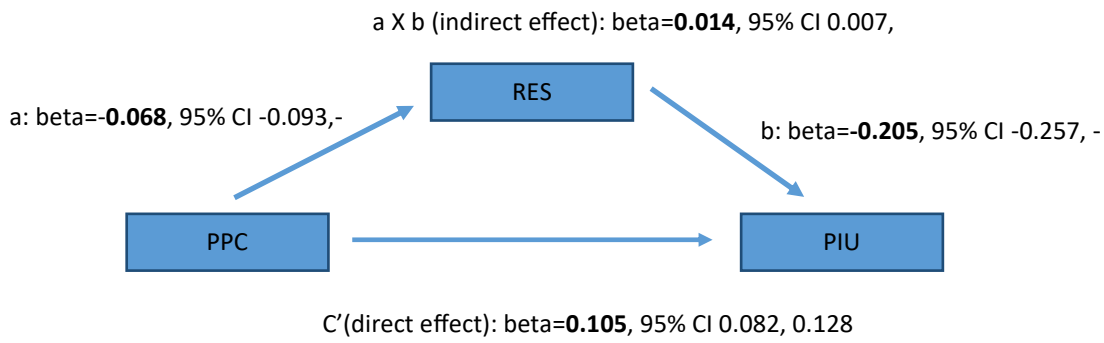


Figure 6.

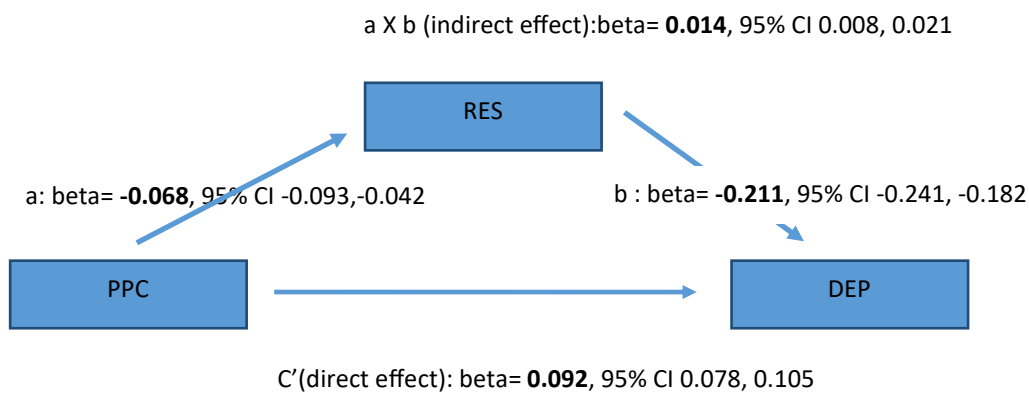


Figure 7.

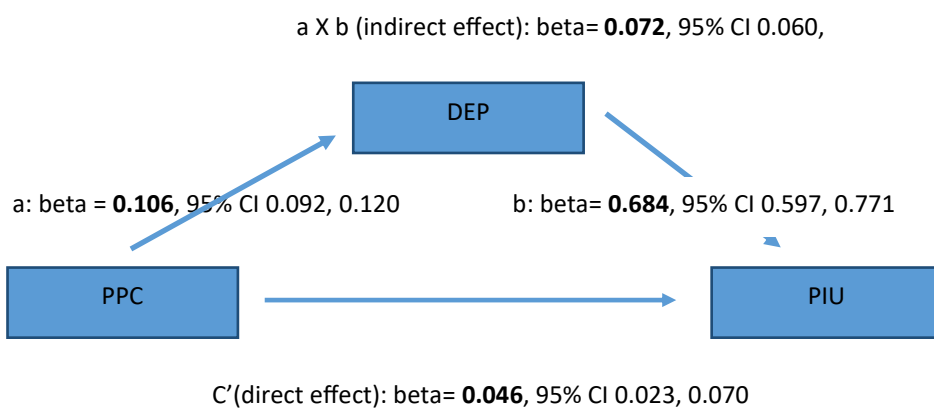


Figure 8.

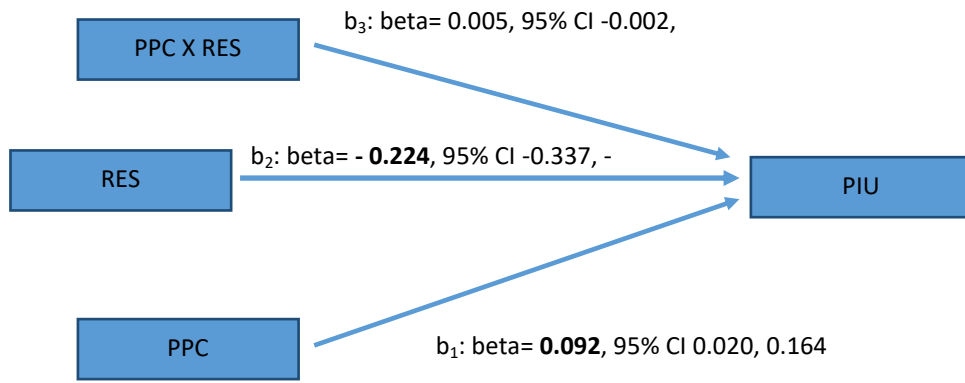


Figure 9.

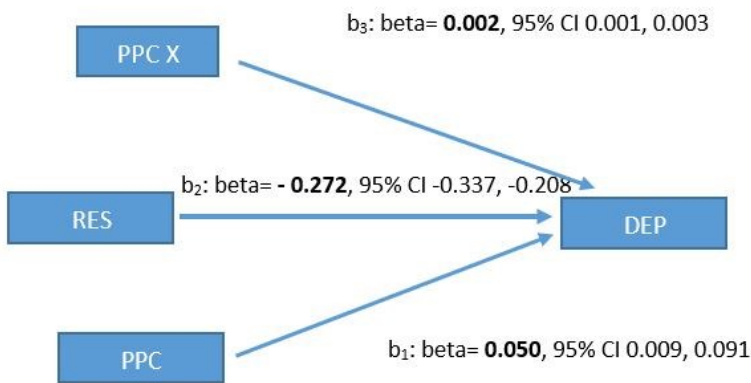


Figure 10.

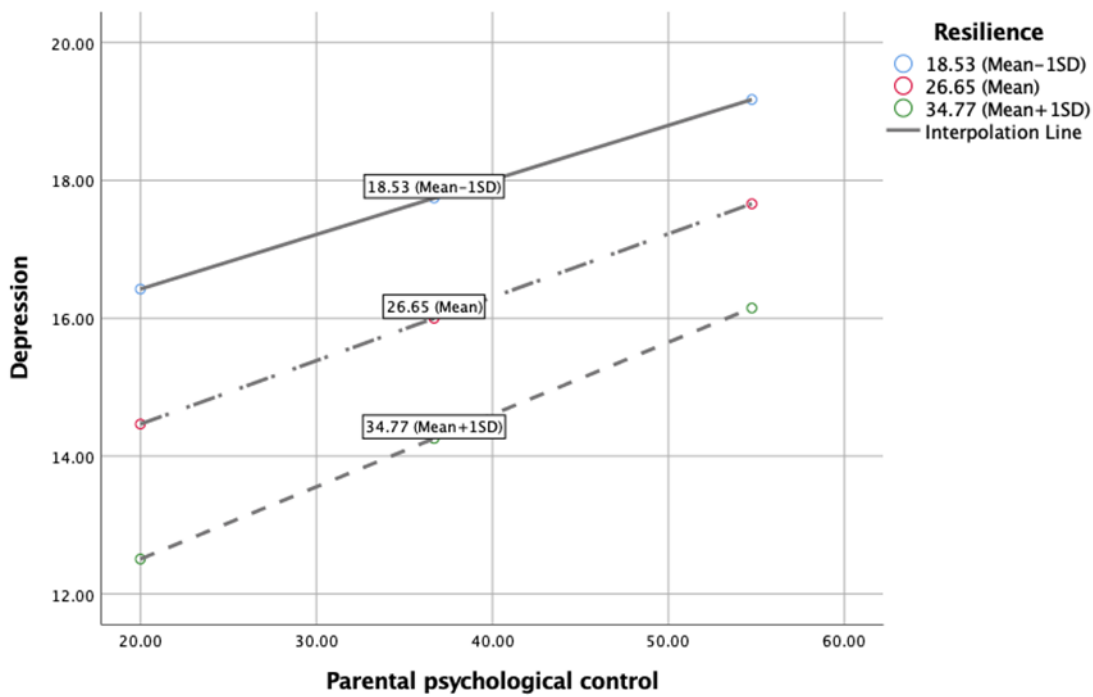


Figure 11.

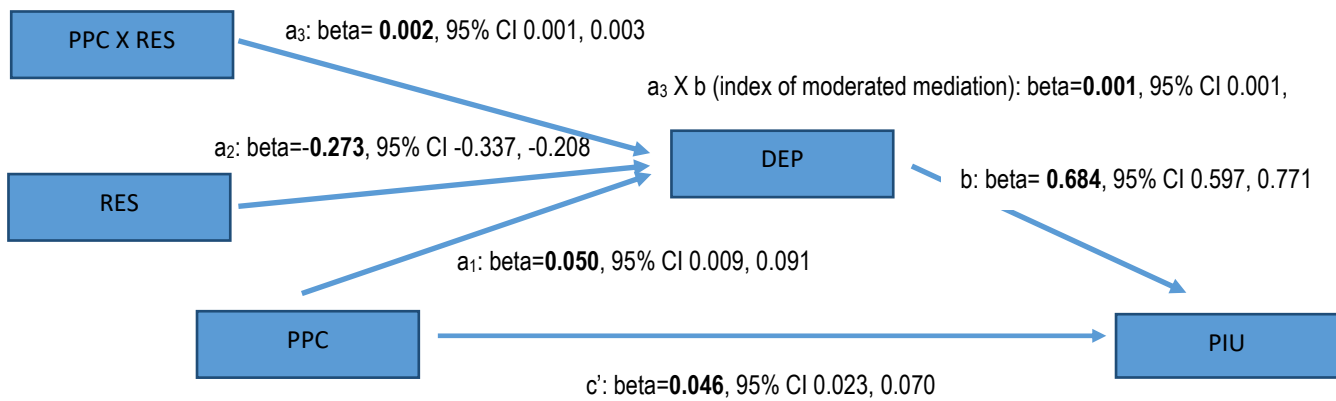


Figure 12.

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