

Aging and Decision-Making Processes: The Role of Emotion Regulation

Yaşlanma ve Karar Verme Süreçleri: Duygu Düzenlemenin Rolü

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Abstract

This review aims to investigate the effect of emotion regulation on decision-making processes in older age in light of previous literature. Emotion regulation is defined as maintaining the positive mood and/or controlling the negative mood. Emotion regulation influence decision-making processes especially under ambiguity. Individuals might try to make optimal decisions as using their emotions. However, this ability does not always lead to optimal decisions. Alternatively, they might regulate their emotions to increase decision satisfaction or overcome their loss. In fact, these effects are more powerful in emotionally charged decisions compared to consciously monitored and effortful decisions as defined in dual-processing model. Later in life, the effect of emotion regulation on pre- and post-decision processes increases due to the decline in cognitive skills and the improvement of emotion regulation skills. However, older adults with severe chronic and fatal diseases cannot use emotion regulation as effective as their healthy peers. This leads to a decrease in the likelihood of optimal decision-making in these patients who already experience reduced cognitive skills. The present study addresses the systematic effects of emotion regulation on pre- and post-decision processes across aging. One of the main aims of the study is to provide a theoretical background for future research. Furthermore, in the clinical field, the information gained from this review can be used to improve the quality of life in late years of life by developing intervention programs.

Keywords: Decision making, emotion regulation, aging

Öz

Bu çalışmada duygu düzenlemenin karar verme mekanizmaları üzerindeki etkilerinin ve bu etkilerin yaşlılık döneminde uğradığı değişikliklerin, alan yazındaki çalışmalar ışığında incelenmesi amaçlanmıştır. Duygu düzenleme bireylerin olumsuz duygularını kontrol ederek olumlu duygu durumunu muhafaza edebilme becerisi olarak tanımlanır. Duygu düzenleme becerisi özellikle seçilebilecek alternatiflerin kesin sonuçları belirsiz olduğunda verilen kararları etkiler. Birey duygularını kullanarak en avantajlı kararı vermeye çalışabilir. Ancak bu beceri bireyin her zaman optimal kararı vermesini sağlamaz. Karar sonrasında ise duygu düzenleme kullanılarak memnuniyet düzeyi artırılabilir veya yas süreci görece erken atlatılabilir. Bu etki, ikili işlem modelinde sunulan mantıksal çıkarım yerine duygu ve dürtülere bağlı kararlarda daha güçlü bir biçimde görülür. Yaşamın ilerleyen yıllarında bilişsel becerilerdeki düşüş ve duygu düzenleme becerilerindeki gelişme sebebiyle duygu düzenlemenin karar öncesi ve sonrası süreçler üzerindeki etkisi artar. Ancak ciddi kronik ve ölümcül hastalıklara sahip yaşlılar duygu düzenlemeyi etkin bir şekilde kullanamazlar. Bu da bilişsel becerilerde düşüş yaşayan bu hastaların optimal karar verme olasılığının daha da düşmesine neden olur. Mevcut çalışmada yaşlılık sürecinde duygu düzenleme becerisinin karar öncesi ve sonrasındaki süreçler üzerindeki etkisi alan yazındaki modeller göz önünde bulundurularak sistematik bir biçimde ele alınmıştır. Bu çalışmada gelecek araştırmalar için teorik bir altyapı sunulması amaçlanmıştır. Ayrıca bu ilişkilerin bilinmesi klinik alanda müdahale programlarına temel oluşturarak yaşlıların yaşam kalitelerinin artırılmasını sağlayabilir.

Anahtar sözcükler: Karar verme süreçleri, duygu düzenleme, yaşlanma

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THE POPULATION of Turkey, similar to global population, is rapidly aging. By 2040 about 16% of the population of Turkey is expected to be age of 65 and older (Turkey Statistical Institute 2018). Older adults are more likely to encounter chronic (diabetes, cholesterol, heart disease) and fatal (cancer) diseases than their younger counterparts (Anderson and Smith 2005, Wolf et al. 2005), and also experience financial difficulties more often after retirement (Department of Economic and Social Affairs 2017). Given that, decisions about health (e.g., avoiding unhealthy food, visiting a doctor or having surgery when needed, taking the medicine on time) and finances (e.g., using the reduced income more efficiently) become more important on late years of life. The decline in some cognitive skills (Addis et al. 2008, Ebner and Johnson 2009, Salthouse 2010, Murman 2015), on the other hand, disrupts optimal decision-making processes in older ages.

Despite the decline in cognitive skills (Baltes et al. 2006), emotion regulation skills (Urry and Gross 2010) tend to improve in late years. These changes reveal the possibility that older adults might use emotion regulation strategies more often than cognitive abilities in their decisions. In this review, our main goal is to examine the effect of emotion regulation on decision-making mechanisms and the changes that these effects have undergone in older age. The role of emotion regulation in decisions under ambiguity and objective risk in late years of life is elaborated based on the previous behavioral and neuroscientific studies. In the review, decision-making process is divided into two parts; pre-decision (risk analysis, gain-loss perception etc.) and post-decision (satisfaction, mourning process, etc.) processes. In addition, the role of health status of older adults in the relationship between emotion regulation and decision making processes is discussed. For the current theoretical model, the Selection, Optimization and Compensation Model (SOC-ER; Urry and Gross 2010) and the Dual Processing Model (Kahneman and Tversky 1979) were utilized to explain the changes in emotion regulation processes in older adults. By understanding these relationships, in the clinical field, intervention programs could be developed to increase the number of optimal decisions in older adults. Therefore, the well-being of the members of the rapidly aging society could be maintained.

Decision making processes

Decision-making processes has attracted attention of many researchers since it is first defined by Savage (1954). Savage (1954) defined decision making as a three-step process. On the first step the probabilities and the desirability of each alternative are assessed. On the second step, the probability and the desirability are multiplied to compute the subjected expected utility for each alternative. On the third and final step, the option which has the highest subjective utility is chosen. In recent years, researchers suggested more complex models than Savage described. Kahneman and Tversky (1979) argued that the decision-making process is driven by two systems governed by executive functioning and calls this system “dual-processing model”. The first system is fast, automatic, implicit, emotionally charged, and difficult to control. When the first system controls the decision, amygdala, ventral striatum and orbitofrontal cortex are activated (Bechara 2005). The second system is slow, demanding, consciously observable, and relatively flexible (Kahneman 2003, Davis et al. 2015, Cappellive et al. 2018). When this system controls the decision, the dorsolateral prefrontal cortex, anterior cingulate cortex and posterior

prefrontal lobe are activated so that past experiences and knowledge could guide the decision (Bechara 2005). Since both processes cannot be performed at the same time, only one of these systems is used. Thus, decisions are made based on either emotional reactions or expected long-term gains and losses (Young et al. 2018). According to the “somatic marker hypothesis” of Damasio (1996) these two systems are not completely independent from each other. Decisions are basically influenced by emotions. If a similar decision is made in the past and caused negative emotions, the marker signals (acceleration of heartbeat, sweating, etc.) arise during decision making. Therefore, the decision is affected by the emotions consciously (according to the second system) or unconsciously (according to the first system) and prevent the person from making the suboptimal decision.

In addition to the differences in the decision-making process, previous research mentions two types of decision-making. The first of these is named as decision making under ambiguity. In this type of decisions all of the alternatives are known. However, it is not possible to predict the consequences of the alternatives (Kahneman and Tversky 1979). That is, the decision is made based on information obtained from previous decisions (Bechara ve ark. 1994) or intuitions for the alternatives (Schiebener and Brand 2015). Schiebener and Brand (2017) argued that most decisions made in daily life resemble this particular type of decisions. Individuals often have to choose alternatives without known advantages and risks. Given that, it is critical to identify the factors that may affect this type of decision-making processes. Decision making under ambiguity is often measured by the Iowa gambling task in experimental research (Bechara et al. 1994). In this task, four decks of cards are presented. Participants are asked to select the cards in a row. They gain or lose money depending of the card they selected. However, at the beginning of the task, participants do not know the advantageous and disadvantageous cards. Some of the cards in the first two decks lead to high wins and some to high losses while the cards in the last two decks are low in gain and loss. In the long run, however, selecting cards from the last two decks makes the individual more profitable than the first two. Previous studies have argued that optimal decision-making in this task (i.e., selecting the cards in the last two decks) depends on working memory and executive functioning. However, Toplak et al. (2010) argued in a meta-analysis that the relationship between these cognitive skills and the Iowa gambling task is not as high as previously suggested. Given that, other factors related to performance in this task, such as emotion regulation, should be examined.

The second type of decision making is decision making under objective risk. In such decisions, the possible consequences of all options are known at the beginning. Before the decision, individuals have the opportunity to calculate the advantages and risks of each option. Executive functioning abilities play a major role in predicting the possible outcomes and/or changing plans if the decision is too risky (Liebherr et al. 2017). In experimental studies, decision-making under objective risk is usually measured by the Game of Dice Task (Brand et al. 2005). In this task, a dice is thrown 18 times and before each throw the participants are asked to choose a number. Participants might make their decisions in three different ways: a single number, a combination of two or a combination of three numbers are chosen. If two or three numbers are chosen and one of those numbers are thrown, participant wins. However, as the number of selected numbers increases, the amount of money earned decreases. In this task, the potential gains and risks of each choice are known at the beginning. Although the probability of win-

ning is not directly stated, participants can calculate the outcomes and the risks of each alternative. Therefore, the decision process is largely driven by cognitive skills, including executive functioning.

Decision making processes in older adults

In older adulthood, cognitive skills such as working memory, reasoning, processing speed decline (Baltes et al. 2006, Depping and Freund 2011, Mata et al. 2011, Samanez-Larkin et al. 2011) while semantic knowledge and vocabulary skills are preserved (Zamarian et al. 2008). Previous studies show that with aging, white and gray matter decrease, and demyelination increases in prefrontal, temporal and parietal cortex. Prefrontal cortex, as one of the effected areas, is known to be critical for decision-making processes (Bechara 2005). Given that, these cognitive and neural changes lead older adults to use different strategies in their decisions. According to the dual processing model, in late adulthood, adults prefer to use their emotions (first system) instead of cognitive afford (second system) (Carstensen and Mikels 2005, Strough et al. 2017, Frazier et al. 2019). Further, they tend to avoid negative emotions before the decision and remember the positive emotions after the decision (Mather and Johnson 2000). All these researches implicate that older adults might use emotion regulation skills when making decisions (Mather 2006).

The strategies used in decisions might either lead maintenance or losses depending on the type of the decision (i.e., decisions under open risk, decisions under ambiguity). The performance of older adults in these two types of decisions tend to be different. In all studies where risks can be observed and calculated, older adults fail to make optimal decisions compared to their younger counterparts (Liebherr 2007). In studies where decision-making under ambiguity is at stake, the performance of older adults were comparable with the young adults (McCarrey et al. 2010). Wiesiolek and colleagues (2014) in a meta analysis, reviewed nine studies (between 2002-2012), which used Iowa Gambling Task to measure the decision making performance under ambiguity. They found that in almost all of the studies, older and younger adults had comparable performances in optimal decisions. This might be the case because of their ability to use emotion regulation skills effectively in their decisions (Huang et al. 2015).

Emotion regulation in older adults

The ability to regulate emotions is defined as the ability to actively manage emotions to support the positive self-evaluation (Tamir 2016). Emotions are regulated through increasing the satisfaction and decreasing the pain the person feels. However, this hedonic pleasure is not the only motivation for emotion regulation. In some cases, emotion regulation is used for other purposes. Emotions could be regulated to produce desired cognitive processes (e.g., increasing positive mood to increase creativity) or behaviors (e.g., increasing fear to avoid a possible danger) (Tamir 2016). In late years of life, the tendency to prefer positive over negative and neutral stimuli increases. Older adults are more likely to recognize (Löckenhoff ve Carstensen 2004, Isaacowitz et al. 2008) and recall (Charles et al. 2003, Scheibe and Carstensen 2010) positive stimuli than younger adults. Researchers call this phenomenon “positivity effect” (Kennedy et al. 2004, Carstensen and Mikels 2005, Mather and Carstensen 2005, Grühn et al. 2007, Langeslag and van Strien 2009). According to Socio-emotional selectivity theory, differences in the amount

of past and future time between young and older adults influence the mental representations of past and future in these two age groups. Due to their limited future, older adults begin to focus on the present instead of the future (Carstensen et al. 2003, Löckenhoff and Carstensen 2004). Isaacowitz and colleagues (2008), in an eye tracking study, found that older adults when they are in a negative mood, looked toward to positive faces and looked away from negative faces. They, also show a low performance in recognizing negative stimuli. Ebner and Johnson (2009) asked young and older adults to identify facial expressions reflecting different emotions on a computer screen. The results showed that older compared to young adults are less successful in recognizing the expressions of anger, sadness and fear. According to Urry and Gross (2010), the main reason of the positivity effect is older adults' ability to regulate their emotions and control their negative mood (Löckenhoff and Carstensen 2004, Mather and Carstensen 2005). In older age, with the decline in cognitive abilities including executive functioning, adults begin to set realistic goals (selection), invest their limited time and energy to the selected goals (optimization), and increase efforts or seek help to compensate for their losses (compensation) (SOC-ER; Urry and Gross 2010). Because they have a small and a close social support system, and are encouraged to use these strategies often, older adults are likely to use SOC-ER (Carstensen et al. 2003).

According to neuroscientific approach, depending on the strategy used for emotion regulation in a negative situation, the activated brain region changes. In case of avoiding negative emotion conditions, the posterior medial cortex is activated. If reappraisal is used to decrease the negative reaction, the prefrontal cortex is activated (Martins et al. 2014). Older adults use reappraisal as an emotion regulation strategy more often than young adults (Wincoff et al. 2011, Martins et al. 2014). Given that in case of facing a negative situation, prefrontal cortex is very likely to be activated in older adults (Leclerc and Kensinger 2008, St. Jacques et al. 2009, Wincoff et al. 2011, Kim et al. 2019). While the activation of amygdala does not differ in young and older adults, its connections with other brain regions differ between age groups (St. Jacques et al. 2009). When facing with a negative stimulus, the connection between the amygdala and the hippocampus is weaker in older adults, whereas a stronger interaction is observed between the amygdala and the dorsolateral prefrontal cortex (Kim et al. 2019). The strengthened communication between the dorsolateral cortex and the amygdala shows the efforts of older adults to increase the positivity effect by emphasizing more on positive emotions. That is, they regulate negative emotions (St. Jacques et al. 2009). Ritcher et al. (2011) assigned older and younger adults to complete the elaborative or shallow tasks while they viewed positive and negative stimuli. As participants completed these tasks, activation in different parts of the brain regions were scanned by fMRI. In older adults, activation in the medial prefrontal cortex and ventrolateral regions was observed in elaborative task only as viewing positive stimuli. This supported the role of emotion regulation in the emergence of the positive effect in the elderly.

Emotion regulation and decision making in older adults

The decline in cognitive abilities in executive functioning, and improved emotion regulation skills closely affect the decision-making processes in older age. While the decline in cognitive functioning leads to suboptimal choices, the effect of improved emotional skills might lead optimal or suboptimal choices depending on the emotion regulation strategy

and the type of the decision (Wright and Bower 1992, Lerner and Keltner 2000, Quartz 2009). In this section, the effect of emotion regulation strategies on pre and post decision processing is reviewed, and a theoretical model is developed based on the previous theories and the empirical studies. As developing the model, the emotion regulation strategies and the types of decisions are considered (Figure 1).

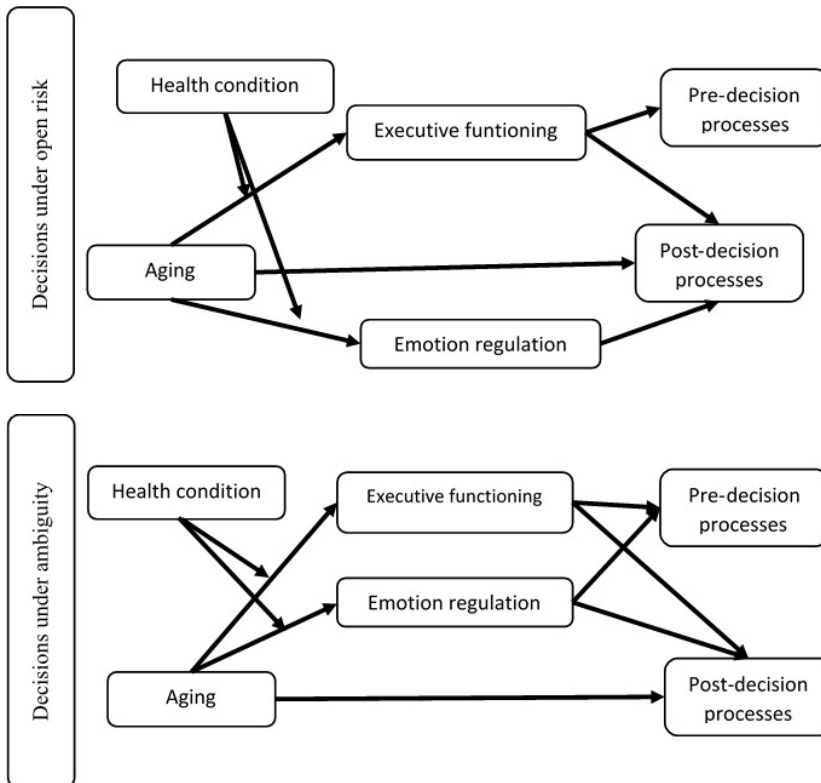


Figure 1. Models show the relationships between adults (age 65 and older), executive functions, emotion regulation and decision-making processes (before and after the decision), as well as the effect of health status on the relationship between aging and emotion regulation. Two different models have been developed for decisions in open risk and uncertainty. In theoretical models, it is assumed that confounding variables such as personality, culture and living conditions are kept under control.

Pre-decision processes

As mentioned earlier, decisions are made under one of the two conditions. In the decisions under open risk, all alternatives are known and their gains and risks can be calculated (Brand et al. 2005). In the decisions under ambiguity, all alternatives are known before the decision. However, it is not possible to calculate the gains and risks of the alternatives (Kahneman and Tversky 1979). As making a decision under open risk, gains and risks can be calculated via executive functioning. Depending on the performance of executive functioning, alternatives with high gain and high risk or alternatives with low gain and a low risk might be chosen. As making a decision under ambiguity, on the other hand, executive functioning does not play a major role. Since the consequences of

the decisions could not be calculated, decisions are made based on two processes: (1) Emotions are regulated after cognitive evaluation of executive functioning, (2) Emotions are regulated without cognitive evaluation. In these types of decisions, positive feelings for the gains and negative feelings for the risks play an important role (Quartz 2009).

According to the dual processing model, individuals decide either quickly based on their current mood (first system) or slowly based on logical inferences about the choices (second system). In the first system the emotion affects risk taking behavior. In a negative mood, for example, the sensitivity to reward decreases and so the decision tend to be suboptimal (Harlé et al. 2010). For example, studies conducted about binge eating disorder (eating high amount of food within a limited period of time) showed that regulating negative emotions is correlated with binge eating (Dingemans et al. 2015). Individuals who experience difficulty in regulating emotions are more likely to have binge eating disorder compared to the ones who have relatively better emotion regulation skills. Some other studies, on the other hand, show that less optimistic individuals take less risk than others in their decisions (Wright and Bower 1992).

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The relationship between negative emotions and risk taking behavior in decision making varies across emotions. For example, risk taking behavior tends to increase in case of anger, but decrease in fear (Lerner and Keltner 2000). According to Damasio's (1996) somatic marker hypothesis, when intense anxiety felt, the autonomic nervous system is activated; blood pressure and heart rate increase. These somatic symptoms act as a 'watch out' warning of the body and help individuals to be careful in their decisions (Damasio 1996, Werner et al. 2009). Further, clinical patients with damaged ventromedial prefrontal cortex are unable to produce somatic markers necessary for reappraisal. Therefore, they are more likely to experience difficulty in making optimal decisions (Bechara 2004, Bechara et al. 1999, Damasio 1996). As shown in these studies, regulating negative emotions can lead either optimal or suboptimal decisions.

Most studies used self-ratings and/or objective measuring of emotions show that older adults are more successful at emotion regulation than their younger counterparts (Gross et al. 1997, Carstensen et al. 2000). However, it is not very clear how this improved skill influences decision-making processes. Some researchers argue that the increase in emotion regulation skills may lead to ignorance of potential risks, so that it prevents individuals to be cautious in decisions under ambiguity (Brand and Markowitsch 2010, McCarrey et al. 2010). In late years of life, individuals focus on positive emotions and are guided by emotion-based rather than cognitive-based processes in their decisions (McCarrey et al. 2010). In another word, decision is made based on the first system in the dual processing model. This prevents individuals to calculate risks effectively and

make an optimal decision as using the second system (Mather ve ark. 2014). Brand ve Markowitsch (2010) argue that older adults are more likely to have problematic gambling behavior than young adults because they are more likely to focus on their present mood instead of the long term gains and losses. This tendency, decreases the life quality of olders who already experience mental, physical or financial difficulties. Therefore, it is critical to understand the effect of emotion regulation on risk perception, especially in old age.

Another group of researchers argues that emotion regulation skill provides an advantage for the older adults prior to the decision-making process under ambiguity (Shiv and Fedorikhin 1999, Bruine De Bruin et al. 2007, Eberhardt et al. 2019). Older adults are guided by their emotions instead of their declining cognitive abilities in their decisions (Eberhardt et al. 2019). Especially in cognitively demanding decisions, older adults are less successful at calculating gains and losses than younger adults. Therefore, their chance to make optimal decisions increases when they are guided by their emotions rather than inadequate cognitive resources (Eberhardt et al., 2019). Mikels et al. (2011) argue that when young and older adults have to make a difficult decision under ambiguity, young adults increase their chance to make optimal decision by focusing on their past experiences. Older adults, on the other hand, are more likely to make optimal decisions when they focus on their emotions instead of past experiences. In other words, young adults are not as successful as older adults in regulating their emotions. Eberhardt et al. (2019) suggest that older adults benefit from their lower levels of negative experience in their financial decisions and so are more likely to make optimal financial decisions than young adults.

In summary, although many studies have repeatedly demonstrated the effect of emotion regulation on pre-decision processes, there are different views on the direction of this effect. These conflicting findings in the literature might be caused by the differences in the type of decisions used in the tasks and the system (in dual processing system) used by the participants. These mixed findings suggest that developmental differences in emotion regulation and decision-making processes during adulthood should be investigated in more detail.

Post-decision processes

Decision making processes involve both choosing one of the available alternatives and the processes experienced after the decision. The satisfaction or the feeling of loss as a consequence of a decision affects the following decisions and so the well-being of the decision maker (Shiv and Fedorikhin 1999, Scheibe and Carstensen 2010). It is critical to know why an option is chosen even if it caused loss in the past. For example, why does an individual choose to eat unhealthy food if she experienced health problems due to consuming the same food in the past? Why does a person make the same investment again if he lost money because of the same investment previously? One of the answers to these questions could be that individuals focus on the emotions they felt during pre-decision instead of post decision feelings and recall these emotions when they have to make the same decision again (Shiv and Fedorikhin 1999, Mather et al. 2000, English and Carstensen 2015). Emotion regulation does not only affect pre-decision but also post-decision processes. Regardless of the type of decision, if the consequence of the decision is perceived positive, the probability of satisfaction about the decision and so

persistence of the positive mood increase (English and Carstensen 2015). On the other hand, to avoid regret, the results of decisions could be distorted and only positive details about the decision could be remembered. In a study conducted with young adults, Mather et al. (2000) asked participants to make a choice between two hypothetical roommates. They listed five positive and five negative features for each option. Later, participants were asked to indicate the features of both options. The results showed that participants were more likely to recall positive features of the chosen option while inferring the negative features to the unchosen option. This tendency increases the satisfaction for the decision. Further, even if individuals realize the disadvantages of their decisions, they still believe they made the optimal decision. However, they might feel guilty after facing the long term negative consequences of their decisions (Shiv and Fedorikhin 1999) or make the same mistake in the future (Carstensen and Mikels 2005). On the other hand, if an undeniable loss is experienced as a result of the choice, the rumination could end more quickly and the state of well-being can be maintained (Bruine de Bruin et al. 2014).

Researchers studying the effect of aging on mood and post-decision process argue that older adults are more successful compared to young adults in maintaining positive mood regardless of the outcome of their decisions (Bruine de Bruin et al. 2014), and therefore feel more satisfied with their decisions (Bruin de Bruin et al. 2007). In an experimental study, Mather and Johnson (2000), asked young and older adults to choose from two consecutive options. Positive and negative features were presented for each option. Two days later, participants were shown a list of features asked to determine which option they belong. Both age groups tended to attribute positive features to the chosen and negative features to the unchosen option. However, this tendency was much higher in the older than younger age group. Researchers argue that this strong tendency in older adults exists due to their desire to control negative emotions and improved emotion regulation skills. Due to the decline in their cognitive skills, in recalling their past decisions, older adults use emotions as a guide and distort their memories to form a positive mood (Mather & Johnson, 2000). However, it is difficult to determine whether this tendency stems from the individual's excessive focus on the positive features of the decision (hypersensitivity to the reward), the tendency to ignore the negative features of the decision (insensitivity to punishment), or both. This system might be functional in case of loss. Considering that rumination maintains a negative mood and keeps individuals away from problem-solving efforts, this skill might increase the possibility to make optimal decisions in the future. On the other hand, it might prevent older adults to predict the risks and so they repeat the same mistake in the future (Mather et al. 2000). Therefore, the effect of emotion regulation on post-decision processes in older adults might be either positive or negative.

The effect of health

With aging, cognitive skills decline (Baltes et al. 1999, Baltes et al. 2006) and physical problems (cholesterol, diabetes, heart disease, etc.) begin to emerge (Anderson and Smith 2005, Wolf et al. 2005). According to the report of World Health Organization (2018), the number of deaths caused by aging related illnesses (e.g., heart disease, diabetes, cancer, etc.) in 2030 will increase by 65% in middle-income countries and 50% in low-income countries. Due to this future threat, in recent years, researchers has begun to

study health-related decisions in late years of life and suggested interventions to maximize the optimal decisions in health domain. Research has shown that these diseases impede the emotion regulation skills, interfere with the optimal decision-making process, thus increasing the risk of death (English and Carstensen 2015, Mather and Carstensen 2005). English and Carstensen (2015), in an experimental study, asked healthy and unhealthy older adults to make some decisions. Older adults with poor physical health reported to have less positive emotions and less satisfaction about their decisions compared to the healthy group. That is, health status moderated the effect of aging on emotion regulation skills and so influenced both pre and post decision processes. Similarly, Peters et al. (2008) reported that emotion regulation has a greater importance for older adults who face serious health problems compared to healthy older adults. Individuals who have cancer experience depression more often than the healthy population. This might implicate that these individuals cannot regulate their negative emotions and therefore cannot use emotion regulation properly in their behavioral (healthy eating, exercising, entering therapy) and pharmacological (medication) decisions required for treatment. Because it is very difficult to evaluate the possible benefits and side effects of the treatment methods in older adulthood (Verhoef and White 2002), decline in emotion regulation skills causes a drastic decline in optimal choices. Therefore, improving these skills is particularly critical for those who struggle with such diseases.

Conclusion

Recent theoretical models (dual processing model and somatic signal hypothesis) indicate that emotional skills have both positive and negative effects on risk taking during pre-decision processes (Kahneman and Tversky 1979, Wright and Bower 1992, Bechara et al. 1997, Nigro et al. 2018). Another set of studies have shown that emotion regulation influences the satisfaction and rumination during post-decision processes (Mather et al. 2000). Further, developmental research draw attention to adults age group differences in this relationship. Older adults use emotion regulation strategies more frequently than cognitive processes in their decisions. Given that the effect of emotion regulation on pre- and post-decision processes is stronger in older compared to younger adults. However, the connection between aging and emotion regulation skills is weaker in older adults who experience fatal diseases (e.g., cancer) and so are less likely to make optimal choices. In the present study, two theoretical models have been developed by considering the aforementioned theories and models (Figure 1). The models illustrate the effect of aging on decision-making, and the mediation effect of emotion regulation on this relationship. Model 1 represents the decisions under open risk while Model 2 represents the decisions under ambiguity. The model illustrates that the main determinant of pre-decision processes for the decisions under open-risk is executive functioning and therefore decisions are adversely affected by aging. In case of decision making under ambiguity, on the other hand, decisions are made either directly based on emotions and so emotion regulation skills (first system) or executive functioning and emotion-regulation skills (second system). Since emotion regulation plays an active role in the decisions under ambiguity, older adults are more likely to benefit from this skill compared to young adults. Post-decision processes, however, are influenced by emotion regulation skills in both type of decisions. We also propose that executive functioning and emotion regulation abilities

show a steep decline in older adults with fatal diseases. Given that, health condition is likely to moderate aging effect on executive functioning and emotion regulation skills.

Future studies, might examine the relationship between aging, emotion regulation and decision-making based on the presented theoretical models. In this interaction, mediator roles of factors such as gender, personality, culture, living conditions can be examined. Note that older adults living in different parts of the world do not have similar living conditions, levels of life satisfaction, and well-being (Department of Economic and Social Affairs 2017). Thus, cross-cultural studies are needed to examine the models presented. Since the population of older adults is rapidly increasing in Turkey (Turkey Statistical Institute 2018), studies related to emotion regulation and decision making processes is critical to identify the potential problems and search for solutions for older age group in Turkey. Potential findings of future studies about the effect of emotions on decision-making processes in the aging process can be used in the clinical field to improve the older adults' life quality. In this regard, intervention programs using emotion regulation strategies could be developed to help individuals to make optimal decisions. Older adults with high risk of death can be taught emotion regulation strategies to make critical decisions such as physical movement, drug use and treatment. In addition, emotion regulation skills can be improved to control negative emotions related to the side effects experienced after the treatment decision.

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