4. RESULTS

This chapter presents the result of the study. Findings are divided into three parts. The first part describes the bivariate relationship between domain specific social cognitive variables and the four behaviors of interest. Further, the hypotheses regarding the applicability of the HAPA-Model to different health behaviors in a Non-Western culture are tested. The role of the past behavior for the prediction of health behaviors is looked at closely.

The second part then tests hypotheses concerned with age-related differences in health behaviors and health cognitions. Initially, the age-related differences in health behaviors such as nutrition, physical activity, alcohol and cigarette consumption are investigated. Then, the age-differences in the behavior patterns are described. Lastly, age-related differences in health cognitions are reported.

In the third part the age-related differences in the interplay of social-cognitive variables in predicting health behaviors are analyzed. The mediating role of planning between intention and behavior is explored for different age groups. Lastly, an alternative hypothesis is tested that suggests that the age-differences in the interplay of social-cognitive variables in predicting health behaviors are attributable to stage of change and not to age-related changes in motivation.

4.1 Applicability of the HAPA-Model to Different Health Behaviors in a Non-western Culture

The first aim of the present study was to investigate the applicability of the HAPA-model to different health behaviors (health promoting verses addictive) in the South Korean culture. It is expected that more variance can be explained by HAPA in predicting health promoting behaviors than addictive behaviors. It is further assumed that HAPA is applicable to a non-Western culture such as South Korea.

4.1.1 Applicability of HAPA to Health Promoting Behavior: Nutrition

In this section the results of the longitudinal relationships between nutrition-related health cognitions and nutrition behavior are reported. The first part describes the bivariate relationships. In the second part, the structural relationships are examined. The main goal here was the replication of the structural relationships as suggested by the HAPA model between nutrition-related health cognitions and nutrition behavior in a new social-cultural context. The descriptive statistics of all constructs under study for both age groups and measurement time points can be found in Appendix A.

4.1.1.1 Correlational Relationships

Table 9 presents the correlations between nutrition-related health cognitions, i.e., risk perception, outcome expectancies, action self-efficacy, and intention at Wave 1, planning, coping self-efficacy, and nutrition style at Wave 2.

Table 9: Correlations between nutrition and nutrition-related health cognitions

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1. Risk perception	1.00								
2. Outcome expectancies	.07	1.00							
3. Action self-efficacy	-.04	.31**	1.00						
4. Intentions	.05	.22**	.18**	1.00					
5. Action planning	.03	.17**	.13**	.21**	1.00				
6. Coping planning	.06	.17**	.18**	.22**	.83**	1.00			
7. Coping self-efficacy	-.07	.19**	.32**	.17**	.39**	.44**	1.00		
8. Nutrition style	.02	.24**	.24**	.25**	.30**	.35**	.44**	1.00	
9. Age	.20**	.11**	.10*	.15**	.16**	.17**	.15**	.34**	1.00

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

The correlations revealed the expected pattern of results. Intention to adopt healthier nutrition was positively associated with outcome expectancies and action self-efficacy. No association was found between risk perception and intention to adopt a healthy diet[4]. There were positive relations between intention, action planning, coping planning, coping self-efficacy, and nutrition style. The relationship between intention or action self-efficacy respectively and nutrition style was lower than the relationship between coping self-efficacy or planning respectively and nutrition style. This is probably due to the fact that the first two variables were more distal predictors of nutrition style and were assessed half a year prior to the nutrition style assessment.

This pattern of results indicates that people with knowledge about contingencies between their nutrition behavior and health outcomes, and strong confidence in their own ability to implement healthier nutrition habits were also the ones who built an intention to adopt a healthy diet. Intention, planning, and coping self-efficacy were facilitative for having a healthy diet.

[4] In the following, the classification of effect sizes was adopted from Cohen (1992). The product-moment correlation corresponds with small (.10), moderate (.30), and large (.50) effect size.

4.1.1.3 Structural Relationships

In this section, multivariate relationships between nutrition-related health cognitions and nutrition style were investigated. Structural Equation Modeling with AMOS 5.0 (Arbuckle & Wothke, 2003) using the Maximum Likelihood (ML) estimation was used to test the structural assumptions. The model fit was assessed by examining the comparative fit index (CFI), the Tucker-Lewis-Index (TLI), and the root-mean-square error of approximation (RMSEA). CFI and TLI are both incremental fit indices. Thus, they assess the relative improvement in fit of the model of interest compared with the null model – which assumes zero population covariances among the observed variables. TLI makes a correction for the model complexity, i.e. it favors more simple models. RMSEA measures how well a model with unknown but optimally chosen parameters values would fit the population covariance matrix if it was available. A model is said to have a good fit if CFI and TLI indices have values higher than .90, the value of RMSEA is smaller than .08 and the lower bound of 90% confidence intervals (CI) is close to zero and the upper bound of the 90% CI does not exceed .10 (Tabachnik & Fidell, 2001). Since the χ^2 statistic is sample size dependent, the χ^2 */df* ratio was employed as a further goodness of fit criterion. Bollen and Long (1993) suggest a χ^2 not larger than 2-5 times the degrees of freedom. For all constructs, except risk perception and intention, parcels were used to create indicators for latent variables (for the composition of parcels and factor loadings see Table B 1 in Appendix B). Parcels have a lower error variance and are thus more reliable than the single indicators (cf. Bandalos & Finney, 2001). Since action and coping planning were closely interrelated ($r = .83$, $p < .001$), they were used jointly as indicators of the planning construct. Prior to the analyses, the data was screened for multiple outliers. Thirteen cases were detected as multiple outliers and were removed from further analysis.

Figure 3 presents the results of structural equation modeling of the HAPA-Model for nutrition. The model fit was good, with CFI = .97, RMSEA = .042, 90% CI = .036, .048, TLI = .96, $\chi^2 /df = 2.18$, and $\chi^2 = 351.11$, $df = 161$, $p < .001$. Risk perception, $\beta = .14$, $p < .05$, outcome-expectancies, $\beta = .18$, $p < .01$ and action self-efficacy, $\beta = .20$, $p < .01$, were significant predictors of intention. The proportion of variance that was explained by predictors amounted to 12%. Intention was a significant predictor of planning, $\beta = .23$, $p < .001$, while planning predicted nutrition style, β = .19, $p < .001$. The coping self-efficacy at Wave 2 was predicted by action self-efficacy at Wave 1, β = .40, $p < .001$. Coping self-efficacy, in turn, was a significant predictor of planning, β = .44, $p < .001$ and of nutrition style, β = .39, p < .001. The amount of explained variance in nutrition style was 27%. Thus, it might be concluded that the HAPA-Model in the domain of nutrition could be replicated in the new social-cultural context.

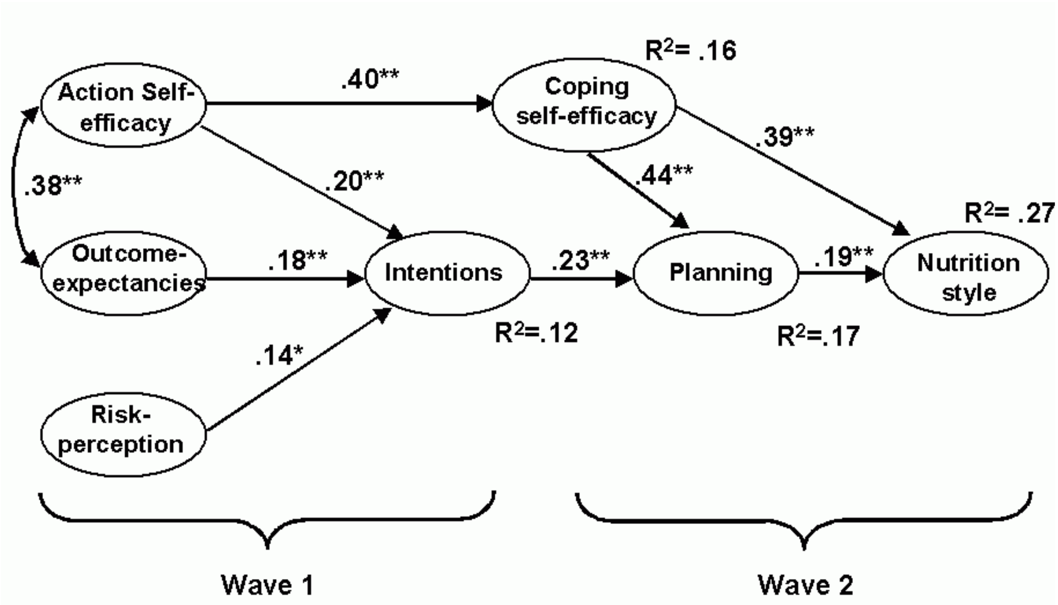

Figure 3: HAPA-model for nutrition for the total sample (n = 684).

4.1.1.3 The Role of Past Behavior in Predicting Nutrition Behavior

As outlined in Chapter 2.1.6, past behavior can be a significant predictor of the intention as well as of future behavior. After the classification made by Ouellette and Wood (1998), nutrition behavior can be considered as a behavior practiced frequently in stable contexts. In this case, future behavior should be a direct function of past act frequency. In order to explore this issue, it was tested whether inclusion of past nutrition behavior into the hypothesized HAPA-Model would improve the overall model fit. A latent construct, called past behavior, was specified as Wave 1 as an additional predictor of nutrition style at Wave 2. Inclusion of baseline nutrition behavior adds 20% of explained variance. The nutrition behavior at Wave 1 was a significant predictor of nutrition behavior at Wave 2, with β = .58, $p < .001$. The model with inclusion of baseline behavior, fits the data better than the hypothesized model ($\Delta\chi^2 = 126.58$, $df = 1$, $p < .001$; for further fit indices of the nested models see Table B 6 in Appendix B). However, a comparison of other fit indices indicates a rather unsubstantial improvement of fit. Moreover, as predicted, coping self-efficacy along with planning remained a significant predictor ($\beta = .29$, $p < .001$; and $\beta = .10$, $p < .05$, respectively) of nutrition behavior at Wave 2 after the past nutrition behavior was controlled for.

4.1.2 Applicability of HAPA to Health Promoting Behavior: Physical Activity

In this section, the results of the longitudinal relationships between physical activity-related health cognitions and physical activity are reported. The first part describes the bivariate relationships. In the second part, the structural relationships are examined. The main goal here was the replication of the structural relationships as suggested by the HAPA model between physical activity-related health cognitions and physical activity in a new social-cultural context.

4.1.2.1 Correlational Relationships

Table 10 presents the correlations between physical activity-related health cognitions, i.e., risk perception, outcome expectancies, action self-efficacy, and intention at Wave 1, planning, coping self-efficacy, and physical activity at Wave 2.

Table 10: Correlations between physical activity-related health cognitions and physical activity

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1. Risk perception	1.00								
2. Outcome expectancies	-.03	1.00							
3. Action self-efficacy	-.02	.46**	1.00						
4. Intentions	.01	.13**	.22**	1.00					
5. Action planning	.02	.14**	.27**	.23**	1.00				
6. Coping planning	.00	.11**	.25**	.14**	.73**	1.00			
7. Coping self-efficacy	.00	.16**	.27**	.17**	.67**	.65**	1.00		
8. Physical activity	-.04	.07	.18**	-.04	.22**	.26**	.30**	1.00	
9. Age	.20**	.08	.11**	.11**	.00	-.01	.00	-.14**	1.00

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

The correlations revealed the expected pattern of results. The intention to be physically active was positively associated with outcome expectancies and action self-efficacy. However, there was no association between risk perception and intentions. There were positive relations between action planning, coping planning, coping self-efficacy and physical activity. The relationship between action self-efficacy and physical activity was lower than the relationships between coping self-efficacy, action planning, coping planning and physical activity. This is probably due to the fact that the action self-efficacy was a more distal predictor of physical activity and was assessed half a year prior to the assessment of physical activity.

This pattern of results indicates that people with knowledge about contingencies between physical activity and health outcomes, and strong confidence in their own ability to be physically active were also the ones who built an intention to be physically active. Action planning, coping planning, and coping self-efficacy were facilitative of physical activity.

4.1.2.2 Structural Relationships

In this section, multivariate relationships between physical activity-related health cognitions and physical activity were investigated. For all constructs except risk perception, intention, and physical activity, parcels were used to create indicators for latent variables (for the composition of parcels and factor loadings see Table B2 in Appendix B). Since action and coping planning scales had a relatively high inter-scale correlation (r = .73, p < .001), both of them were used as indicators of the latent construct planning. Prior to the analyses, the data was screened for multiple outliers. Eight cases were detected as multiple outliers and were removed from further analysis.

Figure 4 presents the results of structural equation modeling of the HAPA-Model for physical activity. The model fit was adequate, with CFI = .92, RMSEA = .062, 90% CI = .056, .067, TLI = .90, χ^2/df = 3.62, and χ^2 = 590.58, df = 163, p < .001. Only action self-efficacy was a significant predictor of intention with β = .23, p < .01. There was no significant association between risk perception and intention, β = .02, n.s., as well as between outcome expectancies, β = .01, n.s. and intention. The proportion of the variance that was explained by predictors amounted to 6%. Intention along with action self-efficacy were significant predictors of planning, β = .19, p < .001 and β = .31, p < .001, while planning failed to predict physical activity, β = .05, n.s[5]. The coping self-efficacy at Wave 2 was predicted by action self-efficacy at Wave

[5] Because of a high inter-correlation between action and coping planning and coping self-efficacy, a more conservative model test was applied. Planning mediated the relationship between action self-efficacy and physical activity.

1, β = .33, $p < .001$. Coping self-efficacy, in turn, was a significant predictor of physical activity, β = .30, $p < .001$. The amount of explained variance in physical activity was 9%. Thus, it might be concluded that the HAPA-Model did relatively poor at predicting physical activity by explaining a small albeit significant amount of the variance (Cohen, 1992).

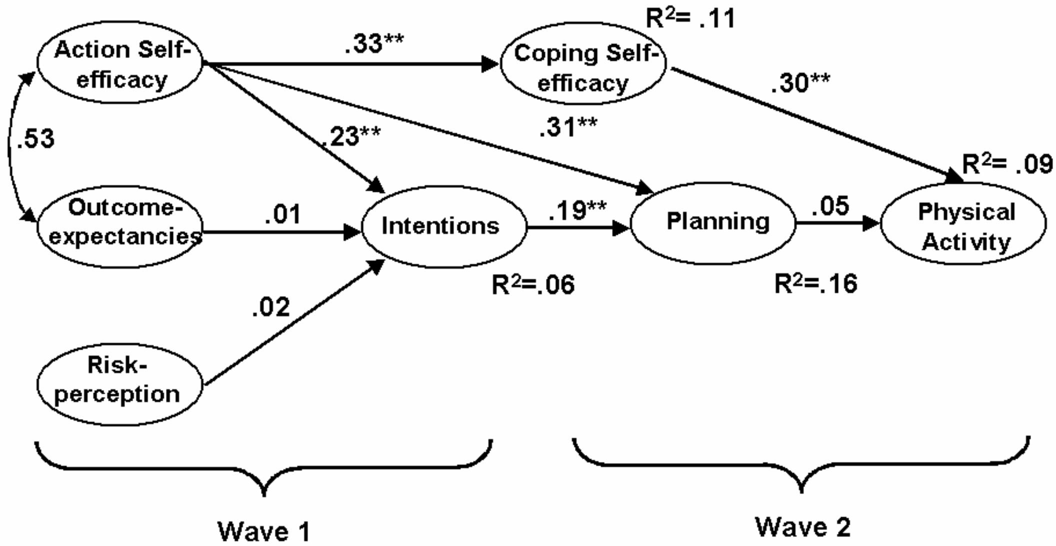

Figure 4: HAPA-Model for physical activity for total sample (n = 689).

4.1.2.3 The Role of Past Behavior in Predicting Physical Activity

The influence of past behavior on future behavior was further investigated. After the classification made by Ouellette and Wood (1998), physical activity is a behavior performed frequently in stable contexts. In this case future behavior should be a direct function of past act frequency. In order to explore this issue, it was tested whether inclusion of past physical activity into the hypothesized HAPA-Model would improve the overall model fit. A latent construct, called past behavior, was specified as the Wave 1 predictor of physical activity at Wave 2. The amount of explained variance in physical activity increased to 27 %. The model including past behavior, also improved the overall model fit ($\Delta\chi^2 = 141.29$, $df = 1$, $p < .001$; further fit indices for the nested models are summarized in Table B 7 in Appendix B). However, a comparison of other fit indices indicated a rather unsubstantial improvement of fit. Physical activity at Wave 1 was a significant predictor of physical activity at Wave 2, with β = .47, $p < .001$. However, coping self-efficacy remained a significant predictor of physical activity at Wave 2 after the past physical activity was controlled for β =

.22, $p < .001$, and planning remained a non-significant predictor of physical activity $\beta = .03$, *n.s*. The present analysis is based on longitudinal data, but behavioral change was not analyzed. In all domains of human functioning, baseline behaviors are typically the best predictors of later behaviors, which mean that their inclusion in the analysis would mask the effects of social-cognitive variables (Bandura, 1997). Baseline behaviors are themselves a product of previous social-cognitive-behavioral processes that cannot be disentangled. Changes should be analyzed when interventions or critical events are at stake.

4.1.3 Applicability of HAPA to Addictive Behavior: Alcohol Consumption

In this section, the applicability of the HAPA-model to addictive behaviors such as alcohol and cigarette consumption is tested on the basis of South Korean sample. The results of the longitudinal relationships between alcohol-related health cognitions and alcohol consumption are reported. The first part describes the bivariate relationships. In the second part, the structural relationships are examined. The main goal here was the replication of the structural relationships as suggested by the HAPA model between alcohol-related health cognitions and alcohol consumption in a new social-cultural context.

4.1.3.1 Correlational Analysis

Table 11 presents the correlations between alcohol-related health cognitions, i.e., risk perception, outcome expectancies, action self-efficacy, and intention at Wave 1, planning and alcohol consumption at Wave 2.

Table 11: Correlations between alcohol consumption and alcohol-related health cognitions

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1. Risk perception	1.00							
2. Outcome expectancies: pros	.02	1.00						
3. Action self-efficacy	-.10	.37**	1.00					
4. Intentions	-.03	.11*	.18**	1.00				
5. Action planning	.09	.15**	.16**	.23**	1.00			
6. Coping planning	.05	.13*	.18**	.18**	.89**	1.00		
7. Alcohol consumption	-.09	-.04	-.08	-.02	.03	.03	1.00	
8. Age	.20**	-.12**	-.02	.05	.05	.00	.06	1.00

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

The correlations partly revealed the expected pattern of results. Intention to reduce alcohol consumption was positively associated with outcome expectancies and action self-efficacy. No association was found between risk perception and intention to reduce alcohol consumption. Contrary to the expectation there were no relationships between intention, action self-efficacy, action or coping planning and alcohol consumption respectively.

To conclude, as discussed in Chapter 2.1.5, intention was expected to correlate with risk perception, outcome expectancies and self efficacy. Further, if intention and self-efficacy are assessed as quitting intention and as confidence to limit alcohol consumption only weak correlations were expected between these two constructs and actual alcohol consumption. In the present study, no relationship could be found between alcohol consumption and health cognitions, pointing to the fact that alcohol behavior in South Korea might be directly controlled by environmental factors, e.g., social norms.

4.1.3.2 Structural Relationships

In this section, multivariate relationships between alcohol-related health cognitions and alcohol consumption were investigated. Since action and coping planning scales had a high inter-scale correlation (r = .89, p < .001), both of them were used as indicators of the latent construct planning (Appendix B, Table B 3 gives the detailed information about factor loadings of the indicators for the latent constructs). Prior to the analyses, the data was screened for multiple outliers. Four cases were detected as multiple outliers and were removed from further analysis.

Figure 5 presents the results of structural equation modeling of the HAPA-Model for alcohol consumption. The model fit was adequate, with CFI = .98, RMSEA = .037, 90% CI = .023, .050, TLI = .97, χ^2/df = 1.57, and χ^2 = 111.26, df = 71, p < .01. Only action self-efficacy was a significant predictor of intention with β = .19, p < .01. There was no significant association between risk perception and intention, β = -.01, n.s., as well as between outcome expectancies and intention, β = .01, n.s. The proportion of the variance that was explained by predictors amounted to 4%. Intention along with action self-efficacy were significant predictors of planning, β = .16, p < .01 and β = .21, p < .001, while planning failed to predict alcohol consumption, β = .01, n.s. Whereas, action self-efficacy was a significant predictor of alcohol consumption, β = -.16, $p < .01$. The amount of explained variance in alcohol consumption was 3%. Thus, it might be concluded that the HAPA-Model only poorly predicted alcohol consumption.

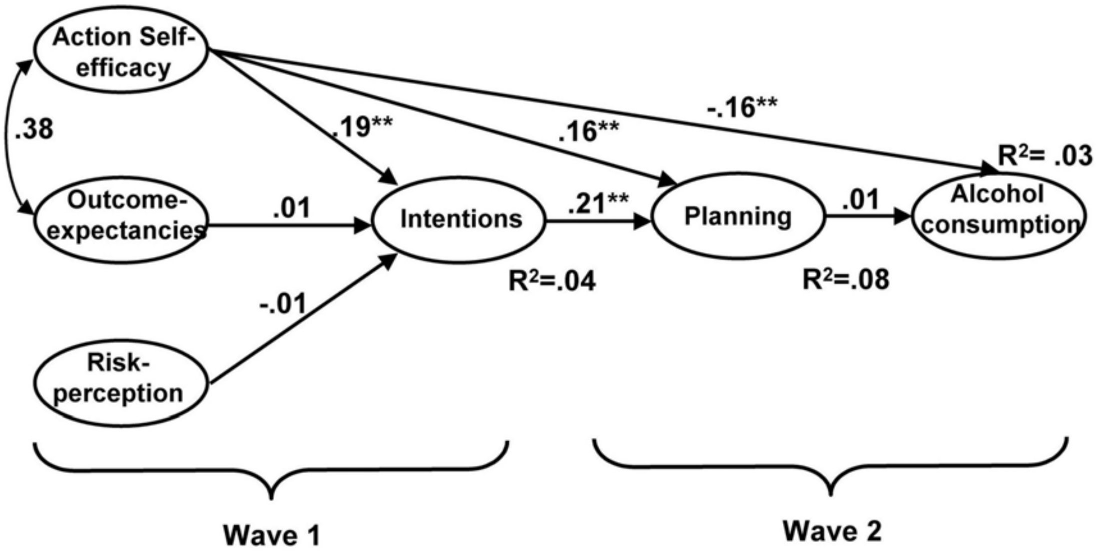

Figure 5: HAPA-Model for alcohol consumption for the total sample (n = 412).

4.1.3.3 The Role of Past Behavior in Predicting Alcohol Consumption

The influence of past behavior on future behavior was further investigated. After the classification made by Ouellette and Wood (1998), alcohol consumption is a behavior performed frequently in stable contexts. In this case future behavior should be a direct function of past act frequency. In order to explore this issue, it was tested whether inclusion of past drinking habits into the hypothesized HAPA-Model would improve the overall model fit. A latent construct, called past behavior, was specified as the Wave 1 predictor of alcohol consumption at Wave 2. The amount of explained variance in alcohol consumption increased to 17 %. The model including past behavior also improved the overall model fit ($\Delta \chi^2(1) = 49.22$, $p < .01$; for further fit indices of the nested models see Table B 8 in Appendix B). However, a comparison of other fit indices indicated a rather unsubstantial improvement of fit. Alcohol consumption at Wave 1 was a significant predictor of alcohol consumption at Wave 2, with β = .39, $p < .001$. However, action self-efficacy remained a significant predictor of alcohol consumption at Wave 2 after the past drinking habits were controlled for, β = -.12, $p < .05$, and planning remained a non-significant predictor of alcohol consumption β = .00, *n.s.*

4.1.4 Applicability of HAPA to Addictive Behavior: Cigarette Consumption

In this section, the results of the longitudinal relationships between smoking-related health cognitions and cigarette consumption are reported. The first part describes the bivariate relationships. In the second part, the structural relationships are examined. The main goal here was to test the structural relationships as suggested by the HAPA model between smoking-related health cognitions and cigarette consumption.

4.1.4.1 Correlational Relationship

Table 12 presents the correlations between smoking-related health cognitions, i.e., risk perception, outcome expectancies, action self-efficacy, and intention at Wave 1, planning and cigarette consumption at Wave 2.

Table 12: Correlations between cigarette consumption and smoking-related health cognitions

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1. Risk perception	1.00								
2. Outcome expectancies	.13	1.00							
3. Action self-efficacy	.08	.13#	1.00						
4. Intentions	.20*	-.01	.22**	1.00					
5. Action planning	.05	.19*	.28**	.10	1.00				
6. Coping planning	.00	.19*	.26**	.03	.85**	1.00			
7. Coping self-efficacy	.23*	.24**	.36**	.09	.51**	.44**	1.00		
8. Cigarette consumption	.07	.04	-.15#	.06	-.18*	-.17*	-.16#	1.00	
9. Age	.29*	.07	.24**	.36**	.00	-.03	.09	.01	1.00

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

The correlations partly revealed the expected pattern of results. Intention to reduce cigarette consumption was positively associated with risk perception and action self-efficacy. No association was found between intention to reduce cigarette consumption and outcome expectancies. Contrary to the expectation there was no relationship between intention to reduce cigarette consumption and actual consumption six months later. As expected, action and coping planning as well as coping self-efficacy correlated negatively with cigarette consumption.

This pattern of results indicates that people's beliefs in contingence between quitting smoking and health improvement had little impact on their actual intention to quit. However, strong confidence in one's own ability to quit smoking and the perception of one's own vulnerability for cardio-vascular diseases were facilitative for the intention to quit. As expected due to the assessment of intention as quitting intention there was no relationship between intention and smoking behavior. All the volitional variables such as action and coping planning, and coping self-efficacy were facilitative for reducing cigarette consumption. However, as expected due to the assessment of self-efficacy as the confidence to quit, the relationship between coping self-efficacy and smoking behavior were only of a small effect size (Cohen, 1992).

4.1.4.2 Structural Relationships

In this section, multivariate relationships between smoking-related health cognitions and cigarette consumption were investigated. Since action and coping planning scales had a high inter-scale correlation (r = .85, p < .001), both of them were used as indicators of the latent construct planning (the detailed description of factor loadings and parcel compositions is summarized in Table B 4 in Appendix B). Prior to the analyses, the data was screened for multiple outliers. Two cases were detected as multiple outliers and were removed from further analysis.

Figure 6 presents the results of structural equation modeling of the HAPA-Model for cigarette consumption. The model fit was adequate, with CFI = .98, RMSEA = .045, 90% CI = .022, .064, TLI = .97, χ^2/df = 1.32, and χ^2 = 147.95, df = 112, p < .05. There were no association between risk perception, β = -.04, n.s., outcome expectancies, β = -.03, n.s. and intention. Action self-efficacy was a significant predictor of intention, with = .22, p < .01. The proportion of the variance that was explained by predictors amounted to 5%. Intention was a non-significant predictor of planning, β = .05, n.s., and planning failed to predict cigarette consumption, β = -.12, n.s. Coping self-efficacy was a non-significant predictor of cigarette consumption, β = -.12, n.s. The amount of explained variance in cigarette consumption was 5%. Thus, it might be concluded that the HAPA-Model did relatively poor at predicting cigarette consumption.

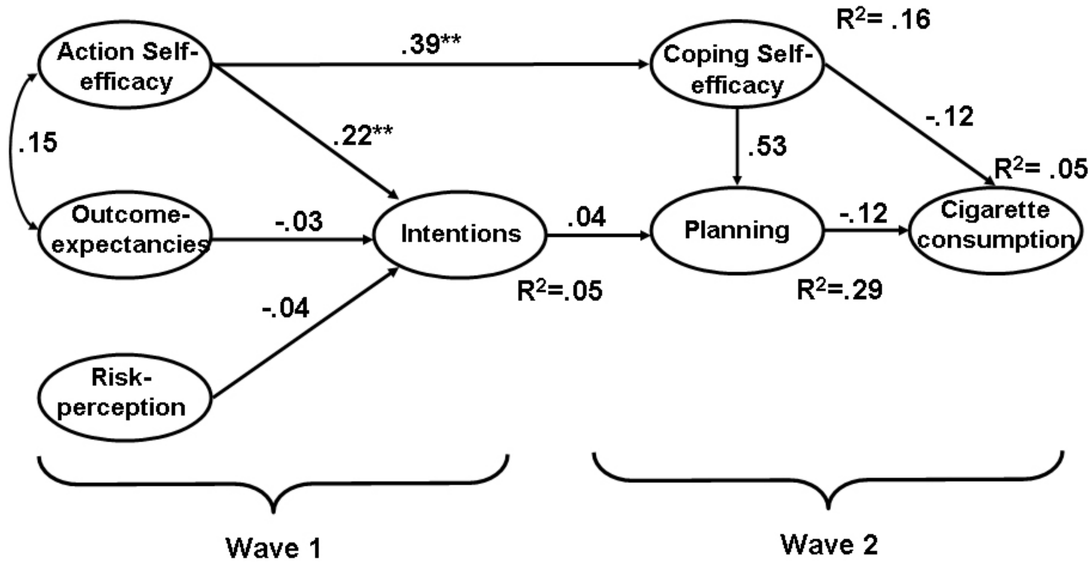

Figure 6: HAPA-Model for cigarette consumption for the total sample of smokers (n = 159).

4.1.4.3 The Role of Past Behavior in Predicting Cigarette Consumption

The influence of past behavior on future behavior was further investigated. After the classification made by Ouellette and Wood (1998), smoking is a behavior performed frequently in stable contexts. In this case, future behavior should be a direct function of past act frequency. In order to explore this issue, it was tested whether inclusion of past smoking habits into the hypothesized HAPA-Model would improve the overall model fit. A latent construct, called past behavior, was specified as the Wave 1 predictor of cigarette consumption at Wave 2. The amount of explained variance in cigarette consumption increased to 47 %. The model including past behavior also improved the overall model fit ($\Delta\chi^2(1) = 74.68$, $p < .001$; for further fit indices of the nested models see Table B 9 in Appendix B). However, a comparison of other fit indices indicated a rather unsubstantial improvement of fit. The cigarette consumption at Wave 1 was a significant predictor of cigarette consumption at Wave 2, with $\beta = .67$, $p < .001$. Both coping self-efficacy ($\beta = -.03$, n.s.) and planning ($\beta = -.12$, n.s.) remained non-significant predictors of cigarette consumption.

To summarize the findings, the HAPA-model when tested in a Non-western cultural context was confirmed for nutrition behavior and to a lesser degree for physical activity. However, model was found to be less applicable to addictive behaviors such as smoking and alcohol consumption. As expected, past behavior was a strong predictor for future behavior in all behavior domains. However, social-cognitive variables remained significant predictors of behavior after inclusion of past behavior into the model.

4.2 APPLICABILITY OF THE HAPA-MODEL TO DIFFERENT AGE GROUPS: MEAN DIFFERENCES

From the life span perspective, age-related changes in health behaviors, health cognition and in motivational orientation were expected. In this section the applicability of the HAPA-Model to different age group across health behaviors is investigated. First, possible age differences in HAPA-related variables such as health behaviors, behavior patterns and health cognition are examined. Further the mediating role of age in predicting different health behavior is explored. The issue of whether the effect of intention on nutrition behavior was mediated by planning is addressed.

4.2.1 Age-Related Differences in Health Behaviors

Age differences in health behaviors were investigated separately for women and men in order to control for possible sex differences. Thus, a 2 X 2 ANOVA design was adopted, with the between subject factor "Sex" (male and female) and the between subject factor "Age" (younger and older adults). In the following, the results for four health behaviors are presented.

Nutrition: The 2 X 2 ANOVA yielded a significant sex difference, $F(1, 599) = 28.42$, $p < .001$, $\eta^2 = .05$. As can be seen in Table 13 women had more favorable nutrition habits than men. Results also pointed to a significant main effect for age, $F(1, 599) = 107.54$, $p < .001$, $\eta^2=.15$, indicating that older adults reported more favorable nutrition habits than younger adults. Interaction between sex and age was not significant $F(1, 599) = 0.75$, n.s.

Table 13: Nutrition behavior of younger and older adults: means, standard deviations and sex differences

	Male			Female		
	M	*SD*	*n*	*M*	*SD*	*n*
Young adults	2.19	.40	255	2.38	.39	181
Older adults	2.58	.39	48	2.83	.51	116

Physical activity: On average, participants reported fairly high levels of physical activity (M = 5.01, Mdn = 4.25, SD = 4.85). Thus, they were performing different kinds of physical activities several times per week. Despite the high mean value for physical activity, its distribution was skewed, pointing to a large number of inactive persons in the sample. The 2 X 2 ANOVA yielded a significant sex difference, $F(1, 584) = 8.13$, $p < .01$, $\eta^2 = .01$. Thus, women were less physically active than men. There was also a significant main effect for age, $F(1, 584) = 10.42$, $p < .01$, $\eta^2 = .02$. Older adults were less physically active than younger adults. As can be seen in Table 14 the significant main effects were complemented by a significant sex by age interaction, $F(1, 584) = 10.14$, $p < .01$, $\eta^2 = .01$. Accordingly, simple main effects were calculated. They revealed that age differences were restricted to the men's group, $F(1, 584) = 16.63$, $p < .001$, indicating that younger men were physically more active than older men. The significant main effect for sex was restricted to the group of younger adults. Thus, younger women were physically less active than younger men $F(1, 584) = 38.01$, $p < .001$.

Table 14: Physical activity (per week) of younger and older adults: means, standard deviations, and sex differences

	Male			Female		
	M	*SD*	*n*	*M*	*SD*	*n*
Young adults	6.59	5.51	255	3.77	3.85	177
Older adults	3.59	3.84	48	2.75	3.65	105

Alcohol consumption: On average, participants reported low levels of alcohol consumption measured in weekly gram ethanol (M = 40.17, SD = 107.34). Hence, participants had approximately four drinks a week. As can be seen in Table 15, there were no age differences regarding alcohol consumption, $F(1, 469) = .32$, n.s. Significant sex differences were found, $F(1, 469) = 10.49$, $p < .01$, $\eta^2 = .02$, indicating that women consumed less alcohol than men. The sex by age interaction was not significant, $F(1, 469) = .11$, n.s[6].

Table 15: Alcohol consumption of younger and older adults: means, standard deviations, and sex differences

	Male			Female		
	M	*SD*	*n*	*M*	*SD*	*n*
Young adults	57.67	138.57	216	22.18	74.55	152
Older adults	54.76	75.56	40	11.31	40.77	62

Smoking: One hundred and thirty-six participants (25.3%) were regular smokers. Only 8 of them (5.9%) were women. A further 21 (3.9%) participants were occasional smokers, with only 3 (14.3%) of them women. Thirty-three (6.1%) participants were ex-smokers, 7 (21.2%) of them were women. The majority of the sample were non-smokers 347 (64.6%), thereof 235 (67.7%) were women. Moreover, the age differences in the distribution of smokers versus non-smokers were explored. As expected, there were more regular smokers in the group of younger adults (n = 134; 32.9%) in comparison to the group of older adults (n = 26; 19.4%), $\chi^2 = 8.85$, $p < .01$.

Further analyses were carried out for smokers only. For this purpose, the categories smoker and occasional smoker were collapsed. Since only 11 women were smokers, sex differences were not explored further. As can be seen in Table 16, no significant age differences concerning the amount of consumed cigarettes were found $F(1, 150) = .39$, n.s..

Table 16: Daily cigarette consumption among younger and older smokers

	M	*SD*	*N*
Young adults	13.94	5.97	126
Older adults	13.12	5.79	25

To sum up, as expected, older adults, especially older women, had better nutrition behavior in comparison to younger adults. Older participants were also less physically active. However, women regardless of age were less physically active than men. Contrary to the findings in Western samples, older adults did not differ with regard to their alcohol consumption from younger adults. As expected, there was a considerable sex difference in alcohol consumption: women consumed less alcohol

[6] The Levene's Test of equality of error variance was significant, the $p < .01$ significance level was used for the analysis.

than men. These results are in line with findings from others studies with South Korean samples. Alcohol consumption is socially widely accepted for men, but not for women. This explains the higher amount and larger variance in the alcohol consumption among men. Moreover, in the course of industrialization, alcohol becomes more acceptable among younger women. Indices for this are the higher amount of consumed alcohol and the larger variance in the group of younger women in comparison to the older women. Probably due to unequal variances, the interaction between sex and age did not reach significance. The distribution of smoking behavior in the present sample is untypical for the South Korean population. According to a Korean Gallup survey, in 1999, about 66.6% (cf. 51.4%) of men and 3.3% (cf. 4.3%) of women over the age of 20 were smokers (Kang et al, 2003). In line with the findings in Western countries, older people were more frequently among non-smokers. However, there were no age differences with regard to the amount of consumed cigarettes among smokers.

4.2.2 Bivariate Relationships among Different Health Behaviors

Do people that perform one health behavior also perform other health behaviors? The question of whether different health behaviors are interrelated can be approached in two ways. One way is to look at bivariate associations between different health behaviors. As expected there were either no associations or small-effect size associations among health behaviors (see Table 17). Only alcohol consumption correlated negatively with nutrition behavior and positively with smoking. Smoker-status exhibited a negative association with nutrition behavior. Thus, the praxis of one health behavior was only weakly related to the praxis of other health behaviors.

Table 17: Behaviors intercorrelations

	Nutrition	Physical activity	Alcohol	Smoking
Nutrition	1.00			
Physical activity	.02	1.00		
Alcohol	-.18***	.01	1.00	
Smoking	-.25***	.00	.17***	1.00

*** $p < .001$

4.2.3 Identification and Description of Different Health Behaviors Patterns

Another way to examine the interrelationship between health behaviors is by investigating the clustering of health behaviors. Thus, one general objective of the present study was to determine meaningful subgroups of individuals with distinct patterns of health behaviors. Specifically, a three-stage latent class (LC) clustering technique was applied using LatentGold 4.0 statistic software which represents the methodological standard in the literature (for review see Lazarsfeld and Henry, 1968; Vermunt & Magidson, 2002; for recent application in research see Dierker, Vesel, Sledjeski, Costello, & Perrine, 2007; Grant, Scherrer, Neuman, Todorov, Price, & Bucholz, 2006; Ploubidis, Abbott, Huppert, Kuh, Wadsworth, & Croudace, 2007).

Exploratory LC cluster analysis is a model-based clustering approach which uses estimated membership probabilities to classify cases into the appropriate cluster (Vermunt & Magidson, 2005). In the first step the ideal number of clusters is obtained using maximum likelihood estimates (MLE) of the latent class probabilities (Goodman, 1974). The *latent class probabilities* describe the distribution of classes (levels) of the latent variable within which the observed measures are (locally) independent of one another. Thus, there are two important aspects of the latent class probabilities: the number of classes and the relative sizes of these classes. The *number of classes (T)* in the latent variable (X) represents the number of latent types defined by the latent class model for the observed crosstabulation. Thus, for example if the latent variable has three classes, the population can be described as being either three "types" or three levels of an underlying (latent) continuum. The *relative sizes* of the latent class probabilities indicate whether the population is relatively evenly distributed among the *T* classes, or whether some latent classes represent relatively large segments of the population while other classes represent relatively small segments. The model assumes that the input variables are mutually independent given X (the so-called axiom of local independence).

The advantage of the LC analysis is that it provides several statistics to determine the number of clusters. An overall model fit index is the likelihood ratio chi-square (L^2) statistic that indicates the amount of the association among the variables that remains unexplained after estimating the model; the lower the value, the better the fit of the model to the data. The decision criterion is set at $p > .05$. Generally, among models for which p-value is greater than 0.05, the one that is most parsimonious would be selected. In addition to the model fit, *AIC*, *AIC3* and *BIC*-statistics take into account the parsimony of the model. They differ from one another according to how much weight is applied to penalize for each additional model parameter. When comparing models, the lower the value of the *BIC* (or *AIC, AIC3*) the better the model. Further, the magnitude of the classification errors, reduction of errors, entropy R^2 and Standard R^2 across models can be compared. When classification of cases is based on modal assignment (to the class with the highest membership probability) the proportion of cases that are estimated to be misclassified are reported in the classification errors statistic. The closer the value is to 0 the better. Reduction of errors (lambda), entropy R^2 and standard R^2 statistics indicate how well one can predict class membership based on the observed variables. The closer these values are to 1, the better the predictors (Vermunt & Magidson, 2005).

In the second step, the conditional probabilities that are comparable to the factor loading in factor analysis are attained via maximum likelihood estimates. These parameters represent the probability of an individual in class *t* of the latent variable (X) to be at a particular level of the observed variables. The conditional probabilities allow us to characterize the nature of the types defined by each of the latent classes and hence the nature of the latent variable (McCutcheon, 1987).

In the third step, the cases are classified into the appropriate latent classes. For any given response pattern, estimates for the posterior membership probabilities are obtained using Bayes theorem. Cases are then assigned to the class for which the posterior probability is highest. Magidson and Vermunt (2001) and Vermunt and Magidson (2002) refer to this kind of model as a LC cluster model because the goal of classification into *T* homogeneous groups is identical to that of cluster analysis. In contrast to an ad hoc measure of distance used in cluster analysis to define homogeneity, LC analysis defined homogeneity in terms of probabilities. Cases in the same latent class are similar to each other because their responses are generated by the same probability distribution.

Four health behavior variables build the basis for the LC cluster analysis: nutrition style (with excellent nutrition [1], good nutrition [2], modest nutrition [3], and poor nutrition [4]), physical activity (with regularly physical active [1], physically inactive [2]), alcohol consumption (with non-consumer [1], regular consumer [2]) and cigarette consumption (with non-smoker [1], ex-smoker [2], occasional smoker [3], and smoker [4]). These four variables net a (4 x 2 x 2 x 4) 64 cell cross-tabulation.

The most positive response category was designated as 1, with increasingly negative responses in ascending order. Participants with missing data for any of the four variables were excluded from the analysis. Therefore, the following analysis could only be computed with 447 participants.

Table 18 reports the statistical criteria from an application of maximum likelihood estimation to the baseline assessment of the health behaviors in the present sample. The likelihood-ratio statistic L^2 indicates that either the model with two, three, four, five or six latent classes is satisfactory. The *BIC, AIC and AIC3* values, on the other hand, give the clear preference for the model with three latent classes. The three-class model also yielded the highest percentage of participants (85%) that were correctly allocated in the latent classes, while the highest lambda measure of prediction (.76). Thus, predictability is more certain with the three-class model. In addition, the model with three latent classes appeared to have pretty equal distribution of participants to the latent classes. Thus, the solution can be considered robust because it assures sufficient sample sizes within each group. A first subgroup was found to be the largest comprising almost half of the sample (n = 178). The other two subgroups were also reasonably large (n = 140; n = 129). Considerations of fit, parsimony, and predictability all favor the three class solution.

Table 18: Goodness of fit indices to determine the optimum number of clusters

	L^2 (df); *p*	*-2LL diff (p)*	*BIC*	*AIC*	*AIC3*	Classific. error	Reduct. Errors (lamda)	Entropy R^2	Stand. R^2
2 Clusters	57.3 (50); .22		-247.8	-42.7	-92.7	.19	.54	.37	.43
3 Clusters	*28.8 (45); .97*	*28.6****	*-245.8*	*-.61.2*	*-.106.2*	*.15*	*.76*	*.60*	*.64*
4 Clusters	23.0 (40); .99	5.7 (n.s.)	-221.1	-.57.0	-.97.0	.16	.72	.65	.65
5 Clusters	19.1 (35); .99	4.3 (n.s.)	-194.5	-50.9	-.85.9	.19	.69	.65	.62
6 Clusters	16.3 (30); .98	2.4 (n.s.)	-166.8	-43.7	-73.7	.21	.63	.62	.59

n.s.; * p < .05; ** p < .01; *** p < .001.

4.2.3.1 Description of the Three Cluster Solution

The results of latent cluster analysis can be described and labeled in terms of their configuration on the different health behaviors variables (see Figure 7 and Table 19, for exact probabilities see Table B 5 in Appendix B). Participants grouped in cluster I were likely to have modest nutrition habits, be physically inactive, not to consume alcohol regularly and not to smoke. Participants in cluster II were likely to have poor nutrition habits, be physically inactive, not to consume alcohol on a regular basis but were very likely smokers. Participant in cluster III, finally, had an overall positive profile: they were likely to have favorable nutrition habits, be physically active, not to consume alcohol regularly and not to smoke. The three clusters can thus, in a necessarily simplifying manner, to be labeled as “compensatory behavior pattern” (cluster I), “unfavorable pattern, but non drinker” (cluster II) and “overall favorable pattern” (cluster III).

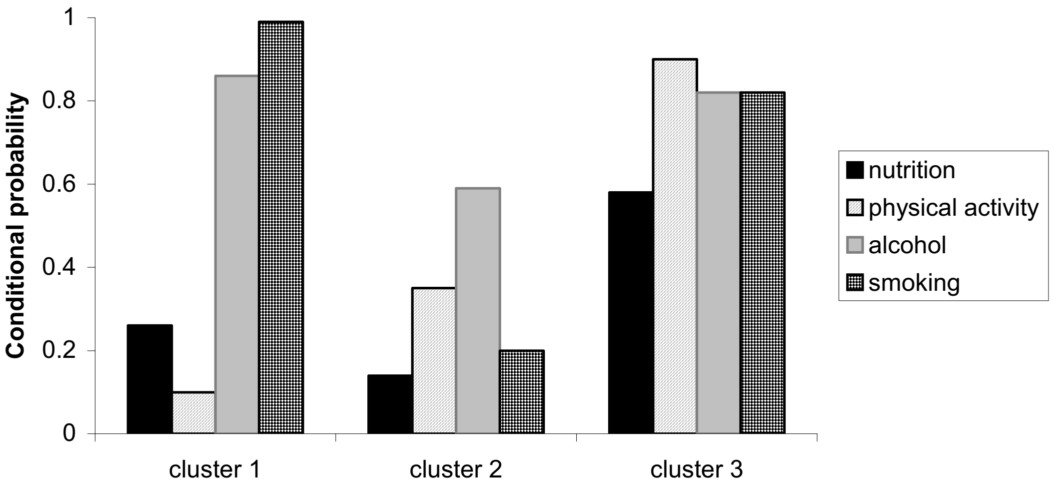

Figure 7: Conditional probabilities of having favorable characteristics on different health behaviors given a certain cluster membership.

Table 19: Clustering variable profiles: cluster size, means or percentage of participants with favorable characteristic on respective behavior, t-test and χ^2 tests of differences between cluster means and percentages, respectively

	n	*M* / %	Univariate *F*, pairwise comparison		
Nutrition					$F(2) = 43.7^{**}$, $\eta^2 = .16$
Cluster I	178	2.34		I	II
Cluster II	140	2.62	II	**	
Cluster III	129	2.14	III	**	**
Physical activity					$\chi2$ (2) = 314.1**
Cluster I	178	0.0		I	II
Cluster II	140	35.0	II	**	
Cluster III	129	100.0	III	**	**
Alcohol consumption					$\chi2$ (2) = 31.1**
Cluster I	178	83.1		I	II
Cluster II	140	58.6	II	**	
Cluster III	129	82.9	III	n.s.	**
Smoking					$\chi2$ (2) = 342.2**
Cluster I	178	100		I	II
Cluster II	140	12.9	II	**	
Cluster III	129	95.3	III	[7]	**

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

4.2.3.2 Age-group Differences in the Likelihood of Cluster Membership.

Did younger and older participants differ in their likelihood of belonging to each of the three clusters? Table 20 shows the numbers and percentages of younger and older adults in each of the three clusters (see also Figure 5).

Table 20: Age-group differences in the frequency of cluster membership

					younger subsample		older Subsample		age-group difference(a)
	nutrition	physical activity	alcohol	Smoking	*n*	%	*n*	%	*p*
Cluster I	"unfavorable"	"inactive"	"no"	"no"	147	43.2	30	28.8	*
Cluster II	"unfavorable"	"inactive"	"no"	"yes"	118	34.7	21	20.2	*
Cluster III	"favorable"	"active"	"no"	"no"	75	22.1	53	51.0	**

* $p < .006$; ** $p < .001$; (alpha adjustment for eight repeated single cell tests)
(a) Fuchs-Kennett test (testing age-group differences in frequency of cluster membership)

[7] $\chi2$- statistics could not be calculated, hence more than 20% of the cell had expected cell count less than 5.

There was a significant relationship between age group and cluster membership ($\chi^2(2) = 32.57$, $p < .01$). Follow-up analyses with the Fuchs-Kennett test (Fuchs-Kennett-Ausreißer-Einfeldertest; see Bortz & Lienert, 2003) showed that this relationship from differential probabilities for young and older adults to belong to different clusters. After the Bonferoni adjustment for multiple comparisons, older participants were significantly more likely to be members of cluster III than were younger participants. Younger participants, in contrast, were significantly more likely to belong to cluster I and II than were older participants. Older adults were unequally distributed across three clusters ($\chi^2(2) = 15.71$, $p < .001$). Pairwise comparison of the frequencies of cluster membership within the older subsample revealed that significantly more older participants were members of cluster III in comparison to cluster I (χ^2 (1, n = 83) = 6.37, $p < .02$[8]) and II (χ^2 (1, n = 74) = 13.84, $p < .001$). There were also differences in the distribution of younger adults to different clusters ($\chi^2(2) = 23.16$, $p < .001$). Pairwise comparison of the frequencies of cluster membership within the younger subsample revealed that significantly fewer younger participants were members of cluster III in comparison to cluster I (χ^2 (1, n = 222) = 23.35, $p < .001$) and II (χ^2 (1, n = 193) = 9.58, $p < .01$).

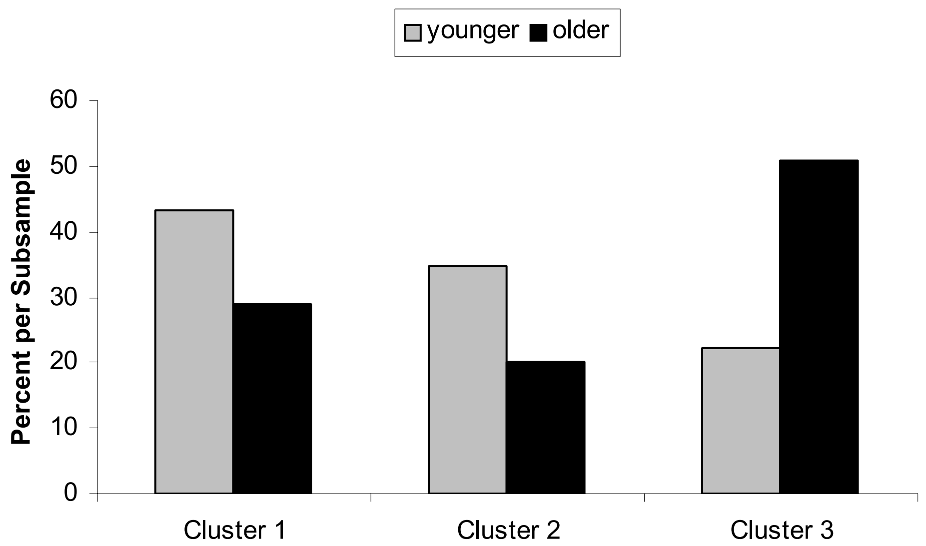

Figure 8: Percentage of younger and older participants in the three clusters

[8] i.e., $p < .02$, critical value after Bonferoni adjustment for three repeated analysis.

In summary, taking an exploratory cluster-analytic approach, three subgroups with different health behavior patterns were identified: a group of n = 178 participants that were likely to have modest nutrition habits, be physically inactive, not to consume alcohol regularly and not to smoke, a group of n = 140 participants that were likely to have modest nutrition habits, be physically inactive, not to consume alcohol on a regular basis but were very likely smoker, and a group of n = 129 participants that were likely to have favorable nutrition habits, be physically active, not to consume alcohol regularly and not to smoke. Older adults were more often members of cluster III than of the other two clusters, whereas younger adults were less often members of cluster III than of the other two clusters. The observed age-groups differences can thus be specified in terms of benignity of health behaviors configurations. In line with the expectations, older adults were more likely to report an overall favorable lifestyle (i.e., to belong to cluster III), and less likely to report "compensatory" lifestyle (i.e., to belong to cluster I) or "unfavorable lifestyle but not to drink alcohol regularly" (i.e., to belong to cluster II) than younger adults

4.2.4 Age Difference in Health Cognitions

4.2.4.1 Nutrition-Related Health Cognitions

In the following, age differences in health cognitions such as risk perception, outcome expectancies, self-efficacy, intention, and planning in the domain of nutrition will be explored. In order to examine age differences in health cognitions, the 2 X 2 ANOVA design was adopted. Sex was included as a second between subject factor in the analyses in order to control for possible sex differences.

Risk perception: As Table 21 shows, women did not differ in their absolute risk perception from men, $F(1, 510) = 0.89$, n.s. With respect to age, it was expected that older adults would feel more vulnerable for cardiovascular diseases than younger adults. Results from an ANOVA support this assumption, showing a main effect for age $F(1, 510) = 8.28$, $p < .01$, $\eta^2 = .02$. The interaction between sex and age did not reach significance $F(1, 510) = 0.33$, n.s.

Table 21: Risk perception of younger and older adults: means, standard deviations, and sex differences

	Male			Female		
	M	*SD*	*n*	*M*	*SD*	*n*
Young adults	3.43	1.37	178	3.48	1.21	189
Older adults	3.74	1.27	43	3.95	1.24	101

Nutrition-related outcome expectancies: With regard to nutrition-related outcome expectancies, there was a significant main effect for sex, $F(1, 589) = 6.83$, $p < .01$, $\eta^2 = .01$, indicating that females scored higher than males on nutrition-related outcome expectancies. The means for outcome expectancies are summarized in Table 22. There was also a significant main effect for age, $F(1, 589) = 3.71$, $p = .05$, $\eta^2 = .01$. Thus, older adults scored higher on outcome expectancies in comparison to younger adults. The interaction between sex and age was not significant, $F(1, 589) = 2.37$, n.s.

Table 22: Nutrition-related outcome expectancies of younger and older adults: means, standard deviations, and sex differences

	Male			Female		
	M	*SD*	*n*	*M*	*SD*	*n*
Young adults	2.64	.68	252	2.91	.55	181
Older adults	2.86	.68	47	2.93	.71	110

Nutrition-related perceived self-efficacy: As can be seen in Table 23, the 2 X 2 ANOVA yielded a significant main effect for age with regard to *action self-efficacy*, $F(1, 583) = 10.47$, $p < .001$, $\eta^2 = .02$, indicating that older adults scored higher on action self-efficacy in comparison to younger adults. No other effects reached statistical significance. Similar results were attained with regard to coping self-efficacy. Again, only the main effect for age reached significance, $F(1, 583) = 11.71$, $p < .01$, $\eta^2 = .02$. Thus, older adults scored higher on coping self-efficacy in comparison to younger adults.

Table 23: Nutrition-related self-efficacy of younger and older adults: means, standard deviations, and sex differences

	Male			Female		
	M	*SD*	*n*	*M*	*SD*	*n*
Action self-efficacy						
Young adults	2.54	.76	254	2.63	.70	175
Older adults	2.84	.63	47	2.80	.75	108
Coping self-efficacy						
Young adults	2.56	.73	254	2.54	.63	175
Older adults	2.76	.62	47	2.83	.77	108

Intention to adopt a healthy nutrition: There was a significant main effect for age, $F(1, 601) = 17.39$, $p < .001$, $\eta^2 = .03$, indicating that older adults had a stronger intention to adopt a healthy diet in comparison to younger adults (see Table 24). No other effects reached statistical significance, with $F(1, 601) = 01$, n.s. for sex and $F(1, 601) = 1.42$, n.s. for interaction.

Table 24: Intention to adopt a healthier diet: means, standard deviations, age and sex differences

	Male			Female		
	M	*SD*	*n*	*M*	*SD*	*n*
Young adults	3.72	1.37	255	3.89	1.21	183
Older adults	4.43	1.16	48	4.28	1.54	116

Nutrition-related action planning: The ANOVA revealed a significant main effect for age $F(1, 584) = 27.76$, $p < .001$, $\eta^2 = .05$, indicating that older adults scored higher on action planning in comparison to younger adults. The means for nutrition-related action and coping planning are summarized in Table 25. The sex effect $F(1, 584) = .02$, n.s. and the interaction effect $F(1, 584) = .19$, n.s. turned out to be non-significant.

Nutrition-related coping planning: The same pattern of results emerged for coping planning. There was a significant main effect for age $F(1, 584) = 22.94$, $p < .001$, $\eta^2 = .04$. Thus, older adults scored higher on coping planning that younger adults did. The main effect for sex, $F(1, 584) = .53$, n.s., and the interaction effect, $F(1, 584) = .48$, n.s., did not reach significance.

Table 25: Nutrition-related action and coping planning of younger and older adults: means, standard deviations, and sex differences

	Male			Female		
	M	*SD*	*n*	*M*	*SD*	*n*
Action Planning						
Young adults	2.11	.88	254	2.16	.90	176
Older adults	2.63	.88	47	2.60	.96	108
Coping Planning						
Young adults	2.14	.83	254	2.26	.85	176
Older adults	2.60	.78	47	2.60	.85	108

4.2.4.2 Physical Activity-Related Health Cognitions

Physical activity-related outcome expectancies: As Table 26 shows, the analysis of variance showed no sex $F(1, 589) = 1.91$, n.s., or age $F(1, 589) = .33$, n.s., differences in the magnitude of physical activity-related outcome expectancies. The sex-by-age interaction did not reach significance $F(1, 589) = .07$, n.s.

Table 26: Physical activity-related outcome expectancies of younger and older adults: means, standard deviations, and sex differences

	Male			Female		
	M	*SD*	*n*	*M*	*SD*	*n*
Young adults	3.27	.53	254	3.31	.54	179
Older adults	3.31	.54	48	3.37	.60	109

Physical activity-related perceived self-efficacy: The physical activity-related self-efficacy construct was further differentiated in *action and coping self-efficacy* depending on point of time within a self-regulatory goal attainment process. The means and standard deviations for both types of self-efficacies can be found in Table 27. The main effect for sex fell only short of reaching significance, $F(1, 578) = 3.42$, $p = .06$, $\eta^2 = .01$, indicating that in trend men scored higher on the *action self-efficacy* scale than women. There was an age difference with regard to action self efficacy, $F(1, 578) = 6.29$, $p < .05$, $\eta^2 = .01$. Thus, older adults scored higher on action self-efficacy than the younger adults did. The sex-by-age interaction was not significant, $F(1, 578) = .00$, n.s.

The same was true for *coping self-efficacy*. The 2 X 2 ANOVA yielded the significant main effects for sex $F(1, 594) = 6.78$, $p < .01$, $\eta^2 = .01$ and age $F(1, 594) = 12.54$, $p < .001$, $\eta^2 = .02$. Men scored higher on coping self-efficacy scale than women. Younger adults scored lower on coping self-efficacy scale in comparison to older adults. The sex by age interaction was not significant, $F(1, 594) = .02$, n.s.

Table 27: Physical activity-related self-efficacy of younger and older adults: means, standard deviations, and sex differences

	Male			Female		
	M	*SD*	*n*	*M*	*SD*	*n*
Action self-efficacy						
Young adults	3.18	.72	248	3.05	.72	179
Older adults	3.37	.66	46	3.23	.80	106
Coping self-efficacy						
Young adults	2.70	.58	254	2.53	.58	181
Older adults	2.91	.48	48	2.76	.82	112

Intention to be physically active: With regard to the intention to be physically active in the next couple of months the 2 X 2 ANOVA indicated a non-significant main effect for sex, $F(1, 601) = 3.71$, $p = .06$[9] (see Table 28). The main effect for age fell only short of being significant, $F(1, 601) = 4.30$, $p = .04$, indicating that in trend older adults had built a higher intention to be physically active than younger adults. There was no interaction effect, $F(1, 601) = 2.09$, n.s.

Table 28: Intention to be physically active: means, standard deviations, age and sex differences

	Male			Female		
	M	*SD*	*n*	*M*	*SD*	*N*
Young adults	4.21	2.11	255	4.85	1.64	183
Older adults	4.88	1.47	48	4.97	2.06	116

Physical activity-related planning: With regard to *action planning,* the 2 X 2 ANOVA revealed a non-significant main effect for sex $F(1, 594) = 2.06$, n.s., but a significant main effect for age $F(1, 594) = 6.59$, $p < .05$, $\eta^2 = .01$. Thus, as can be seen in Table 29, older adults scored higher on action planning in comparison to younger adults. There was no interaction effect, $F(1, 594) = .02$, n.s.

The results with regard to *coping planning* were similar. The 2 X 2 ANOVA indicated a non-significant main effect for sex $F(1, 594) = 1.99$, n.s. and a significant main effect for age $F(1, 594) = 12.98$, $p < .001$, $\eta^2 = .02$, pointing that older adults

[9] Levene's test (p < .001) indicated departures from the assumption of equality of error variances. Thus, the significance niveau of .01 was adopted for further analysis.

scored higher on coping planning in comparison to younger adults. There was no interaction effect, $F(1, 594) = 2.65$, n.s.

Table 29: Physical activity-related planning of younger and older adults: means, standard deviations, and sex differences

	Male			Female		
	M	*SD*	*n*	*M*	*SD*	*n*
Action planning						
Young adults	2.56	.70	254	2.47	.77	181
Older adults	2.76	.64	48	2.65	.83	112
Coping planning						
Young adults	2.35	.70	254	2.13	.75	181
Older adults	2.50	.68	48	2.51	.81	112

To conclude, there were considerable age differences with regard to health cognitions concerning health promoting behaviors such as healthy nutrition and physical activity. Older adults felt more vulnerable for cardiovascular diseases than younger adults. They also had a stronger intention to adopt healthy nutrition and to be physically active. Moreover, they reported higher self-regulation resources (action self-efficacy, coping self-efficacy, action and coping planning) for transforming their intentions into action. Both younger and older adults were aware of the outcomes these two behaviors might have on their health, although older adults scored slightly higher on nutrition-related outcome expectancies. Sex differences in the health cognitions regarding health promoting behaviors were for the most part negligible and will not be considered further.

4.2.4.3 Alcohol-Related Health Cognition

Alcohol-related outcome expectancies: The 2 X 2 ANOVA yielded a non-significant main effect for sex, $F(1, 475) = 1.03$, n.s., (see Table 30). There was a significant main effect for age, $F(1, 475) = 9.62$, $p < .01$[10], $\eta^2 = .02$. The sex by age interaction was also significant, $F(1, 475) = 4.90$, $p = .027$, $\eta^2 = .01$. Accordingly, further simple main effects of age were assessed within each of the sex categories. There was a significant age difference among women, $F(1, 475) = 14.54$, $p < .001$, $\eta^2 = .02$ indicating that younger women scored higher on outcome expectancies than older women did. Thus, the significant main effect for age was restricted to women.

[10] Due to violation of equality of error variance effects were tested at .025 significance level (Tabachnick and Fidell, 2001)

Table 30: Alcohol-related outcome expectancies of younger and older adults: means, standard deviations, and sex differences

	Male			Female		
	M	*SD*	*n*	*M*	*SD*	*n*
Young adults	3.01	.88	232	3.13	.77	152
Older adults	2.92	.75	42	2.59	1.13	50

Alcohol-related perceived self-efficacy: There were no sex $F(1, 466) = 2.54$, n.s., or age $F(1, 466) = 1.50$, n.s., (see Table 31) differences with regard to alcohol self-efficacy. The sex by age interaction was also non-significant, $F(1, 466) = 2.10$, n.s.

Table 31: Alcohol-related self-efficacy of younger and older adults: means, standard deviations and sex differences

	Male			Female		
	M	*SD*	*n*	*M*	*SD*	*n*
Young adults	2.83	.94	230	3.17	.84	153
Older adults	2.86	.83	42	2.87	1.14	42

Intention to reduce alcohol consumption: The 2 X 2 ANOVA indicated that both main effects turned out to be non-significant: with $F(1, 601) = .30$, n.s. for sex, and with $F(1, 601) = 1.63$, n.s. for age (see Table 32). However, there was a significant sex by age interaction, $F(1, 601) = 10.60$, $p < .01$, $\eta^2 = .02$. The inspection of the simple main effects revealed that there was an age difference among men with regard to the intention to reduce alcohol consumption $F(1, 601) = 8.06$, $p < .01$. Thus, older men built a stronger intention to reduce alcohol consumption than younger men did. Moreover, younger women built a stronger intention to reduce alcohol consumption than younger men, $F(1, 601) = 14.95$, $p < .001$.

Table 32: Intention to reduce alcohol consumption: means, standard deviations, age and sex differences

	Male			Female		
	M	*SD*	*n*	*M*	*SD*	*N*
Young adults	3.38	1.97	255	4.09	1.81	183
Older adults	4.23	1.64	48	3.72	1.92	116

Alcohol-related action planning: With regard to action planning, the 2 X 2 ANOVA yielded a non-significant main effect for sex, $F(1, 451) = 2.36$, n.s., and a non-significant main effect for age, *F*(1, 451) = .01, n.s., (see Table 33). The sex by age interaction did not reach significance as well, *F*(1, 451) = 1.77, n.s.

Alcohol-related coping planning: A similar pattern of results emerged also for coping planning. Both main effects did not reach significance with *F*(1, 450) = .73, n.s. for sex and with *F*(1, 450) = .31 n.s. for age (see Table 29). The sex by age interaction was also non-significant, *F*(1, 450) = .19, n.s.

Table 33: Alcohol-related planning of younger and older adults: means, standard deviations, and sex differences

	Male			Female		
	M	*SD*	*n*	*M*	*SD*	*n*
Action planning						
Young adults	2.14	1.03	227	2.11	1.05	149
Older adults	2.32	1.02	38	1.95	1.09	38
Coping planning						
Young adults	2.19	1.03	227	2.13	1.05	149
Older adults	2.17	1.00	37	2.00	1.15	38

4.2.4.4 Smoking-Related Health Cognitions

Since only 11 women were smokers, only age differences were further explored. The analyses were also restrained to current smokers.

Smoking-related outcome expectancies: There were no age differences with regard to smoking-related outcome expectancies *t*(157) = .62, n.s. The means and standard deviations for smoking-related outcome expectancies can be found in Table 34.

Table 34: Smoking-related outcome expectancies of younger and older adults: means and standard deviations

	M	*SD*	*N*
Young adults	3.31	.62	133
Older adults	3.23	.48	26

Smoking-related perceived self-efficacy: As can be seen in Table 35 there was a significant age difference with regard to smoking related action and coping self-efficacy, *t*(156) = 2.14, *p* < .05 and *t*(156) = 2.44, *p* < .05 respectively. Thus, older adults scored higher on the self-efficacy scales than the younger adults.

Table 35: Smoking-related self-efficacy of younger and older adults: means and standard deviations

	M	*SD*	*N*
Action self-efficacy			
Young adults	2.35	.86	132
Older adults	2.73	.68	26
Coping self-efficacy			
Young adults	2.41	.92	132
Older adults	2.87	.53	26

Intention to quit smoking: There was an age difference in the strength of intention to quit smoking, $t(156) = 3.97$, $p < .001$, indicating that older adults had a stronger intention to quit than younger adults (see Table 36).

Table 36: Intention to quit smoking: means, standard deviations and age differences

	M	*SD*	*N*
Young adults	2.62	1.93	133
Older adults	4.32	2.10	25

Smoking-related planning: As can be seen in Table 37, there were no age differences with regard to *smoking-related action planning*, $t(156) = .43$, n.s. and *smoking-related coping planning*, $t(155) = 1.26$, n.s.

Table 37: Smoking-related planning of younger and older adults: means, standard deviations

	M	*SD*	*N*
Action planning			
Young adults	2.27	1.04	132
Older adults	2.36	1.00	26
Coping planning			
Young adults	2.13	.95	132
Older adults	2.39	.86	25

To summarize, a differential picture emerged with regard to health cognitions concerning health impairing behaviors, such as alcohol and smoking. Thus, older women in comparison to other groups were more aware of the positive health consequences that limitation of alcohol consumption might have. Moreover, older men along with younger women, built stronger intentions to reduce alcohol consumption in comparison to younger men. Contrary to health promoting behaviors, there were no age differences in the self-regulatory skills regarding the limitation of alcohol consumption. However, older adults perceived themselves as more capable of quitting smoking than younger adults. They also had a stronger intention to do so.

Thus, in general older adults had stronger intentions toward a healthier life style than younger adults.

4.3 APPLICABILITY OF THE HAPA-MODEL TO DIFFERENT AGE-GROUPS: STRUCTURAL DIFFERENCES

From the life span perspective, age-related changes in motivational orientation were expected. Therefore, in the last part of the results section, possible age differences in the structure of HAPA variables were investigated. The main interest was to explore whether there were age-related differences in the interplay of factors that facilitate health behavior. Given that only 25 of older adults were smokers, the investigation of possible age differences in the structure of smoking-related HAPA variables were abandoned due to the lack of statistical power. Further, the mediating role of planning between intention and behavior was explored for different age groups. An alternative hypothesis was tested that might explain structural differences between age groups.

4.3.1 Age-Related Structural Difference by Predicting Nutrition Behavior

The applicability of HAPA in the domain of nutrition for different age groups was tested via multiple group comparison. The procedure of testing for parameter invariance between different groups proposed by Byrne (2001) was applied. The precondition for a multiple group comparison is the adequateness of the model when tested for each group separately. Only if the hypothesized model is sufficient in all sub-samples, may the model work well in the multiple group analysis. Therefore, the HAPA-Model for nutrition was tested separately for each age group. Goodness-of-fit indices for the different age groups are summarized in Table 38.

Table 38: Goodness of Fit statistics for the groups of young and older adults

Sample	n	χ^2	df	χ^2/df	p	CFI	TLI	RMSEA	CI 90 %
Young adults	479[11]	307.9	161	1.91	<.001	.97	.96	.044	.036, .051
Older adults	199	218.1	161	1.35	<.01	.96	.95	.042	.027, .056

[11] Six participants did not indicate their age, therefore the total sample under consideration of age does not sum-up to 684 participants.

As can be seen in Table 38, the hypothesized model represented the data well across different age groups. Consequently, because the model offered a reasonable fit in all samples, the multiple groups structural equation model was employed next.

4.3.1.1 Testing for Multiple Group Invariant Factorial Structure of Measurement Instruments

Testing for group differences requires a sequence of nested models ranging from the unconstrained multiple group model (M1 as baseline model) with the parameter estimates free to vary across sub-samples to more parsimonious nested models. In a first step, the baseline model is tested in both age groups *simultaneously*. The fit of this simultaneously estimated model provides the baseline value against which all subsequently specified models are compared. This multiple group model reflects the extent to which the structure of the HAPA model for nutrition fits the data when no cross-group constraints are imposed. As can be seen in Table 39, the fit indices for the baseline model indicate that the hypothesized HAPA structure is well represented across both age groups.

In a second step, measurement invariance between age groups was investigated. Thus, the question whether items or parcels assess the same constructs in different age-groups was examined. A common practice is to constrain the factor loadings to be equal across the samples and then to constrain factor variances. By additionally constraining factor variance, the equality in factor variability between age groups can be tested. Accordingly, a model (M2) constraining all factor loadings to be equal was tested against a model that allowed the factor loadings to vary across subsamples. With a χ^2-difference value of 13.24 and $df = 13$ ($p = .43$), the assumption of factorial invariance across different age groups was confirmed. This model (M2) was tested against a model (M3) that additionally constrained the factorial variance. Again, no difference between groups was found, with a χ^2-difference value of 2.39 and $df = 3$ ($p = .50$).

After the measurement model equivalence across age groups was substantiated, the invariance (i.e., equivalence) of the structural model across groups was investigated in the third step. Accordingly, a model (M4) fixing all regression weights to be equal across groups was tested against model M3. If the nested-model comparison suggests a significant difference between these two models, the patterns of social-cognitive variables between younger and older adults can be regarded as being different. The results were not significant, with a χ^2-difference value of 12.44 and df = 8 (p = .13), indicating no apparent differences in the prediction pattern of nutrition behavior between age groups. Since the results fell only short of being significant, single path differences were investigated in the following step.

Lastly, by examining group differences in the single paths, the unique prediction patterns for age groups were identified. This was done by setting equality constraints on each single path and comparing this model to model M4. Significant difference between groups was found in the risk perception, with a χ^2-difference value of 8.43 and df = 1 (p < .01). Figure 9 displays the standardized solution.

Table 39: Goodness of Fit indices for nested models

Model	χ^2	df	p	χ^2/df	CFI	TLI	RMSEA	CI 90%
Baseline (M1)	526.23	322	<.001	1.63	.96	.95	.031	.026, .035
Constrained factor loadings (M2)	539.48	335	<.001	1.61	.96	.96	.030	.025, .035
Constrained factor variance (M3)	541.87	338	<.001	1.60	.96	.96	.030	.025, .034
Constrained regression weights (M4)	554.31	346	<.001	1.60	.96	.96	.030	.025, .034

As these results show (see Figure 9), there was a significant difference between the older and younger groups in the motivation to adopt a healthy nutrition. For younger adults, action self-efficacy along with outcome expectancies was sufficient for the intention formation. In the group of older adults, all three health cognitions (risk perception, action self-efficacy, and to a lower degree outcome expectancies) were facilitative for intention formation. Generally, the variance explained in intention was much lower in the group of younger adults. Intention was associated with planning. The strength of the associations between intention and planning was lower in the group of younger adults than in the group of older adults. Coping self-efficacy and planning jointly predicted nutrition behavior in both age groups. It can be concluded that the perception of one's own vulnerability serves as a motivational source for intention formation in the group of older adults but not in the group of younger adults.

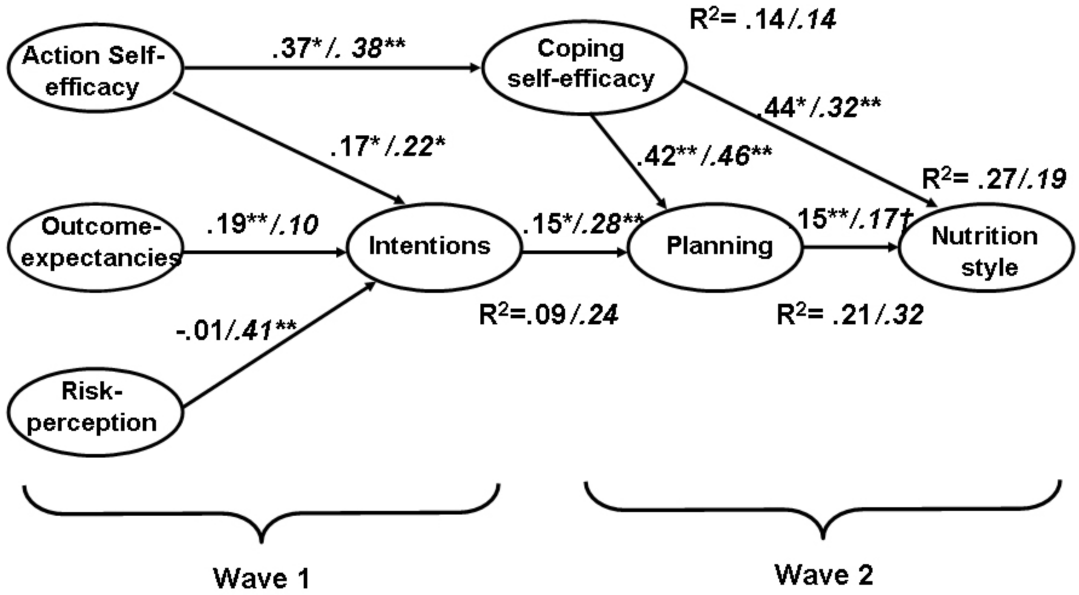

Figure 9: HAPA-Model for nutrition in different age groups: In italics are coefficients for the older group.

4.3.1.2 Testing Mediation

In this section, the results aimed at testing the mediation effect of planning in different age groups are reported. Mediation analyses were performed in order to test whether the adoption of favorable nutrition was motivated by health-related reasons in both age groups. The general procedure for testing mediation was proposed by Baron and Kenny (1986). A variable functions as a mediator when it meets the following conditions: the independent variable should correlate with the proposed mediator variable and with the dependent variable, and the mediator variable should correlate with the dependent variable. When this is the case, then the strength of association between independent and dependent variables should decrease significantly when controlling for the mediator variable.

To test the proposed mediation hypotheses, it was necessary to ascertain a relationship between predictors (intention and planning) and the proposed outcome variable nutrition style. Initially, Pearson correlations were inspected. Correlations revealed anticipated bivariate relationships between intention (t1), planning (t2), and nutrition style (t2). Intention was significantly correlated with nutrition style in the group of younger and older adults respectively (r = .17, $p < .01$; r = .32, $p < 0.01$) and planning correlated positive with nutrition style (with r =.32, $p < .001$ for younger adults; with r =.32, $p < .001$ for older adults). Further, the relationship between intention and planning was examined. The simple correlations were inspected and revealed, as expected, a positive association between intention and planning in the groups of younger and older adults respectively ($r = .18$ $p < .001$; $r = .32$ $p < .001$).

Figures 10 and 11 present the results of the hierarchical regression analysis that was aimed at testing the mediation effect of planning. Using a multiple regression analysis the intention-nutrition style relationship can be divided into two parts, one part mediated through planning (indirect effect of intention on nutrition style) and one part unrelated to planning (the direct effect of intention on nutrition style). To demonstrate mediation, the indirect effect should be relatively large. The indirect effect is large when there is a significant drop in the strength of the association between intention and nutrition style. The results pointed to the mediation model, Sobel test = 2.60, $p < .01$ for the young adults and Sobel test = 2.87, $p < .01$ for the older adults. Thus, the relationship between intention and nutrition style is partially mediated through planning, indicating that people who intend to adopt a healthier diet do so partly by making concrete plans of how and when they want to start changing their nutrition habits. However, the direct effect of intention on nutrition style was stronger in the older adults group in comparison to younger adults. Thus, the adoption of favorable nutrition in the younger age group is more likely to be performed for reasons other than health-related ones.

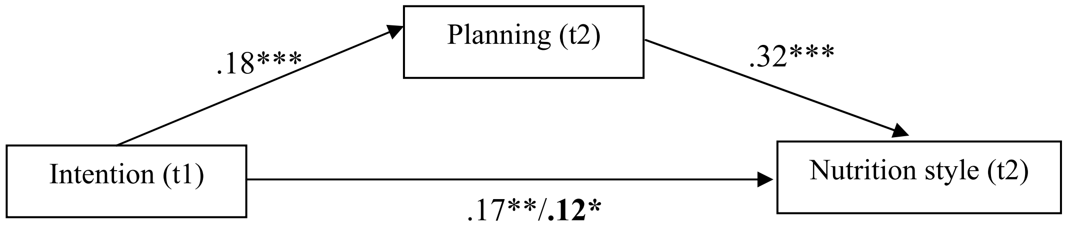

Figure 10: Relationship among intention to adopt healthier nutrition, planning and nutrition style for younger adults. The coefficient for direct effect after controlling for indirect effect is in bold, (n = 394).

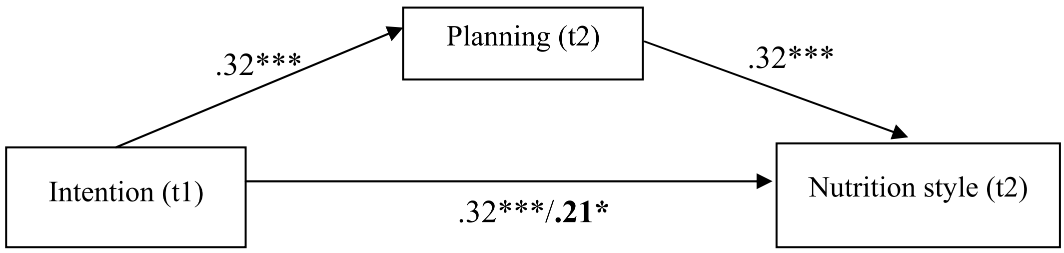

Figure 11: Relationship among intention to adopt healthier nutrition, planning and nutrition style for older adults. The coefficient for direct effect after controlling for indirect effect is in bold, (n = 131).

4.3.1.3 Alternative Explanation: Intenders vs. Nonintenders.

Older adults had a stronger intention to adopt favorable nutrition in comparison with younger adults ($M = 4.32$, $SD = 1.42$ vs. $M = 3.79$, $SD = 1.30$; $t(610) = 19.42$; $p < .001$). Thus, it could be argued that the cause of structural differences lies in the stage of change people are in and not in the age-related changes in goal orientation (cf. Chapter 2.1.3). In order to examine this line of reasoning, two extreme groups of nonintenders and intenders were established. The group of nonintenders (n = 123) was created by applying the same method as used by Renner & Schwarzer (2005) by combining the first three response categories of the seven-point intention score. The group of intenders (n = 120) was created by combining the last two response categories.

A comparison of the two groups confirmed the mean differences between nonintenders and intenders. Intenders in comparison with nonintenders scored higher on outcome expectancies ($M = 3.01$; $SD = .68$ versus $M = 2.59$; $SD = .76$ $t(238) = 19.72$; $p < .001$), action self efficacy ($M = 2.97$; $SD = .75$ versus $M = 2.57$; $SD = .81$;

t(235) = 15.44; *p* < .001), coping self-efficacy (*M* = 2.96; *SD* = .69 versus *M* = 2.47; *SD* = .79; *t*(235) = 25.42; *p* < .001), planning (*M* = 2.59; *SD* = .89 versus *M* = 2.03; *SD* = .93; *t*(236) = 22.06; *p* < .01) and nutrition behavior at Wave 1 (*M* = 2.60; *SD* = .51 versus *M* = 2.24; *SD* = .50; *t*(242) = 29.69; *p* < .001). However these two groups did not differ with regard to risk perception (*M* = 3.55; *SD* = 1.48 versus *M* = 3.27; *SD* = 1.32; *t*(169) = 1.51, *n.s.*).

The next question was whether the adoption of healthy nutrition within the group of intenders is motivated differently than within the group of nonintenders and whether these differences mirror the age-related structural difference described in 4.1.2. In order to investigate structural differences between intenders und nonintenders multiple-group comparisons were conducted. No structural differences in the interplay of social-cognitive variables were found between intenders and nonintenders (for details of multiple group analysis see Section 7.3.1 in Appendix C). Thus, it was age-related changes in motivation and not the stage of change that moderated the interplay of social-cognitive variables by prediction of healthy eating.

4.3.2 Age-Related Structural Difference by Predicting Physical Activity

In order to investigate age differences in the structure of social-cognitive variables at predicting physical activity, a multiple group comparison was carried out. The procedure of testing for parameter invariance between different groups proposed by Byrne (2001) was again applied. The precondition for a multiple group comparison is the adequateness of the model when tested for each group separately. Therefore, the HAPA-Model for physical activity was tested separately for each age group. The model for younger adults (*n* = 484) yielded a reasonable fit to the data, χ^2 = 528.8, *df* = 164, *p* < .001, χ^2 /df = 3.22, CFI = .91, TLI = .88, RMSEA = .068, 90% CI = .062, .075. The fit of the model for older adults (*n* = 199) was also satisfactory, χ^2 = 261.9, *df* = 164, *p* < .001, χ^2 /df = 1.60, CFI = .94, TLI = .92, RMSEA = .055, 90% CI = .043, .067. Thus, the hypothesized model represented the data well within each age group.

The predicted relationships were confirmed. A large amount of variance was accounted for within the older sample, 20% of physical activity, 55% of planning, and 19% of intention variance. In the younger sample, the corresponding amounts were only 6% of physical activity, 4% of planning, and only 3% of intention variance. The question whether age moderates the specified relations was investigated in the next set of analyses.

4.3.2.1 Testing for Multiple Group Invariant Factorial Structure of Measurement Instruments

In order to investigate whether these age differences represent significant differences in the structure of social-cognitive variables across age groups, multiple-group analyses were further pursued. The goodness of fit indices for the models with different constraints are summarized in Table 40. The fit indices for the baseline model indicate that the hypothesized HAPA structure is well represented across both age groups.

In a second step, measurement invariance between age groups was investigated. Accordingly, a model (M2) constraining all factor loadings to be equal was tested against a model that allowed the factor loadings to vary across subsamples. With a χ^2-difference value of 11.24 and $df = 13$, $p = .59$, the assumption of factorial invariance across different age groups was confirmed. This model (M2) was tested against a model (M3) that additionally constrained the factorial variance. Again, no difference between groups was found, with a χ^2-difference value of 1.65 and $df = 3$, $p = .64$.

After the measurement model equivalence across age groups was substantiated, the invariance (i.e., equivalence) of the structural model across groups was investigated in the third step. Accordingly, a model (M4) fixing all regression weights to be equal across groups was tested against model M3. The results were significant, with a χ^2-difference value of 46.04 and $df = 8$, $p < .001$, indicating structural differences in the prediction pattern of physical activity between age groups. In order to pinpoint the source of age differences, single path differences were investigated in the following step.

Lastly, by examining group differences in the single paths, the unique prediction patterns for age groups were identified. This was done by setting equality constraints on each single path and comparing this model to model M4. Significant differences between groups were found in the following regression weights: risk perception, with a χ^2-difference value of 2.69 and $df = 1$, $p = .10$ on intention, outcome-expectancies with a χ^2-difference value of 4.10 and $df = 1$, $p < .05$, on intentions, intention on planning with a χ^2-difference value of 4.65 and $df = 1$, $p < .05$, action self-efficacy with a χ^2-difference value of 14.40 and df = 1, p < .001, on planning, and action self-efficacy with a χ^2-difference value of 10.50 and df = 1, p < .01, on coping self-efficacy.

Table 40: Goodness of Fit indices for nested models

Model	$\Delta\chi^2$(df; p)	χ^2	df	p	χ^2/df	CFI	TLI	RMSEA	CI 90%
Baseline (M1)		790.00	326	<.001	2.43	.92	.89	.046	.042, .050
Constrained factor loadings (M2)	11.24 (13; n.s)	802.13	339	<.001	2.37	.92	.90	.045	.041, .049
Constrained factor variance (M3)	1.64 (3; n.s)	803.78	342	<.001	2.35	.92	.90	.044	.040, .048
Constrained regression weights (M4)	46.04 (8, < .001)	849.82	350	<.001	2.43	.91	.89	.046	.042, .050

The regression weights for different age groups are depicted in Figure 12. There were significant differences in the motivation to be physically active between older and younger adult age groups. For younger adults, action self efficacy alone was sufficient for intention formation. In the group of older adults, all three health cognitions (risk perception, outcome-expectancies and action self-efficacy) were facilitative for intention formation. No differences in the interplay between self-regulatory variables such as coping self-efficacy and planning were found between age groups, indicating that self-regulatory skills were a prerequisite for successful performance in both age groups.

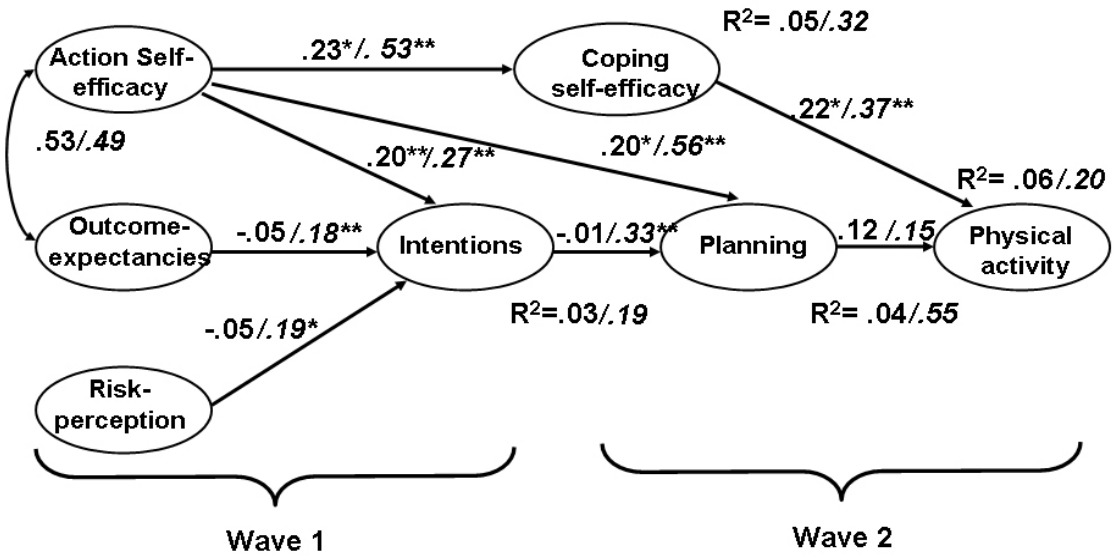

Figure 12: HAPA-Model for physical activity in different age groups: In italics are coefficients for the older group.

4.3.2.2 Testing Mediation

In this section, results of the analyses aimed at testing the mediation effect of planning in different age groups are reported. Mediation analyses were performed in order to test whether the engagement in physical activity was motivated by health-related reasons in both age groups. Correlations revealed anticipated bivariate relationships between intention (t1), planning (t2), and physical activity (t2), but only in the group of older adults. Intention was significantly correlated with physical activity only in the group of older adults (r = -.09, *n.s,.* for younger adults; r = .20, p < .05, for older adults), planning correlated positively with physical activity in both age groups (r = .22, p < .001 for younger adults; r = .36, p < .001, for older adults), and there was a positive association between intention and planning in both age groups (r = .11 p < .05 for younger adults; r = .43, p < .001 for older adults). Thus, the precondition for mediation analysis was not met in the group of younger adults. Therefore the mediation analysis was carried out only for the group of older adults.

Figure 13 presents the results of the hierarchical regression analysis that was aimed at testing the mediation effect of planning in the group of older adults. The mediation analysis revealed a significant decrease in the association between intention and physical activity when planning was entered into the regression analysis (Sobel test Z = 3.55, p < .001). The relationship between intention and physical activity was fully mediated through planning, indicating that older adults who intend to be physically active do so by making concrete plans of how and when they can be physically active. Whereas for younger adults, physical activity is likely to be performed for reasons other than health-related ones.

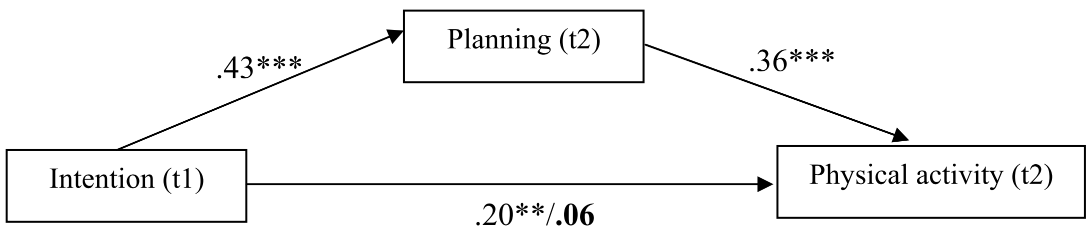

Figure 13: Relationship among intention to be physically active, planning and nutrition style: Standardized regression coefficients (n = 135). The coefficient for direct effect controlled for the indirect effect is in bold.

4.3.2.3 Alternative Explanation: Intenders vs. Nonintenders

Older adults had a stronger intention to be physically active in comparison with younger adults (*M* = 4.93, *SD* = 1.89 vs. *M* = 4.48, *SD* = 1.95; $t(610) = 6.65$; $p = .01$). Thus, it could be argued that the cause of structural differences lies in the stage of change people are in and not in the age-related changes in goal orientation. In order to examine this line of reasoning, two extreme groups of nonintenders and intenders were established. The group of nonintenders (*n* = 123) was created by combining the first three response categories of the seven-point intention score. The group of intenders (*n* = 209) was created by combining the last two response categories.

A comparison of the two groups confirmed the mean differences between nonintenders and intenders: Intenders in comparison with nonintenders scored higher on outcome expectancies (*M* = 3.43; *SD* = .52 versus *M* = 3.28; *SD* = .60 $t(328) = 5.95$; $p < .05$), action self efficacy (*M* = 3.46; *SD* = .64 versus *M* = 3.02; *SD* = .80; $t(320) = 28.28$; $p < .001$), coping self-efficacy (*M* = 2.79; *SD* = .47 versus *M* = 2.53; *SD* = .68; $t(288) = 14.58$; $p < .001$), and planning (*M* = 2.64; *SD* = .56 versus *M* = 2.31; *SD* = .72; $t(321) = 19.62$; $p < .001$). However these two groups did not differ with regard to risk perception (*M* = 3.48; *SD* = 1.44 versus *M* = 3.43; *SD* = 1.25; $t(250) = .57$; n.s.) and the level of physical activity at Wave 1 (*M* = 5.68; *SD* = 4.67 versus *M* = 5.06; *SD* = 5.41; $t(325) = 1.22$; n.s.).

The next question was whether the performance of physical activity within the group of intenders is motivated differently than within the group of nonintenders. Thus, the issue was whether possible structural differences between nonintenders and intenders mirror the age-related structural differences described in 4.2.2. Multiple-group comparisons were conducted in order to investigate structural differences between intenders und nonintenders. No structural differences in the interplay of social-cognitive variables were found between intenders und nonintenders (for details of multiple group analysis see Section 7.3.2 in Appendix C). Thus, it was age and not the stage of change that moderated the interplay of social-cognitive variables by prediction of physical activity.

4.3.3 Age-Related Structural Difference by Predicting Alcohol Consumption

Next, in order to investigate age differences in the structure of social-cognitive variables at predicting alcohol consumption, a multiple group comparison was carried out. The procedure of testing for parameter invariance between different groups proposed by Byrne (2001) was again applied. The precondition for a multiple group comparison is the adequateness of the model when tested for each group separately. Therefore, the HAPA-Model for alcohol consumption was tested separately for each age group. The model for younger adults (n = 337) yielded a reasonable fit to the data, χ^2 = 113.5, df = 71, p < .01, χ^2 /df = 1.60, CFI = .98, TLI = .96, RMSEA = .042, 90% CI = .027, .056. The fit of the model for older adults (n = 73) was also satisfactory, χ^2 = 85.4, df = 71, *n.s*, χ^2 /df = 1.20, CFI = .94, TLI = .91, RMSEA = .053, 90% CI = .000, .090. Thus, the hypothesized model represented the data well within each age group.

The predicted relationships were confirmed. A moderate amount of variance was accounted for within the older sample, 16% of alcohol consumption, 13% of planning, and 20% of intention variance. In the younger sample, the corresponding amounts were only 2% of alcohol consumption, 7% of planning, and only 4% of intention variance. The question whether age moderates the specified relations was investigated in the next set of analyses.

4.3.3.1 Testing for Multiple Group Invariant Factorial Structure of Measurement Instruments

In order to investigate whether these age differences represent significant differences in the structure of social-cognitive variables across age groups, multiple-group analyses were further pursued. The goodness of fit indices for the models with different constraints are summarized in Table 41. The fit indices for the baseline model indicate that the hypothesized HAPA structure is well represented across both age groups.

In a second step, measurement invariance between age groups was investigated. Accordingly, a model (M2) constraining all factor loadings to be equal was tested against a model that allowed the factor loadings to vary across subsamples. With a χ^2-difference value of 11.82 and df = 8, p = .16, the assumption of factorial invariance across different age groups was confirmed. This model (M2) was tested against a model (M3) that additionally constrained the factorial variance. Again, no difference between groups was found, with a χ^2-difference value of 3.33 and df = 3, p = .34.

After the measurement model equivalence across age groups was substantiated, the invariance (i.e., equivalence) of the structural model across groups was investigated in the third step. Accordingly, a model (M4) fixing all regression weights to be equal across groups was tested against model M3. The results were non-significant, with a χ^2-difference value of 8.83 and df = 7, p = .22, indicating no structural differences in the prediction pattern of alcohol consumption between age groups. Figure 14 displays the standardized solution

Table 41: Goodness of Fit indices for nested models

Model	$\Delta\chi^2$(df; *p*)	χ^2	df	*p*	χ^2/df	CFI	TLI	RMSEA	CI 90%
Baseline (M1)		199.45	142	<.01	1.40	.97	.96	.031	.020, .041
Constrained factor loadings (M2)	11.82 (8; n.s)	211.28	150	<.001	1.41	.97	.96	.032	.021, .041
Constrained factor variance (M3)	3.33 (3; n.s)	214.60	153	<.001	1.40	.97	.96	.031	.021, .041
Constrained regression weights (M4)	8.83 (7, n.s.)	223.43	160	<.001	1.41	.97	.96	.032	.021, .040

Although the test for age group differences did not reach significance (probably due to the small sample size, especially in the group of older adults, and consequently the lack of statistical power), the pattern of results was very similar to those found in the other two behavioral domains. As a tendency, there were differences in the motivation to reduce alcohol consumption between older and younger adult age groups. For younger adults, action self-efficacy alone was sufficient for intention formation. In the group of older adults, all three health cognitions (risk perception, outcome-expectancies and action self-efficacy) were facilitative for intention formation. However, action self-efficacy had a small impact on intention to reduce alcohol consumption in the older adults group. No differences in the interplay between self-regulatory variables such as action self-efficacy and planning were found between age groups. The relationship between planning and alcohol consumption turned out to be non-significant in both age groups. Action self-efficacy was a prerequisite for successful performance regardless of age.

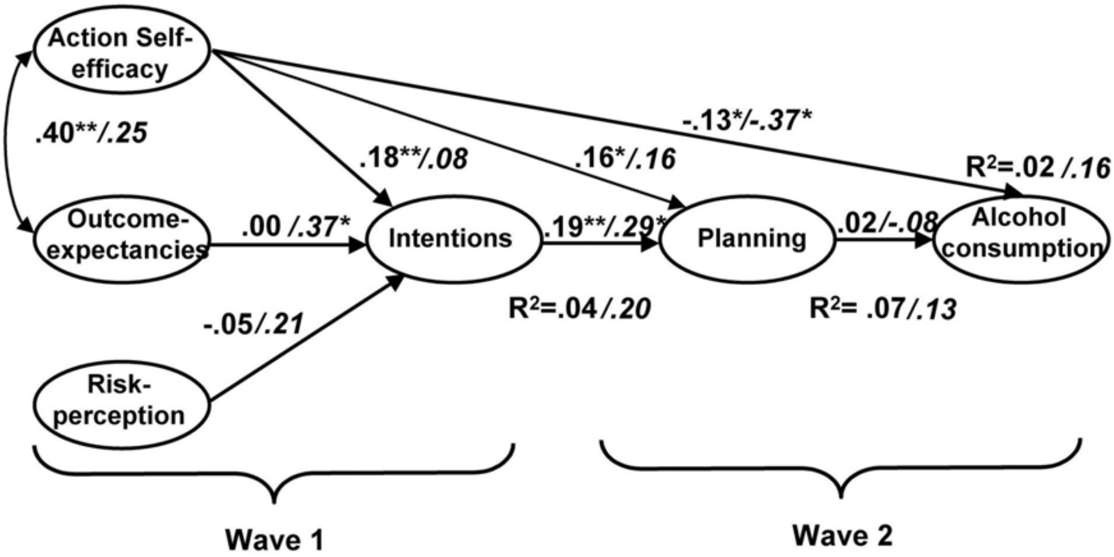

Figure 14: HAPA-Model for alcohol consumption in different age groups: In italics are coefficients for the older group.

4.3.3.2 Testing Mediation

In this section, results of the analysis aimed at testing the mediation effect of planning in different age groups are reported. Mediation analyses were performed in order to test whether the limitation of alcohol consumption was motivated by health-related reasons in both age groups. Correlations revealed unexpected bivariate relationships between intention (t1), planning (t2), and alcohol consumption (t2) in both age groups. There was no significant correlation between both the intention to reduce alcohol consumption and alcohol consumption six months later (r = -.09, *n.s,.* for younger adults; r = .00, *n.s.*, for older adults), and between planning and alcohol consumption in both age groups (r = .00, *n.s.* for younger adults; r = -.17, *n.s.*, for older adults). However, there was a positive association between intention and planning in both age groups (r = .20 p < .001 for younger adults; r = .29, p < .05 for older adults). Because the precondition for mediation analysis was not met, further regression analyses were abandoned.

4.3.3.3 Alternative Explanation: Intenders vs. Nonintenders

Older adults had a stronger intention to reduce alcohol consumption in comparison with younger adults (M = 4.21, SD = 1.58 vs. M = 3.56, SD = 1.87; t(382) = 2.64; p < .01). Thus, it could be argued that the cause of structural differences lies in the stage of change people are in and not in the age-related changes in goal orientation. In order to examine this line of reasoning, two extreme groups of nonintenders and intenders were established. The group of nonintenders (n = 137) was created by combining the first three response categories of the seven-point intention score. The group of intenders (n = 64) was created by combining the last two response categories.

A comparison of the two groups confirmed the mean differences between nonintenders and intenders. Intenders in comparison with nonintenders scored higher on action self efficacy (M = 3.32; SD = .79 versus M = 2.78; SD = .99; $t(177)$ = 3.66; p < .001) and planning (M = 2.56; SD = 1.05 versus M = 2.03; SD = .93; $t(182)$ = 3.41; p < .001). However, these two groups did not differ with regard to risk perception (M = 3.34; SD = 1.39 versus M = 3.41; SD = 1.39; $t(146)$ =.29; n.s.), outcome expectancies (M = 3.22; SD = .63 versus M = 2.95; SD = .96; $t(181)$ = 1.94, n.s.), and the level of alcohol consumption at Wave 1 (M = 41.22; SD = 117.48 versus M = 60.51; SD = 162.91; $t(174)$ = .81; n.s.).

The next question was whether the alcohol consumption within the group of intenders is motivated differently than within the group of nonintenders. Thus, the issue was whether possible structural differences between nonintenders and intenders mirrored the age-related structural differences described in 4.3.2. Multiple-group comparisons were conducted in order to investigate structural differences between nonintenders and intenders. No structural differences in the interplay of social-cognitive variables were found between nonintenders and intenders (for details of the multiple group analysis see Section 7.3.3 in Appendix C). Thus, as a tendency it was age and not the stage of change that moderated the interplay of social-cognitive variables by prediction of alcohol consumption.

To summarize the results, the HAPA model, in general, did a better job for predicting health promoting behaviors, such as nutrition and physical activity, in comparison to addictive behaviors such as alcohol and cigarette consumption. For all health behaviors, with the exception of smoking where age comparisons were not possible, age differences were found in the motivational processes and not in the volitional ones. Perception of one's own vulnerability for cardio-vascular diseases motivated only older adults but not the younger ones to adopt a healthier life style. The same was true for health-related outcome expectancies. A reason for the observed age differential effects could be that nutrition, physical activity, or reduction of alcohol consumption are regarded as an explicit health behavior by the older group, whereas they are considered as a lifestyle factor by the younger ones: That is, generated by social influence and daily habits, but not guided by particular health concerns. However, both forms of self-efficacy emerged as the major determinants of reported health behaviors in the older and younger group, indicating that self-regulatory skills are a necessary prerequisite for successful performance.