Perception of risk for older adults: Differences in evaluations for self vs. others and across risk domains

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Abstract

Background and objectives: Proxy decision-making may be flawed by inaccurate perceptions of risk. This may be particularly true when older adults are the targets of the decisions, given the pervasive negative stereotypes about older adults. *Methods*: Study 1: 18- to 87-year-olds (as target persons) as well as one of their close social partners (as informants) reported on the risks they perceived for the target person in various life domains. Study 2 additionally explored potential differences in how people make risky decisions on behalf of younger and older adult targets. Younger (18–35 years) and older (60–81 years) adults (as target persons of the risk evaluations) as well as informants reported on risk perceptions and likelihood of risk-taking for health, financial, and social scenarios concerning the target persons. Congruence between self-rated and informant-rated risk perceptions and risk-taking were computed on a dyadic as well as group level. *Results*: Informants' risk perceptions were positively associated with the risks their partners perceived for themselves. Informants and their partners agreed that social risks vary little across adulthood, but disagreed for recreational, financial, and health risks, disagreeing also in the decisions they would make. *Conclusion*: Family members, partners, and close friends are sensitive to vulnerabilities of their social partners, but in some domains and according to their partners' age perceive greater (or less) risk than their partners perceive for themselves. In situations requiring surrogate decision-making, people may decide differently to how their social partners would decide for themselves.

Perception of risk for older adults: The role of perspective and life domain

As people age, they face risky decisions in a range of domains, such as health, recreation, finance, and social environment. However, risk in these domains may not change uniformly across adulthood. For example, the social risk of speaking in public may be similar across adulthood, whereas swimming in rapid waters may pose greater risk for older adults who typically have lower muscle strength. There also exist individual differences in the factors associated with risk at any given age. For instance, while the average 75-year-old may have lower muscle strength than the average 45-year-old, a specific 75-year-old's muscle strength may be higher than that of her 45-year-old daughter. People likely possess unique insight into the personal risks they face (e.g., informed by perceptions of their own frailty).

Yet, in many instances, such as when decision-making capacity is impaired in older age, family members, partners, or close friends are called to act as surrogate decision-makers and to decide partially or entirely on behalf of others. In fact, nearly half of hospitalized patients aged 65 years and older receive at least some surrogate involvement in decisions about their health care and treatment [1]. Close to one quarter of the medical decisions that involve a surrogate are made with no involvement from the patient [1]. Especially in old age, important financial decisions, including changes to wills and inheritance, as well as social decisions, such as whether to live independently or in a residential community, often involve surrogates in the decision-making process [2,3]. To address this important issue, the current research investigates the risks perceived and decisions made by younger and older adults for themselves and compares these with the risks perceived and decisions made for them by familiar others, including family members, partners, and close friends.

Older adults have typically been shown to be more cautious than younger adults when judging risks for themselves [4,5]. However, a wealth of research now suggests that risk-taking is to some extent domain-specific: Risk-taking in some domains (e.g., health) is less strongly associated with risk-taking in other domains (e.g., financial) than with risk-taking for other activities in the same domain [6, 7]. To capture the domain-specific nature of risk-taking, Weber and colleagues developed the Domain-Specific Risk-Taking scale (DOSPERT; [6, 8]. In their analysis of the revised DOSPERT, Highhouse and colleagues ([9]; see also [10]) discovered that risk-taking as assessed by the DOSPERT scale comprises both a general risk factor and domain-specific tendencies. Rolison, Hanoch, Wood, and Pi-Ju [11] employed the revised DOSPERT to measure risk-taking across adulthood. Their study uncovered age trends specific to each of the DOPSERT domains. Health risk-taking reduced smoothly with age, whereas recreational risk-taking reduced more steeply in early adulthood. Financial risk-taking declined more sharply in later life and risk-taking in the social domain actually increased slightly from younger to middle adulthood, before decreasing sharply in older adulthood.

Are there differences in how people perceive their own risk in various domains in younger and older age from how others perceive the risks for them? Some research suggests that people may be reasonably accurate at perceiving risks specific to a person whom they know well. Clinical tools for the assessment of vulnerabilities in older age have often recruited family members, partners, and close friends as knowledgeable informants. For example, the Social Vulnerability Scale (SVS) was developed as an informant scale to identify social vulnerabilities in older age, such as credulity and gullibility [12,13]. The SVS is designed as a clinical tool for identifying vulnerabilities among individuals aged 50 years or older and is completed by a knowledgeable informant (e.g., a family member) to circumvent issues associated with poorer

insight into one's own behavior in older age [13]. High scores on the SVS have been shown to predict neurological disease in older adults, suggesting that people may be reasonably good at judging the risks that are specific to a person they know well. Moreover, the use of surrogates to aid decision-making about people's medical care and treatment and their financial future and social environment rests on the assumption that people are sensitive to the risks faced by others.

Our current studies investigated if, and in what way, risk perceptions for social partners in different age groups (i.e., younger and older adults) differ from the risk that those social partners perceive for themselves and whether this depends on the domain of risk. In Study 1, we asked younger, middle-aged, and older participants about the risks they perceived for themselves and their likelihood of risk-taking for several activities and behaviors in multiple domains. Each participant also nominated a person who knew them well to report on the risks they perceived for their nominating partner. In Study 2, we asked younger and older participants about their risk perceptions and likelihood of risk-taking for a smaller number of more detailed scenarios and asked their nominated partners to report how likely they would be to take the same risk on behalf of their nominating partner in addition to reporting the risks they perceived for their partner.

We anticipated differences between how people perceive risks for themselves to how those risks are perceived for them by others. Namely, people may have specific insight into their own risks, which may lead them to perceive different risks to those judged for them by others. Fragility, dependency, physical handicaps, and need of care are prominent in stereotypes about older people [14,15]. The influence of aging stereotypes can even resist contradictory experience. For example, caregivers in nursing homes use baby talk regardless of the physical and cognitive abilities of older residents [16]. Thus, based on aging stereotypes, people may infer greater risks for older adults even despite contradictory knowledge about their strengths. We

hypothesize that if informants base their perceptions solely on age-related stereotypes, they will perceive greater risk for their older social partners in all domains than their partners perceive for themselves, making more cautious decisions on their behalf. However, aging stereotypes, internalized during childhood, can become self-stereotypes in older age. In fact, older adults have been shown to display negative aging self-stereotypes as implicit attitudes that are as negative as those possessed by people of younger ages [17]. Negative aging self-stereotypes can negatively impact on cognitive abilities, such as memory performance [18]. Thus, older adults may perceive themselves as more vulnerable than they truly are, leading to a higher estimate of their risks compared to estimates by their close social partners and consequently to more cautious decision-making.

Study 1

Methods

Participants

One hundred thirty adults aged 18-87 years ($M = 47.80$; $SD = 21.07$; 63% female), were recruited from the local community. All participants aged 60 years or older passed the mini mental state examination as a screen for cognitive impairment [19] and none were excluded. Regarding education, 21% indicated high school as their highest level of education, 34% had completed college or third level education (e.g., A-levels, diploma), 33% had completed an undergraduate degree, and nine 7% indicated that they had completed post-graduate education (e.g., Master's degree, PhD degree). Each participant nominated a family member, partner, or close friend aged 35-60 years ($M = 46.19$; $SD = 8.27$; 62% female) to report on the risks they perceived for their nominating partner. We targeted the 35-60 year age range in order to restrict the age-related variance in risk perceptions in the informant sample, and because it seems the

most likely age of potential proxy decision-makers for both young and older adults who may not be able to make decisions for themselves. The informants had known their nominating partner at least one year ($M = 26.91$; $SD = 14.02$). The majority were parents (30%), sons or daughters (24%), spouses or partners (15%) siblings (6%), nieces or nephews (4%), or other family members (4%), and the remaining were close friends or work colleagues (18%). Regarding education, 20% indicated high school as their highest education level, 37% indicated that they had completed college or third level education, 33% had completed an undergraduate degree, and 8% indicated a post-graduate degree as their highest level of education. Ethical approval for the research protocol was granted by the institution ethics review board.

Materials and Procedure

Self-ratings: All participants received the same 16 items divided equally into four domains, including the recreational (e.g., '*Going camping in the wilderness*'), social (e.g., '*Admitting your tastes are different from those of a friend*'), financial (e.g., '*Betting on the outcome of a sporting event*'), and health (e.g., '*Taking a ride on a motorcycle without wearing a helmet*') domains (see Appendix A for the full list of items). We did not include the ethical domain in our survey as the items were not suitable for use with informants (e.g., '*Having an affair with a married man/woman*'). Some of the survey items were similar or identical to those in the revised DOSPERT [20]. Other items were generated for our present purposes to ensure that they were suitable for a diverse age range. For example, rather than ask participants about '*Piloting a small plane*' or '*Bungee jumping off a tall bridge*,' which did not seem suitable for older adults, we asked them about '*Starting a new intense exercise routine*' and '*Going winter swimming in an icy lake.*' Items such as '*Starting a new career in your mid-thirties*' in the social domain of the revised DOSPERT were replaced with less age-specific items, such as '*Speaking*

at a debate club in your local community.' Some DOSPERT items in the financial domain

referred to income (e.g., '*Betting a day's income on the outcome of a sporting event*') and were

made more generic ('*Betting on the outcome of a sporting event*'), and items in the health

domain that required specific abilities (e.g., '*Riding a motorcycle without a helmet*') were made

more general ('*Taking a ride on a motorcycle without wearing a helmet*').[1,2]

Participants received a printed booklet containing the 16 items. They rated their risk-

taking likelihood and perceived risk in separate sections of the booklet. The items were presented

in a randomly generated order within each section, but in the same order for each participant.

The order of sections was randomly generated for each participant. In the risk-raking likelihood

section, participants were asked to '*indicate the likelihood that you would engage in the*

described activity or behavior if you were to find yourself in that situation.' Participants provided

their ratings on a 7-point scale, ranging -3 ('Extremely unlikely'), 0 ('Not sure'), to 3

('Extremely likely'). Responses were summed across items to calculate likelihood ratings for

each risk domain, where higher ratings indicate a higher likelihood of risk taking. In the risk

perception section, they were told:

> '*People often see some risk in situations that contain uncertainty about what the outcome*
>
> *or consequences will be and for which there is the possibility of negative consequences.*
>
> *However, riskiness is a very personal and intuitive notion, and we are interested in your*
>
> *gut level assessment of how risky each situation or behavior is for you.*'

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[1] Some items underwent further modification following initial pilot testing.

[2] As some of the scale items were modified for our purposes, we conducted an exploratory factor analysis (FA) on self-rated risk perceptions using Varimax rotation to test its factor structure. The FA extracted four factors based on a criterion of eigenvalues > 1 and explained 59% of the variance. All 4 recreational items loaded most heavily on Factor 1; 3 of the 4 social items loaded most heavily on Factor 2 (item 3 [see Appendix A for item description] loaded on Factor 1); 3 of the 4 financial items loaded most heavily on Factor 3 (item 3 loaded on Factor 1); and 2 of the 4 health items loaded most heavily on Factor 4 (items 2 and 4 loaded on Factor 1). Thus, our FA broadly confirmed the four-domain structure for our modified version of the DOSPERT (see Appendix B for more details).

Participants were then asked to '*indicate how risky you perceive each situation for you personally if you were to find yourself in that situation*' on a 7-point scale, ranging 0 ('*Not at all risky*') to 6 ('*Extremely risky*'). Risk perception ratings for each risk domain were calculated by averaging responses across items, where higher ratings indicate higher perceived risk. The participant instructions were similar to those used in the revised DOSPERT scale [20].

Informant ratings: The informants completed an online version of the risk perception section of the survey and were asked to rate the 16 items as they perceived them for their partner. This required slight amendments to the instructions, which instead read *'...we are interested in your gut level assessment of how risky each situation or behavior is for* [partner name].' and '*indicate how risky you perceive each situation would be for* [partner name] *if he/she were to find himself/herself in that situation*'. The online nature of the informant version enabled us to insert the partner's name in the amended text. Some of the scale items also required minor amendments (e.g., '*Admitting their tastes are different from those of a friend*') to reflect the informant's perspective. Participants provided their ratings on the same scale as self-rating participants.

Statistical analysis

To test for associations between the risks informants perceived for their partners and risks their partners perceived for themselves, we calculated Pearson *r* correlations between self-rated and informant-rated risk perceptions for each risk domain. To test whether informants' risk perceptions correlated more highly with their partners' risk perceptions for the same domain than for each other domain, we used the method proposed by Steiger [21, 22] for comparing dependent correlations, which involves comparing the correlation coefficients after applying Fisher's *r*-to-*z* transformation (see [22] for more details).

Domain differences in self-rated risk-taking likelihood were assessed with a one-way analysis of variance (ANOVA) on likelihood ratings, including domain (recreational, social, financial, health) as a repeated-measures factor. In the analysis of risk perceptions, we additionally included group (informant-ratings vs. self-ratings) in the ANOVA to test for group differences in risk perceptions.

To test for effects of the self-rating participant's age on their risk perceptions and the risk perceptions of their partner, we conducted a multiple regression analysis on risk perceptions in each domain. Age (as a continuous grand mean-centered predictor) and group (informant-ratings vs. self-ratings) were included as predictors in a first block (Model A). In a second block (Model B), an interaction term between age and group was included. In a final block (Model C), the interaction term was removed and a quadratic term for age was included to test for curvilinear effects of age on risk perception. The R^2 change for Models B and C was assessed in comparison with Model A. An α level of .05 was used in all analyses.

Results

Table 1 provides the Cronbach α scores, showing reasonable levels of internal consistency of the scales. The positive intercorrelations in self-rated risk-taking likelihood (and risk perception) indicate that greater risk-taking likelihood (risk perception) in each domain was associated with greater risk-taking likelihood (risk perception) in each other domain. Regarding informant ratings, the intercorrelations were all positive, indicating that informants' perceptions of greater risk for their partners in one domain were associated with greater perceived risk for their partners in other domains (Table 1).

As shown in Table 2, the risks informants perceived for their partner correlated with the risks their partner perceived for themselves in each domain.[3] In general, informants' risk perceptions also correlated more highly with their partner's risk perceptions for the same domain than with their partners' risk perceptions in other domains (Table 2).

Table 3 provides the mean group risk-raking likelihood and risk perception ratings. Self-rated risk-taking likelihood was highest in the health domain, followed by the financial, social, and recreational domains. A significant effect of domain was confirmed by the analysis of variance (ANOVA; $F(3,387) = 57.06$, $p < .001$, $\eta^2 = .31$). Regarding risk perception, informants perceived similar risks for their partners as their partners perceived for themselves ($F(1,258) = 0.11$, $p = .74$). Moreover, informants and their self-rating partners agreed about domain differences in risk, perceiving the greatest risk in the health domain, followed by the financial, recreational, and social domains. The ANOVA confirmed a significant effect of domain ($F(3,774) = 466.10$, $p < .001$, $\eta^2 = .64$) and showed no significant interaction.

Do people perceive greater (or less) risk according to the other's age? Table 4 provides the results of the regression analyses on the risk perceptions of self-ratings participants and informants. In the recreational, financial, and health domains, group (informant- vs. self-rating) interacted with the age of the self-rating participant.[4] This result suggests that in these domains the association between age and risk perception differed between self-rating participants and

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[3] We additionally conducted multiple linear regression analyses on partners' self-rated risk perceptions in each domain to test for moderating effects of informants' relationship with their partner (parent vs. other relations, adult children vs. other relations) and the absolute age difference between informants and their partners on the association between informant- and self-rated risk perceptions. Parent (vs. other relations) interacted with informant risk perceptions in the recreational domain (see Appendix C), such that the association between informant- and self-ratings was weaker for parent informants. There were no other significant interactions.

[4] According to a post-hoc power analysis with significance level (α) = .05 and effect sizes based on our regression analysis for each domain, our power to detect the significant age by group interaction was .95 in the recreational domain, .996 in the financial domain, and .74 in the health domain. Therefore, we had sufficient power to detect a significant age by group interaction on 74% to 99% of occasions.

informants (Model B; Table 4). In the recreational domain, self-rated risk perceptions increased linearly with age, whereas the risk perceptions of informants followed a quadratic trend with the age of their self-rating partner (Model C; Table 4).

Figure 1 provides the best fitting slopes for age on risks perceptions. Informants perceived that recreational risk for others vary little from age 18-56 years, but from thereon increase with age. Consequently, informants perceived more risk for their youngest partners than their partners perceived for themselves, and perceived slightly less risk for their oldest partners than their oldest partners perceived for themselves. In the financial domain, participants perceived greater risk for themselves as their age advanced from 18-87 years. Conversely, their informants did not perceive greater risk as their partner's age increased. Consequently, informants perceived greater risk for their younger partners and lower risk for their older partners than their partners perceived for themselves. Similarly, participants perceived greater health risks for themselves as their age increased from 18-87 years, whereas their informants did not perceive greater risk as their partner's age increased. In the social domain, self-rating participants and their informants perceived a gradual increase in risk with age.

In sum, informants perceived greater risks for younger social partners in the recreational, financial, and health domains than their partners perceived for themselves. Moreover, informants perceived less risk for their older social partners in these domains than their partners perceived for themselves. These findings speak against our hypothesis that people base their judgments of others primarily on age-related stereotypes, which would have led to a higher risk evaluation for older adults. Rather, our findings resonate with our alternative hypothesis that older adults estimate their own risks as higher than perceived by their social

partners. This may indicate that older adults evaluate their own risks in line with aging self-stereotypes.

Study 2

In Study 1, family members, partners, work colleagues, and close friends acting as informants perceived risk differently depending on the age of the social partners and differently to how their social partners perceived risk for themselves. Given that these results have potential implications for proxy decision-making, we were interested if these differences also bear out for making risky decisions on the behalf of social partners. Study 2 addressed this question by further exploring potential differences between how people of different ages make risky decisions and how their informants would make decisions for them (i.e. proxy decision-making).

Methods

Participants

A sample of 106 adults (53 younger adults, 18–35 years, $M = 21.76$ years, $SD = 4.75$; 62% female; 53 older adults, 60–81 years, $M = 69.11$ years; $SD = 5.36$; 55% female) were recruited from the local community. All older adults passed the mini mental state examination as a screen for cognitive impairment [19] and none were excluded. Regarding education, 15% indicated high school as their highest level of education, 17% had completed college or third level education, 58% had completed an undergraduate degree, and 10% indicated post-graduate education as their highest level of education. Self-rating participants nominated a family member, partner, or close friend aged between 35-60 years ($M = 47.62$; $SD = 7.44$; 64% female) to report on their nominating partner. Informants had known their nominating partner at least one year ($M= 27.05$; $SD = 13.32$). The majority were parents (40%), sons or daughters (29%), spouses or partners (15%), siblings (3%), or other family members (4%), and the remaining were

friends or work colleagues (10%). Regarding education, 18% indicated high school as their

highest education level, 23% had completed college or third level education, 44% had completed

an undergraduate degree, and 12% indicated a post-graduate degree as their highest level of

education. Ethical approval for the research protocol was granted by the institution ethics review

board.

Materials and Procedure

Self-ratings: We designed 12 decision scenarios, divided equally into the health,

financial, and social domain (Appendix D). Each scenario asked participants to make a decision

for themselves. We also asked informants to make decisions on behalf of their partner. We did

not include items in the recreational domain (e.g., "*Going camping in the wilderness*") as people

typically engage in such activities for personal pleasure, and thus, it may be difficult for

informants to imagine making such decisions on behalf of their partner. The scenarios were

provided on separate pages of a booklet. Participants indicated their likelihood of deciding in

favor of the decision option described in the scenario on a 7-point scale, ranging -3 ('*Extremely*

unlikely'), 0 ('*Not sure*'), to 3 ('*Extremely likely*'). Participants also rated the risks they perceived

for the decision option on a 7-point scale, ranging 0 ('*Not at all risky*') to 6 ('*Extremely risky*').

Informant-ratings: Informants received altered versions of the 12 scenarios, which

instead asked for decisions on behalf of their partner (Appendix D). The scenarios were provided

on separate pages of a booklet. The partner's name was inserted into each scenario. Informants

their likelihood of deciding in favor of the decision option on behalf of their partner and rated the

risks they perceived for their partner.

Statistical analysis

As in Study 1, we calculated Pearson r correlations to test for associations between informants' risk perceptions and risks their partners perceived for themselves. Group differences (informant-rating vs. self-rating) and domain differences (social, financial, health) in risk perceptions and risk-taking likelihood were assessed with two-way analyses of variance (ANOVA), including group as a between-subjects factor and domain as a repeated-measures factor. As in Study 1, to test for effects of the self-rating participant's age on their risk perceptions and the risk perceptions of their partner, we conducted a multiple regression analysis on risk perceptions in each domain. Age (older vs. younger) and group (informant-ratings vs. self-ratings) were included as predictors in a first block (Model A). An interaction term between age and group was included in a second block (Model B). We conducted the same regression model to assess self-rated and informant-rated risk-taking likelihood.

Results

The Cronbach α scores showed reasonable levels of internal consistency for most of the scales (Table 5). The intercorrelations in risk-taking were positive and significant for self-ratings only between the health and financial domains and for informant-ratings only between the financial and social and financial and health domains. This may reflect the contextual nature of the scenarios, due to their detailed descriptions, which may have increased the specificity of risk-taking across domains. The intercorrelations in risk perception across domains were in general positive and significant. The risk perceptions of informants correlated with their partner's risk perceptions in the financial domain ($r = .22$, $p = .02$), but not in the social ($r = .05$, $p = .61$), or health domains ($r = -.05$, $p = .59$).[5] There were no significant correlations across domains. The

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[5]As in Study 1, we additionally conducted multiple linear regression analyses on partners' self-rated risk perceptions to test for moderating effects of informants' relationship with their partner and the absolute age difference between informants and their partners. These analyses yielded no significant moderating effects of relationship or informant-partner age differences on the association between informant- and self-rated risk perceptions (Appendix C).

low correlations between the risk perceptions of informants and their partners may reflect the contextual nature of the scenarios, which may have led to more idiosyncratic responding to the current scenarios compared to the DOSPERT in Study 1.

Informants rated a lower likelihood of taking a risk on behalf of their partners than self-rating participants indicated for themselves (Table 6). An analysis of variance (ANOVA) confirmed a significant effect of group (informant-rating vs. self-rating; $F(1,212) = 4.41$, $p = .04$, $\eta^2 = .02$) on likelihood ratings. Informants and self-rating participants showed similar trends in risk-taking likelihood across domains, reporting highest risk-taking likelihood in the social domain, followed by the health and financial domains (Table 6). The ANOVA showed a significant effect of domain ($F(2,424) = 137.20$, $p < .001$, $\eta^2 = .39$), but no interaction. Regarding risk perceptions, informants perceived lower risks for their partner than self-rating participants perceived for themselves (Table 6), which was confirmed by a significant effect of group in the ANOVA on risk perceptions ($F(1,212) = 8.03$, $p = .005$, $\eta^2 = .04$). Informants and self-rating participants agreed about domain differences in risk, perceiving greatest risk in the financial domain, followed by the health and social domains (Table 6). The ANOVA showed a significant effect of domain ($F(2,424) = 211.20$, $p < .001$, $\eta^2 = .50$), but no interaction.

Table 7 shows the regression analyses on risk-taking likelihood. The age of the self-rating participant interacted with informant-rating versus self-rating in the financial and health domains, but not in the social domain (Model B; Table 7). With advancing age, self-rating participants rated lower risk-taking likelihood in the financial and health domains (Figure 2). Conversely, informants were not influenced by their partners' age. We tested for effects of age separately for self-ratings and informant-ratings. These analyses confirmed an effect of age on

self-ratings in the financial (β = -.50, p < .001) and health (β = -.46, p < .001) domains, but not on informant-ratings in the financial (β = -.01, p = .94) and health (β = .04, p = .70) domains.

Table 7 provides the results of the regression analyses on risk perceptions. Age of the self-rating participant interacted with informant-ratings versus self-ratings in the financial domain (Model B; Table 7).[6] Self-rating participants, but not informants, perceived greater financial risk in older age (Figure 2). Conversely, self-rating participants and informants both perceived greater health risk in older age, which was confirmed by significant main effect of age and no significant interaction between age and informant-ratings versus self-ratings in the regression analysis (Model B; Table 7). Conversely, in the social domain, there was no significant effect of age on risk perceptions (Model B; Table 7).

General Discussion

How do we perceive risks for others as they age? Do we generally believe that older adults are more vulnerable across different life domains or are we, as we are for ourselves, sensitive to differences in heightened risks across domains? The central finding of the current studies is that the deviations of risk perceived for oneself and by others differ for younger and older age groups and across life domains: in the recreational, financial, and health domains, social partners believe that younger adults are more prone to risks than younger adults perceive for themselves, and that older adults are less prone to risks than older adults perceive for themselves. This concerns the group level. On the dyadic level, people were in fairly good agreement with their social partners about the risks their partners faced.

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[6]According to a post-hoc power analysis with significance level (α) = .05 and effect sizes based on our regression analysis for each domain, our power to detect the significant age by group interaction on likelihood ratings was .99 in the financial domain and .98 in the health domain and on risk perceptions was .74 in the financial domain. Thus, we had sufficient power to detect a significant age by group interaction on 74% to 99% of occasions.

Previous work has relied heavily on gambling tasks as a method for studying age-related differences in risk taking [23]. Although gambling tasks provide valuable insights into behavior, research has revealed domain-specificity in risk taking [11,20]. Risk taking may comprise both a general factor that is common across domains, but differs from one person to another, and a domain-specific factor that differs from one domain to another [9]. Our current research revealed a four-domain structure to the scale we used to assess risk perceptions (see Appendix B), confirming the existence of domain-specificity in perceptions of risk. Yet, risk perceptions correlated highly across domains, indicative of a domain-general component of risk perception (Table 1). Domain-specificity in risk raises important questions about whether age differences are independent of context. The aim of our studies was to explore whether family members, partners, and close friends acting as informants perceive greater age-related risks as people perceive for themselves. If older adults perceive greater risk in some domains than in others because they are sensitive to their own vulnerabilities, then these vulnerabilities may also be perceptible to their family members, partners, and close friends. In fact, social partners have often been used as informants in clinical assessments of social vulnerabilities in older age [12,13]. Further, surrogate decision making for others about their medical treatment, finance, and social environment rests on the assumption that people can judge risk accurately for others. Using a novel methodological approach, we asked informants to rate the risks they perceived for their nominating partner.

In Study 1, the risks participants perceived for themselves were strongly associated with the risks perceived for them by their informants. Informants also agreed with their partners about domain differences in risk. In Study 1, both informants and self-rating participants perceived risk to be greatest in the health domain, followed by the financial, recreational, and social domains.

In Study 2, both groups perceived the decision-making scenarios to be most risky in the financial domain, followed by the health and social domains. However, while informants and their partners agreed about domain differences in risk, informants disagreed with their partners about how these risks change across adulthood. In the recreational domain, the risk perceptions of self-rating participants increased linearly with age from youngest to oldest adults. Conversely, informants perceived that risk for their partners changed little until 56 years, whereupon it was perceived to increase sharply with advancing age. Informants were sensitive to greater potential risks of engaging in recreational activities in older age. Moreover, informants perceived that their younger partners were more at risk when engaging in recreational activities than their younger partners perceived for themselves. This finding dovetails with reports of heightened impulsivity and sensation seeking in younger adulthood [24]. Sensation seeking is also linked to recreational risk taking in younger adulthood [25]. For example, Pizam et al. [26] found that when on a leisure trip, university students who scored high in combined risk-taking and sensation seeking were more likely to engage in risky recreational activities, such as hiking, camping, and open water swimming. Thus, younger adults perhaps misjudge the risks they face by underestimating their physical vulnerabilities.

Informants and their partners also disagreed about how financial risks change across adulthood (Figures 1 & 2). Informants perceived less financial risk for their older partners than their partners perceived for themselves. Study 2 further revealed that while participants were less likely to take a financial risk for themselves as their age increased, risk-taking of informants on behalf of their partners was not influenced by their partners' age. Financial advisors often recommend to older adults that they be prudent in their financial investments, as a loss to savings in later life could take many years to recover [27]. We speculate that older adults may be very

cautious in their financial decision-making, maybe even overestimating their vulnerabilities in financial contexts. Indeed, while some of the financial items we used in Study 1 and some of the financial scenarios in Study 2 concerned investments of income and savings, others described betting on a sporting event or using a credit card to make an online payment. Our findings seem to reflect a general tendency toward caution in financial contexts with advancing age, at least in comparison with the views of others. This is in line with the finding that older adults are less willing than younger adults to take risks on a range of monetary gambling tasks [4, 23, 28-31], although such tasks typically involve gambling on small and inconsequential monetary gains and losses (for a discussion of this issue see [32]).

In Studies 1 and 2, participants perceived greater health risks for themselves in older age. While informants also perceived greater health risks for their older partners in Study 1, they did not perceive significantly greater risks for their older partners in the more detailed scenarios in Study 2. However, there was some suggestion in Study 2 that participants perceived slightly more risk for themselves in older age than their partners perceived for them (Figure 2). Moreover, in Study 2, older adults were less likely than younger adults to take a health risk on their own behalf, but informants did not differ in their decision-making on behalf their younger and older partners. Together, these findings suggest that in the health domain people may be highly sensitive to their own health-related vulnerabilities. Indeed, many older adults choose not to renew their driver license, despite being unimpaired [33]. While health authorities strongly recommend daily physical activity in older age, many older adults feel that they are too physically vulnerable to engage in fitness activities [34]. Thus, overly cautious behavior has serious potential consequences for health and well-being in older age. Reduced mobility, which

may result from feelings of vulnerability, can lead to social isolation, which is associated with poor physical health [35] as well as loneliness and depression [36].

While informants and self-rating participants disagreed about how risks change across adulthood in some domains, they agreed that social risks differed little with age. The items we used in the social domain included admitting one's tastes differ from those of an authority figure or person of influence (Study 1) or sharing one's views with a journalist on a controversial issue (Study 2). As discussed earlier, with advancing age some situations can pose greater risk than others. However, informants and self-rating participants agreed that social risks do not increase in older age. Furthermore, in the social domain, informants reported that they were equally likely to take a social risk on behalf of their partners as their partners were to take a social risk for themselves.

Our findings have implications for research on age-related stereotypes. This field of enquiry has shown that older adults are perceived as fragile, dependent, physically handicapped, and in need of care [14,15]. These negative stereotypes have been shown to influence people's perceptions of older adults regardless of the target's actual physical or cognitive abilities [16]. Hence, we expected that middle-aged informants would employ negative aging stereotypes, perceiving their older social partners as more vulnerable and at risk than their partners perceive for themselves. Yet, informants in our study actually perceived less risk for their older social partners in the recreational, financial, and health domains than their partners perceived for themselves. This indicates that aging stereotypes did not lead to exaggerated perceptions of vulnerability in older age. Moreover, on a dyadic level, informants' risk perceptions were positively associated with the risk perceptions of their partners, indicating that informants had similar perceptions of their partners' vulnerabilities as their partners had for themselves.

Therefore, when judging their older social partners' risks, people in younger age ranges seemingly do not draw solely upon broad age-related stereotypes but draw upon their personal knowledge of their partner.

Our studies cannot assess whether informants were more (or less) accurate than their self-rating social partners in judging the risks they face. However, our finding that older adults perceived greater risk for themselves in some domains than informants perceived for them suggests that older adults may draw on aging self-stereotypes. Previous research has shown that negative aging stereotypes can be internalized as early as in childhood and in later life re-emerge as self-stereotypes [17]. Negative aging self-stereotypes (e.g., that older people have poor memory), can even have detrimental effects on cognitive abilities in older age [18]. It is possible that older adults in our studies perceived, due to negative aging self-stereotypes of frailty, that they are more vulnerable, and thus, at greater risk than they truly are. Therefore, older adults may overestimate their vulnerabilities and risks in some domains life. This could have serious real-life implications as overly cautious behavior is associated with missed opportunities, which can lead to poorer physical health and well-being [35,36].

The current research also has limitations. First, we asked participants to report on their own risk behavior, rather than directly measure risk-taking. As our current interest was domain-specificity of risk perceptions across adulthood, we targeted self-reported behaviors in multiple domains. In Study 1, we based our survey items on those of the revised DOSPERT, which has been shown to predict real-world behavior [37]. In Study 2, we devised decision-making scenarios with the intention that they were applicable to people of a broad age range. While some of the sub-scales demonstrated reasonable Cronbach α levels of internal consistency, others exhibited poorer levels, indicating that the items of some domains were less closely related. We

observed the lowest levels in the health domain in Study 2. Therefore, the broad domains we focused on presently should be treated with some caution as their breadth may conceal multiple sub-domains. For example, the health domain may comprise distinct medical, dietary, and exercise sub-domains.

Second, although our findings suggest that family members, partners, and close friends when acting as informants were able to detect vulnerabilities in their partner, some vulnerabilities (e.g., physical risks, '*Going camping in the wilderness*') may be more detectable to informants than others (e.g., health-related risks, '*Using a sunbed in a tanning studio*'). Studies have shown that self-other agreement about personality traits depends on the observability or visibility of a person's characteristics [38]. Moreover, some vulnerabilities may not be detectable even to oneself, such as the risk one might face when '*Walking home alone at night in an unsafe area of town*.' The degree to which pairs of individuals are well acquainted and their relationship with each other also affects self-other agreement [39,40]. We chose informants who were highly familiar with their nominating partner. Informants had known their self-rating partners on average for more than 25 years in both studies, and the majority were family members. However, there was some indication in our data that acquaintanceship was important for informants' perceptions of their social partners. In Study 1, informants who were parents of their social partner exhibited weaker associations between their risk perceptions and their partners' risk perceptions in the recreational domain. Thus, extending previous research [39,40], acquaintanceship may be an important mechanism underpinning people's perception of the risks faced by others. Had we recruited informants who were less well acquainted with their social partner, we may have observed a much weaker association between their risk perceptions and perhaps greater reliance by informants on aging stereotypes. An implication of this finding is

that when using clinical tools to assess the vulnerabilities of older adults, such as the Social Vulnerability Scale (SVS, [12,13]), clinicians and researchers need to be cognizant that the informant's relation to the target older adult could influence their degree of insight into the target's vulnerabilities.

Finally, we asked whether people are sensitive to age-specific risks that others face. To answer this question, we compared the risk perceptions and risk behavior of self-rating participants with reports provided on their behalf by a nominated partner. It is important to note, however, that self-related risk perceptions are highly personal. Particular events or outcomes can be marked by varying levels of affect that are person-specific and the positive and negative feelings that people associate with particular outcomes of decision options inform their risk perceptions [41]. Moreover, positive and negative personal experiences (e.g., receiving a scornful criticism) can mark future decision options (e.g., disagreeing with an authority figure) with positive or negative emotions that influence decision-making [42]. We acknowledge that such influences of affect on self-related risk perceptions presumably would not be visible or observable to others. Yet, despite the personal relevance of risk perceptions, our findings showed that in many instances informants' risk perceptions were strongly associated with those of their partners, indicating that informants were able to detect risks faced by their partners.

Conclusion

As people grow older, they perceive greater risk in some domains than in others, leading to domain-specificity in risk-taking differences with age. Family members, partners, and close friends are sensitive to the vulnerabilities of others, but in some domains, perceive greater risk in younger age and less risk in older age than others perceive for themselves. When decision-making capacity is impaired, such as in older age, some high-risk decisions about healthcare and

treatment and important financial and social decisions are made not by oneself, but by others. Our findings suggest that for decisions involving risk, others may decide differently to how their social partners would decide for themselves. As informants perceived less risk in older age than older adults perceived for themselves, middle-age persons acting as surrogate decision-makers may make riskier decisions on another's behalf than their elderly family members, partners, and close friends would be willing to make for themselves.

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Table 1. Study 1: Intercorrelations across domains for self-rated risk-taking

likelihood and self-rated and informant-rated risks

	Self-rating: Likelihood			
	Recreational	Social	Financial	Health
Recreational	(.65)			
Social	.67**	(.60)		
Financial	.68**	.63**	(.60)	
Health	.46**	.60**	.58**	(.50)

	Self-rating: Risk Perception			
	Recreational	Social	Financial	Health
Recreational	(.78)			
Social	.53**	(.64)		
Financial	.60**	.44**	(.68)	
Health	.59**	.40**	.52**	(.69)

	Informant rating: Risk Perception			
	Recreational	Social	Financial	Health
Recreational	(.68)			
Social	.45**	(.60)		
Financial	.29**	.28**	(.58)	
Health	.47**	.35**	.41**	(.64)

Note. *$p \leq .05$, **$p \leq .01$, 2-tailed significance test of the Pearson *r* correlation
coefficient compared to zero. Cronbach α values are in parenthesis.

Table 2. Study 1: Correlations between informant-rated and self-rated risks

	Informant rating			
Self-rating	Recreational	Social	Financial	Health
Recreational	.46**	.26**†	.17*††	.26**
Social	.31**	.46**	.11††	.22*
Financial	.36**	.17††	.35*	.21*
Health	.19*††	.14††	.15††	.25**

Note. *$p \leq$.05, **$p \leq$.01, 2-tailed significance test of the Pearson *r* correlation coefficient compared to zero; $^\dagger p \leq$.05, $^{\dagger\dagger} p \leq$.01, 2-tailed of the Pearson *r* correlation coefficient informant-ratings and self-ratings of the same domain compared to self-ratings of each other domain

*Table 3. S*tudy 1: Mean group self-rated risk-taking likelihood and self-rated and informant-rated risk perceptions for each domain

	Self-rating: Likelihood	Self-rating: Risk Perception	Informant rating- Risk Perception
	M (*SD*)	*M* (*SD*)	*M* (*SD*)
Recreational	-1.57 (1.25)	3.59 (1.40)	3.46 (1.23)
Social	-1.05 (1.20)	2.12 (1.12)	2.21 (1.05)
Financial	-0.81 (1.41)	4.18 (1.14)	4.18 (1.00)
Health	-0.31 (1.13)	4.82 (1.02)	4.72 (0.99)

Table 4. Study 1: Multiple linear regression analyses on self-ratings and informant-ratings

of risk perception

Model	Parameter	Recreational Domain	Social Domain	Financial Domain	Health Domain
Model A	Age	.50**	.21**	.33**	.23**
	Group	-.05	.04	.00	-.05
	R^2	.25**	.22**	.11**	.06**
Model B	Age	1.07**	.48*	1.11**	.69**
	Group	-.05	.04	.00	-.05
	Age by group	-.60**	-.29	-.83**	.49*
	R^2 change	.036**	.008	.068**	.024*
Model C	Age	.65** (.30**)	.20**	.56** (.07)	.39** (.06)
	Group		.04		
	Age^2	.01 (.25**)	.10	-.06 (.06)	-.08 (.17)
	R^2 change	.000 (.059**)	.009	.003 (.003)	.006 (.030)

Note. *$p \leq .05$, **$p \leq .01$; The R^2 change for Models B and C is in comparison with Model A. For Model C, values not in parenthesis = self-ratings and value in parenthesis = informant ratings.

Table 5. Study 2: Intercorrelations across domains for self-rated and informant-rated risk-taking likelihood and risk perceptions

	Self-rating: Likelihood		
	Social	Financial	Health
Social	(.41)		
Financial	.08	(.77)	
Health	.12	.33**	(.37)

	Informant-rating: Likelihood		
	Social	Financial	Health
Social	(.45)		
Financial	.19*	(.62)	
Health	.11	.24*	(.18)

	Self-rating: Risk Perception		
	Social	Financial	Health
Social	(.71)		
Financial	.09	(.73)	
Health	.22*	.22*	(.38)

	Informant-rating: Risk Perception		
	Social	Financial	Health
Social	(.62)		
Financial	.29**	(.62)	
Health	.30**	.27**	(.47)

Note. *$p \leq .05$, **$p \leq .01$, 2-tailed significance test of the Pearson *r* correlation coefficient compared to zero. Cronbach α values are in parenthesis.

Table 6. Study 2: Mean group self-rated and informant-rated risk-taking likelihood and risk

perceptions for each domain

	Self-rating: Likelihood	Informant-rating: Likelihood	Self-rating: Risk Perception	Informant-rating: Risk Perception
	M (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)
Social	0.88 (1.10)	.77 (1.13)	2.66 (1.14)	2.32 (1.06)
Financial	-.70 (1.53)	-1.14 (1.19)	4.40 (1.00)	4.11 (0.97)
Health	0.36 (1.27)	.18 (1.10)	3.57 (0.96)	3.38 (0.93)

Table 7. Study 2: Multiple linear regression analyses on self-ratings and informant-ratings of risk-raking likelihood and risk perception

		Risk-taking likelihood			Risk perception		
Model	Parameter	Social Domain	Financial Domain	Health Domain	Social Domain	Financial Domain	Health Domain
Model A	Age	.07	-.28**	-.23**	.01	.13	.15*
	Group	-.05	-.16*	-.07	-.15*	-.15*	-.10
	R^2	.01	.10**	.06**	.01	.04*	.03*
Model B	Age	.08	-1.10	-1.02**	.20	.65**	.36
	Group	-.04	-.98**	-.86**	.04	.37	.11
	Age by group	-.02	1.19**	1.15**	-.27	-.76**	-.31
	R^2 change	.000	.075**	.069**	.004	.030**	.005

Note. *$p \leq$.05, **$p \leq$.01; The R^2 change for Model B is in comparison with Model A.
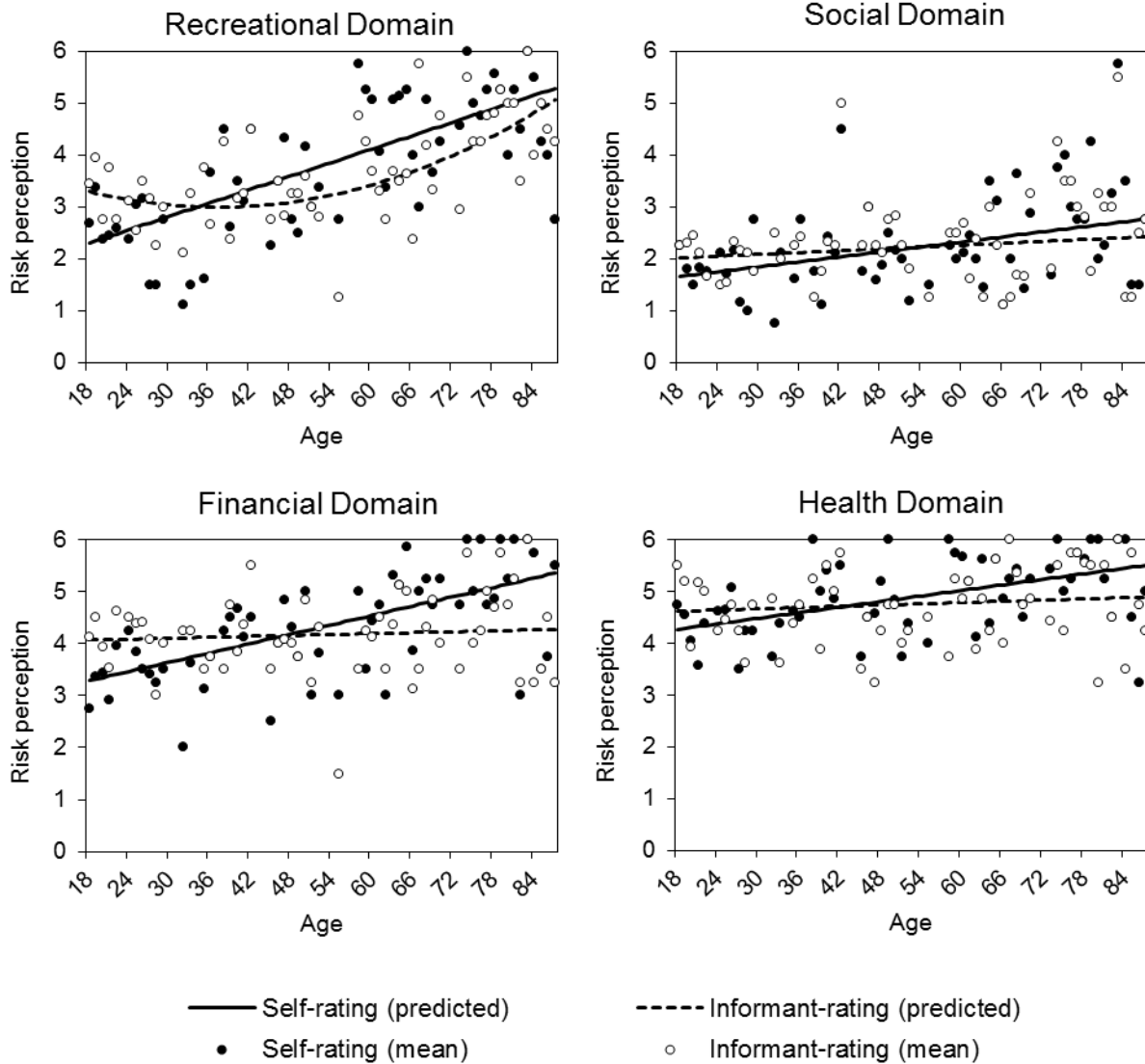
Figure 1. *Self-rated risk perceptions and informant ratings with age in Recreational, Social, Financial, and Health domains. Predicted slopes were estimated using a linear regression analysis. Dots indicate the mean group values at each individual age containing at least one participant.*
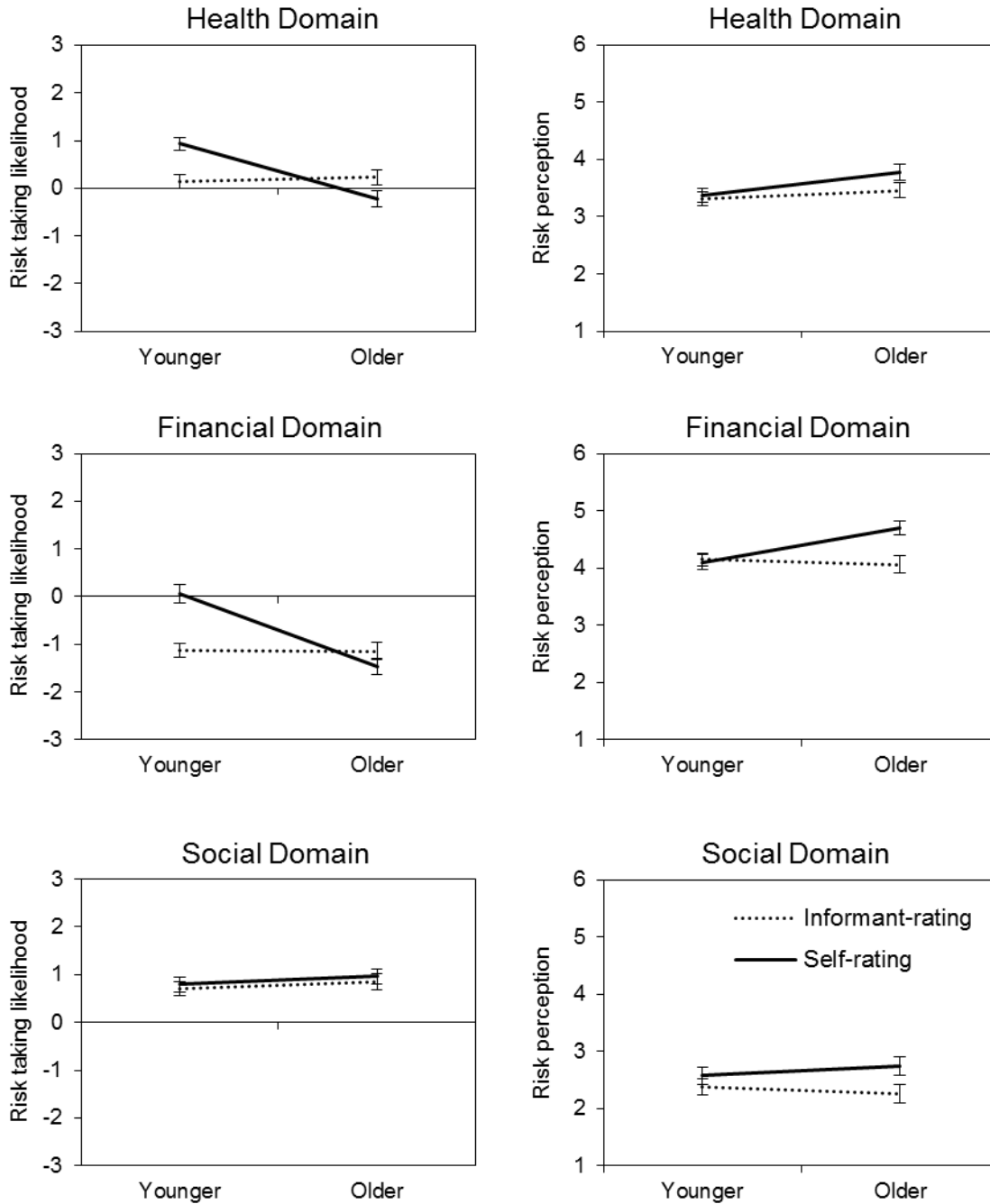
Figure 2. *Mean group self-rated and informant-rated risk perceptions and risk behavior with age in the health, financial, and social domains. Error bars indicate the 95% confidence intervals.*