

Representations of Medical Risks and Their Connection to Different Personal Characteristics of Doctors and Medical Students

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Background. There is no generally accepted psychological understanding of how a doctor's representation of risk and uncertainty affects professional medical decision-making. The concept of a Unified Intellectual and Personal Potential can serve as a framework to explain its multiple and multilevel regulation. Our objective was to research the connections between medics' perceptions of risk and related personal factors.

Design. Medical doctors were compared to different control groups to identify their personal and motivational characteristics in three studies. *Study 1* assessed the motivational profile of doctors (using Edwards Personal Preference Schedule) in connection with their risk-readiness and rationality (measured by the Personal Factors of Decision-making questionnaire, also known as LFR) in a sample of 33 doctors, as compared to 35 paramedics and 33 detectives. *Study 2* compared 125 medical students and 182 non-medical students to 65 doctors as to the levels of their risk perception (measured by Implicit Theories of Risk questionnaire, the LFR, and their direct self-esteem of riskiness^a), tolerance for uncertainty (measured by Budner's questionnaire), and rating on the Big-Five personality traits (TIPI). *Study 3* presented two new methods of risk perception assessment and investigated the connection between personality traits, risk reduction strategies, and cognitive representations of risk in 66 doctors, as compared to 44 realtors.

Results. Study 1 found differences between the doctors', paramedics', and investigators' motivational profiles. The doctors' motivations were not associated with conscious self-regulation. In Study 2, risk-readiness was positively related to tolerance for uncertainty (TU) and the self-esteem of riskiness. The latter was significantly lower in doctors compared to the student groups and had different relationships with personality variables. In Study 3, doctors differed from realtors not only in their traits (*i.e.*, being less willing to take risks), but also in their choices and greater integration of their risk representations.

Conclusions. The three studies demonstrated the multilevel processes behind the willingness to take risks and risk acceptance, as well as the relationship between the multilevel personality traits and doctors' assessments of medical risks and their preferences in risky decision-making.

Keywords: decision-making (DM); risk representation; risk-readiness; implicit theories (IT); Implicit Theories of Risk (ITR); self-esteem of riskiness; tolerance for uncertainty (TU); Big Five

Introduction

In various professions, decision-making (DM) under conditions of uncertainty involves not only subjective risk for the decision-maker him/herself, but also might be a source of risk and danger for someone else. Medicine is an example of such a profession (Heller, Saltzstein, & Caspe, 2017). This profession is essential in one's life, but there's no generally accepted psychological understanding of how a doctor's representation of risk and uncertainty affects his/her professional decision-making.

The medical professional has to utilize decision-making and basic knowledge in his/her analysis of any specific individual case. Risk perception and implicit theories of risk (ITR) constitute cognitive components of DM, and they interact with different strategies for using professional knowledge (Kahneman, Slovic, & Tversky, 1982). Personal characteristics are also part of DM regulation, as has been shown in the research on the framing effect (Kahneman, 2011; Kornilova, Kerimova, 2018) and on the connection between DM and personal and motivational characteristics of medical professionals (e.g., Kamenev, Kornilova, & Razvalyaeva, 2018).

Despite the active development of various risk assessment scales in medical practice, designed to simplify and increase the objectivity of medical DM (e.g., Diadichkina, Radetckaia, 2016; Suriadi, Sanada, & Sugama, 2008), practicing doctors tend to rely more on their clinical experience. At the same time, "mechanized" DM (that based on statistics, risk scales, and other algorithms) shows an advantage in comparison with "clinical" forms of assessment (when one bases their decisions on experience and knowledge without relying on third-party assessment tools). As shown in the literature, "mechanized" decisions are 10% more accurate than traditional (subjective) risk assessments (Grove, Zald, Lebow, Snitz, & Nelson, 2000). At the same time, medics do not always base their decisions on rational grounds (Perneger & Agoritsas, 2011). As the literature shows, doctors tend to test hypotheses during diagnosis in only 39% of their cases, but in general, tend to search for additional information using inductive methods (Donner-Banzhoff et al., 2017).

One of the principal sources of risk in medical DM is the prognostic aspect of any DM. This aspect is inseparably linked to uncertainty, not only in terms of the results and the probabilistic nature of a patient's symptomatology, but also in terms of the general prognostic character of a professional's world image. This image necessarily includes a dynamic attitude towards uncertainty and risk (Kornilova, 1994; Smirnov, Chumakova, & Kornilova, 2016).

Perception of risk can function on different levels, ranging from reflections on risk conditions and factors, up to the deeper level of *implicit theories (IT)*. The latter can be part of the existential level of consciousness as defined by V. Zinchenko (2006). They consist of social representations as well as professional systems of knowledge, strategies, and tacit assumptions (Gigerenzer, 2008; Sternberg et al., 2000).

The concept of *risk representation* implies a cognitive representation of a situation or a task, its outcomes, and possible alternatives. D. Kahneman's and A. Tver-

^a The "self-esteem of riskiness" refers to an individual's self-esteem in light of their willingness to take risks. This formulation will be used throughout this article, as to constantly elaborate its meaning would be too unwieldy.

sky's work has shown the role of cognitive representations of uncertain conditions in judgment, and how heuristics condition the situation image (Kahneman, 2011). At the same time, they didn't look into the actual genesis of DM, or its interaction with cognitive, stylistic, and personal variables. In the medical profession, the connection between the perception of medical risks and non-specific ones is also essential.

However, risk perception and personal risk-readiness connect with the personal and cognitive sphere of a person to varying degrees. Normative models of DM under conditions of uncertainty and risk suggest that a person seeks to maximize utility as a result of their DM, but research shows deviations from the "optimal" strategies (Gigerenzer, 2015; Kozeletskii, 1979). The particular characteristics of risk-readiness differ from both impulsivity and sensation seeking (see Lauriola & Weller, 2018). At the same time, risk readiness, tolerance for uncertainty (TU), and intuition form the latent variable of Acceptance of Uncertainty and Risk (Kornilova, Chumakova, Kornilov, & Novikova, 2010), which, in turn, links to intelligence through the integrative Self-concept (Novikova & Kornilova, 2013).

We must distinguish risk readiness as a personal characteristic from *implicit theories of risk* (ITRs). Implicit theories (ITs) manifest themselves in DM, but are not necessarily recognized by a person. Different aspects of ITRs are actualized in different situations, and that might explain lower correlations between personal factors, self-reports, and real behavior in various professional and everyday situations (Figner & Weber, 2011).

We assume that cognitive representations of risk are components of the image of the situation; they can act on both the level of ITs and the conscious level of risk-readiness in the assessment of the consequences of a decision. At the same time, they indicate how a hypothesis opens up the situation under the influence of a person's world image (Leontiev, 2003; Smirnov, 2003), an image that varies for representatives of different specialties (it includes both professional knowledge and professional values). DM by a professional is based on his/her world image and an attitude towards uncertainty and risk. It contributes to the specific choice in a given practical situation.

Personal characteristics that contribute to and inhibit risk acceptance have been studied previously (Kornilova, 2016), but the role of the direct self-assessment of one's willingness to take risks has just begun to be considered (Krasavtseva, 2018). At the same time, Acceptance of Risk and Uncertainty can be understood as "trying on" alternatives to a potential decision (Kornilova, 2003), and the individual's self-esteem of riskiness plays an essential role in this process. Studies of DM have shown that people tend to take higher risks for themselves, in contrast to their advice to others (Kamenev et al., 2018).

According to the concept of a person's *Unified Intellectual and Personal Potential*, an individual's regulation of DM and activity under uncertainty is multiple and multi-level. This notion allows us to study the interaction between the cognitive and personal (and situational and dispositional) aspects of risk representations and medical decision-making. At the same time, such a study can take into account not only cognitive representations of risk in everyday situations, or subjective cognitive representations of a medic's willingness to take risks, but also their interaction, and their connection to the medical risk perception.

The goal of this paper was to study the connections between a medic's risk perception (from ITRs to the direct self-esteem of riskiness) and the different levels of their personal traits; we used different personal characteristics, ranging from a deep motivation toward the self-esteem of riskiness and stable personal features (such as the Big-Five personality traits), to ones that reflect a person's attitude towards uncertainty. We did not set as a separate goal the investigation of the role of a doctor's ethics in their decision-making process. However, we can assume that ethical principles and following the Hippocratic oath are one of the factors determining the results of this study. In particular, awareness and understanding of the moral aspects of medical decisions are fundamentally different between doctors and medical students (along with other elements of professionalization). Perhaps that is why the idea of risk as something harmful or undesirable (in comparison with a hedonistic interpretation) manifests itself in many aspects of our research.

We believe that the study of risk-readiness and motivational tendencies (diagnosed with Edwards Personal Preference Schedule, Kornilova, 1997a, b) would benefit from the analysis of personal characteristics of professional medics. We have previously outlined the specifics of medics' motivational profiles (Kamenev et al., 2018), but didn't compare them with those of emergency doctors and non-medical professions. This paper expands our research in this direction. The multi-level structure of an individual's dynamic regulative systems assumes there is a deep level of motivational hierarchies; their relationships with risk-readiness can help establish how closely different kinds of motivation lead toward risk acceptance processes.

Study 1. The Connection between Personal Aspects of Self-Regulation (Risk-Readiness and Rationality)

Study 1. Overview

The *goal* of this study was to compare the personal and motivational profiles of three groups of participants: doctors, paramedics, and detectives of the Investigative Committee of Russia.

We dedicated some of our previous work to the problem of risk perception and risk reduction during DM in doctors (see Bogacheva, Kornilova, & Krasavtseva, 2017; Kornilova et al., 2010; Pavlova, Kornilova, Krasavtseva, & Bogacheva, 2019). A. Sakharova compared the prognostic effectiveness of paramedics and doctors; she showed that general anticipation, personality-situational prognostic competence, and the DM in the process of self-control are significantly higher among emergency doctors (Sakharova, 2012).

In our previous research on the connection between kinds of motivation and DM in verbal tasks, a group of paramedics made up about a third of the sample (13 people out of 33, Kamenev et al., 2018). The differences between the doctors and the paramedics in DM were shown to be insignificant. At the same time, in that study, deep motivation was related to the acceptance of risk, and the style of self-regulation was connected to decision confidence but not its orientation.

However, we did not compare the motivational profiles of the doctors and the paramedics. We decided to include more doctors of different specialties in our research to study this problem further. We believe that the differences in work condi-

tions (a scheduled appointment versus an ambulance) can't be more decisive than the professionalization factor (doctors have more intensive training than paramedics). Therefore, we studied the specifics of personal self-regulation and the deep motivation of the participants as determined by the whole situation, including the unity of the intellectual and personal components of professionalization.

We chose detectives as a control group for this study. There is no current information about detectives' motivational profiles (their latest profesiograms were created in 1925 and 1967 – Shadrikov, 1994). However, like doctors, their activity involves following certain norms, detailed intellectual strategies, multi-stage decisions, and taking responsibility for others.

Study 1. Method

Participants

The sample consisted of 101 people:

- 33 doctors (13 men, 20 women); ages ranged from 26 to 68 years ($M = 45.79$, $SD = 12.58$);
- 35 paramedics (5 men, 30 women); ages ranged from 25 to 63 years old ($M = 44.11$, $SD = 8.47$); and
- 33 detectives (15 men, 18 women); ages ranged from 26 to 56 years old ($M = 39.09$, $SD = 7.78$).

The detectives were selected from a larger group of 90 in order to obtain a group equivalent to the medical workers in terms of gender and age. The comparison between doctors and paramedics allows us to take into account the professionalization factor, and with detectives, the factor of the profession itself. At the same time, all of the participants are representatives of the so-called “person-to-person” kind of profession.

The participation in all three studies was anonymous, and all participants signed informed consent.

Work experience was normally distributed (according to Pearson's chi-square crosstab test), but age was not: the doctors turned out to be older than the other groups ($F = 4.173$, $df = 2$, 98 , $p = .018$).

Procedure

Questionnaires

1. *Edwards Personal Preference Schedule* (Kornilova, 1997a). This measure evaluates “motivational tendencies” that correspond to G. Murray's types of motivation. The questionnaire has an ipsative format. Motivation tendencies in this questionnaire are shown by the general directions of the person's preferred methods of action and interaction with the social environment. The test has eight scales: achievement; order; autonomy; self-knowledge; dominance; abasement; endurance; and aggression.
2. *Personal Factors in Decision-making Questionnaire* aka LFR (Kornilova et al., 2010). This was used to measure risk readiness (an ability to make decisions under risk) and rationality (readiness to search for additional information).

Study 1. Results

Using the Mann–Whitney U-test, we examined how *sex* affects motivation and personal factors of DM. According to our results, men tend to be more *dominant* ($p = .013$). Other parameters don't show significant differences.

We used Kruskal–Wallis one-way analysis of variance to establish the differences between the variables in the groups (see *Table 1*).

Table 1

Significant differences in the variables between groups of doctors, detectives, and paramedics (Kruskal–Wallis one-way analysis of variance)

Variable	Groups	p	M _{doctors}	M _{paramedics}	M _{detectives}
Risk-readiness	P – Dt, Dc – Dt	.030	1.24	0.91	3.33
Rationality	Dc – P, Dc – Dt	.001	6.06	8.17	7.91
Achievement	Dc – P, P – Dt	.006	7.85	6.51	7.82
Order	Dc – P, P – Dt	.023	6.94	8.4	7.09
Dominance	Dc – P, P – Dt	.001	7.88	5.54	8.97
Abasement	Dc – P, P – Dt, Dc – Dt	.001	5.94	8.74	4.18
Aggression	P – Dt, Dc – Dt	.001	4.94	5.71	3.91

Note. Dc = doctors, P = paramedics, Dt = detectives.

Risk-readiness in the detectives is higher in comparison with other groups, and *rationality* is lower in the doctors.

The *motivation for achievement* and *dominance* is significantly lower among paramedics; at the same time, they have significantly higher *aggression*, *abasement*, and love for *order*. Doctors and detectives have higher *dominance* and *achievement*; at the same time, they have lower *abasement* and *aggression*.

Correlation analysis shows that *motivation* is not connected to self-regulatory properties in doctors, and *risk-readiness* tends to be linked to *aggression* ($p = .078$). Among paramedics, *risk-readiness* positively correlates with *autonomy* ($p = .031$) and *dominance* ($p = .01$) and negatively correlates with *abasement* ($p = .05$). *Rationality* in this group positively correlates with *order* ($p = .027$) and negatively with *aggression* ($p = .012$). Finally, detectives' *motivational* scales do not correlate with *risk-readiness*, but *rationality* was positively associated with *order* ($p = .01$) and negatively with *self-knowledge* ($p = .016$).

Study 1. Discussion

Correlation analysis established that the components of motivation and personal self-regulation of DM (namely *risk-readiness* and *rationality*) are not integrated among doctors, as compared to paramedics, who also have a stronger desire for order, as well as exhibiting aggression and abasement. This connection is quite convincing: people with a stronger desire for order are more rational, and those who are abased (willing to accept blame) are less risk-ready. Thus, there are reasons to

associate paramedics' lower level of basic knowledge and their activity with a more pronounced motivational regulation.

The group of detectives appears intermediate: they don't demonstrate the connection between motivation and risk-readiness that the doctors do, and their rationality correlates with the desire for order like the paramedics. In general, they have less correlation between variables as compared to paramedics.

Doctors and detectives are involved in a more intellectual activity than paramedics. Quasi-experimental comparison results (for the student sample) show that people with lower intelligence tend to manifest more personal-motivational regulation of their cognitive activity (Chumakova, 2010; Shadrikov, 2017). In our study, we found that doctors demonstrated lower rationality, which may be due to their being more critical in the self-assessments the questionnaire is based on. In general, the results of Study 1 allow us to consider the differences between groups in the context of the differences in their professionalization and intellectual activity. These may be the reason there are no significant connections with deeper motivational levels among the doctors and as compared to the paramedics.

Study 1. Conclusion

The following two studies are dedicated to analyzing actual DM situations and risk perception among doctors, and include analysis of their characteristics on different levels (from personal traits to self-esteem and ITRs).

Study 2. Risk Representation Levels of Doctors and Students

Study 2. Overview

Personal risk-readiness includes perception of risk, although risk-readiness can't be reduced to it. In Study 2, we identify relationships between the self-esteem of riskiness, ITRs (Implicit Theories of Risk as unrecognized implicit representations of risk perception), and risk-readiness and rationality (as personal properties of self-regulation).

We believe that the acceptance of risk is based on personal experience that crystallizes in the form of 1) implicit perceptions of situations and sources of risk (Slovic, 1984, 2000); and 2) the person's own readiness for action and DM under conditions of uncertainty or danger (Kornilova, 2016).

ITRs include not only common knowledge, but also different forms of tacit assumptions formed in professional activity (Sternberg, 2000). They are related to critical thinking and personal traits of self-regulation. We consider ITs less as perceived parts of risk perception, than as reflecting the self-esteem of riskiness. Self-esteem represents an assessment of one's capabilities for making choices in a risk situation.

In Study 2, we identified the features of direct self-esteem of riskiness, ITs, and personal risk-readiness by comparing 1) medical practitioners and medical students, and 2) students at medical and non-medical universities.

We tested the hypothesis about the role the stage of professionalization plays in determining the interconnections between the processes behind the latent variable Accepting Uncertainty and Risk.

Study 2. Methods

Participants

372 people participated in the study:

- 65 doctors (28 men and 37 women); ages ranged from 24 to 73 years old ($M=41$, $SD=12.5$); with professional experience from 1 to 50 years ($M=15.7$, $SD=11.9$);
- 125 students from First Moscow State Medical University, Department of Pediatrics and Department of Medicine (36 men and 89 women); ages ranged from 17 to 29 years old ($M=19$, $SD=1.4$); and
- 182 students from Lomonosov Moscow State University, Department of Psychology (18 men and 164 women); ages ranged from 18 to 33 years old ($M=19.8$, $SD=1.3$).

Procedure

Questionnaires

1. *Implicit theories of risk* questionnaire (ITR, Ordinova, 2013). This considers ITRs as stable individual perceptions of risk and risk situations, and has seven scales: 1) *impossibility of prognosis/calculation*; 2) risk as a *conscious choice* (conscious violation of standards, willingness to act without regard to danger); 3) risk as a *challenge*; 4) risk as a *lack of rationality* and control over the situation; 5) risk as *acquisition of value*; 6) risk as a *loss or gain*; and 7) risk as *pleasure* (risk as a search for vivid impressions, a source of positive experiences).
2. *Budner's questionnaire* (Kornilova, Chumakova, 2014). This measures two scales: 1) *tolerance for uncertainty* (TU, as a personal characteristic that reflects one's readiness act in uncertain situations), and 2) *intolerance for uncertainty* (ITU, a pursuit of clarity, simplicity).
3. *Personal Factors of Decision-making Questionnaire* aka LFR (Kornilova, et al., 2010). See description in Study 1.
4. *Ten-Item Personality Measure* (TIPI, Gosling, 2013). This was adapted for a Russian sample by Kornilova and Chumakova (2016) and used to measure extraversion, agreeableness, conscientiousness, emotional stability, and openness.
5. The *self-esteem of riskiness* (Kornilova et al., 2010). This was measured using a procedure analogous to the self-esteem of intelligence proposed by Furnham (2001). In this method, participants are asked to assess their level of willingness to take risks based on the normal distribution graph ($M=100$, $SD=15$).

Study 2. Results

The significant differences between the groups are shown in *Table 2*.

Medical students have higher *risk-readiness* than psychology students ($p=.002$). Doctors show significantly lower *risk-readiness* in comparison with medical students ($p=.001$), but not psychology students, who also have lower *rationality* ($p=.031$). At the same time, the groups do not differ in their *TU-ITU*.

Next, doctors show a significantly higher level of *conscientiousness* in comparison with both student groups ($p=.026$, $p=.001$). At the same time, they are more *emotionally stable* than the psychology students ($p=.008$).

Table 2

Significant differences in ITR, LFR, Big-Five factors, and self-esteem of riskiness between groups of doctors, medical students, and psychology students (Kruskal–Wallis one-way analysis of variance).

		H	P	M _{medics} (SD)	M _{medical students} (SD)	M _{psychology students} (SD)
ITR	Risk as a challenge	9.125	.010	13.3 (2.7)	14.6 (2.9)	14.2 (2.9)
	Lack of rationality	13.976	.001	22.3 (3.8)	20.9 (3.5)	20.7 (4.1)
	Pleasure	10.622	.005	16.5 (3.7)	18.7 (4.5)	18.1 (3.8)
LFR	Risk-readiness	19.866	.001	0.5 (3.2)	2.4 (4.1)*	.5 (4.6)*
	Rationality	5.991	.050	5 (3)	4.1 (2.8)	3.8 (3.8)
TIPI	Conscientiousness	17.351	.001	11.2 (2.3)	10.1 (2.5)	9.4 (3.2)
	Emotional stability	9.024	.011	8.7 (2.8)	7.8 (2.7)	7.4 (2.8)
	Self-esteem of riskiness	8.179	.017	90.2 (20.4)	99.8 (22.9)	98.6 (21.6)

Note. Bold=significant differences found in pairwise comparison ($p < .05$); *=significant differences between student groups; only scales with significant differences ($p < .05$) are shown.

The participants from the different groups also show different ITRs. For doctors, it's more common to see risk as a *lack of rationality* ($p = .009$ with medical students, $p = .001$ with psychology students), and less as a *challenge* (only in comparison with medical students, $p = .008$). At the same time, they are less susceptible to *hedonistic risk* than the other two groups ($p = .004$ with medical students, $p = .037$ with psychology students). Finally, both student groups assess their willingness to take risks higher than the doctors do ($p = .027$ with medical students, $p = .028$ with psychology students).

We conducted a correlation analysis to clarify the specific characteristics of groups (the correlations between variables are shown in *Tables 1* and *2* in the Appendix).

All groups demonstrate significant connections between *self-esteem of riskiness* and *risk-readiness*. The latter, in turn, is positively connected to *extraversion* and negatively to *rationality* and ITR *conscious choice*. ITU in all groups relates to the ITR *lack of rationality*. The rest of the correlations are specific to each group.

The connection between the *self-esteem of riskiness* and ITR *acquisition of value* was found only among the doctors. At the same time, the *self-esteem* of the students in both groups positively correlates to ITRs *conscious choice*, *extraversion*, and *openness*, and negatively to ITU. Psychology students' *self-esteem of riskiness* also links to *rationality* and the ITR *impossibility of prognosis*.

In the medical students, TU correlates to ITR *pleasure*, but among psychology students, it relates to ITR *challenge* (positively) and ITR *acquisition of value* (negatively). ITU is connected to ITR *acquisition of value* (in both student groups), and negatively to *conscious choice* and *hedonistic risk* among medical students.

Risk-readiness positively connects to ITR *pleasure* in medical students. Psychology students demonstrate a different profile: their *risk-readiness* positively corre-

lates with *risk as a challenge* and negatively correlates with ITR *acquisition of value*. *Rationality* measured with LFR among doctors and psychology students correlates with the ITR *lack of rationality*. Psychology students also show a correlation of *rationality* with ITR *conscious choice* (negative) and ITR *loss or gain* (positive). Medical students also demonstrate the link between *rationality* and risk as a result of an *impossibility of prognosis*.

Finally, there is a difference in the correlations of personal characteristics between the groups. The *rationality* of doctors significantly connects to their *conscientiousness* and *emotional stability*. Medical students demonstrate the relationship between *rationality* and *ITU* (positive) and *extraversion* (negative). Their *risk-readiness* also relates to *openness*. In psychology students, *rationality* correlates with *conscientiousness* (same with doctors) and negatively with *openness*; *risk-readiness* links to all factors of the Big-Five except for *conscientiousness*; *TU* correlates with *risk-readiness*.

Study 2. Discussion

We established the existence of differences in the *self-esteem of riskiness* between professionals and students (the student groups have no difference between them). The lower *self-esteem of riskiness* of the doctors may be connected to their higher degree of caution, and the fact that the doctors' group is older in general.

The *self-esteem of riskiness* demonstrates the diverse structure of connections among the different groups. A doctor's self-esteem relates only to personal *risk-readiness*, but among students of both professions, it links to intolerance for uncertainty, extraversion, and openness. We can assume that criteria for self-assessment may vary. The lack of connections of *self-esteem* with other variables may indicate that participants base their *self-esteem* on their self-concept, and also have a more differentiated interpretation of willingness to take risks as a trait.

All groups show a correlation between *self-esteem of riskiness* and the IT *conscious choice*. This relationship suggests that this IT corresponds with the general criterion of risk: doctors and students see riskiness as an intentional violation of norms. Doctors differentiate themselves from the other groups by their link between *self-esteem of riskiness* and ITR *acquisition of value*, which represent risk as a "trial of fate" and the source of rewards. This representation points to the role of risk-taking in fateful decisions, an essential aspect of medical professional activity, which has to deal with issues of life or death.

We establish the differences in *risk-readiness* (medical students are more risk-ready than two other groups), *rationality* (doctors are more rational in comparison with psychology students), *conscientiousness* (doctors have higher conscientiousness), and *emotional stability* (doctors are more stable than psychology students). These results reflect the path of professionalization that medics take; they have to overcome their risk-readiness. Thereby, we can assume that a medic's professionalization implies the additional differentiation of personality traits that allow them to control their actions better. This control is vital because of the high cost of risk in the medical profession. This assumption also explains the shift from the positive interpretations of risk towards more "serious" ones (like the lack of rationality or the value aspect of risk).

We haven't found any difference between doctors and students in their *TU-ITU*; this confirms the idea that high *TU* is a selection (and self-selection) criterion for the medical profession (Geller, 2013).

Doctors have higher rationality and lower risk-readiness in comparison with students. This shows that we need to differentiate between cognitive assessment processes and risk acceptance in professionalization. Study 1 showed that doctors have higher rationality in comparison with other professional groups. The results of Study 2 indicate that medical students haven't mastered the ability to maximize their search for information in DM. At the same time, the *rationality* of doctors has a tight association with the personal factors of *conscientiousness* and *emotional stability*, and no connection to *TU-ITU*, unlike the student groups.

Study 2. Conclusion

A doctor's *self-esteem of riskiness* associates only with *risk-readiness* and the *ITR acquisition of value*, but student groups demonstrate various connections between different personality traits and ITs. Thus, risk self-awareness in the student group tends to be less differentiated compared to that of the professionals. Various ITRs also correlate with each other in the student groups. Altogether this can be evidence of the greater integration of the multilevel processes associated with cognitive-personal regulation of DM under conditions of risk and uncertainty in this group.

ITs are the result of learning experiences. Therefore, a doctor's development follows the path of differentiation, specification, and the separation of implicit perceptions of risk from each other. At the same time, the *ITR pleasure* is reduced during professionalization and loses its connection with different traits. This suggests a transition from a positive interpretation of risk, to one seeing it as a threat, over the course of doctors' professional development.

Study 3. Relationships Between the Personal Characteristics of Doctors and Realtors and their Medical Risk Assessments

Study 3. Overview

On the one hand, risk perception and readiness to take on tasks have a multi-level structure. On the other hand, we have to take into account the base knowledge that doctors use when making a decision. This requires us to use some special measurements of medical risk: the Medical Risk Scale (MRS) and the Cognitive Representations of Risk (CRR) questionnaire.

The CRR Questionnaire reflects different aspects of professional and non-specific risks, and the MRS consists of verbal tasks (vignettes) based on medical practice. Both specify specific risk sources and alternative ways of reducing risk (the control group makes its decisions as if they were medics).

Study 3 has two goals. The first is to establish the links between the conscious aspects of risk perception (rated in the CRR) and verbal choice preferences (measured by the MRS); and the second is to study the relationships between a direct risk assessment (shown in CRR), and the attitude towards it in verbal tasks, as shown in the MRS and ITRs.

In this study, we tested the following hypothesis: cognitive representations of risk correlate with professional verbal choice preferences; ITRs are also included in the regulation of choice (and correlate with MRS).

Realtors were chosen to be a control group, because they also have to take risks involving other people, although those risks concern their financial state. We have discussed the psychological profile of realtors, their motivation, and personal self-regulation in our previous work (Kulagina & Kornilova, 2005).

Study 3. Methods

Participants

110 people participated in Study 3:

- 66 doctors (29 men and 37 women); ages ranged from 24 to 73 years old (M = 41.0, SD = 12.5); and
- 44 realtors (8 men and 36 women); ages ranged from 21 to 71 years old (M = 45.6, SD = 9.3).

Procedure

Questionnaires

1. The Medical Risk Scale (MRS) was developed to assess medical risk representation and methods for risk reduction. This questionnaire includes 10 verbal tasks (vignettes) created based on interviews with doctors; these vignettes describe different risk situations from within medical practice. Each case has to do with one of the following sources of risk: lack of skills; lack of knowledge; the patient's state of health; the patient's psychology; the lack of equipment; the personality and condition of the doctor; actions of the management; actions of colleagues; imperfections of medicine as a science; the risk of incorrect assessment of the situation; and timing. Participants assessed the riskiness of each situation using a 5-point Likert scale and then chose one of the ways to reduce this risk.
2. The Cognitive Representations of Risk questionnaire (CRR, see *Appendix 5*) is a list of 21 risks (identified in the qualitative analysis of interviews with doctors). The list consists of both professional medical risks (*i.e.*, "lose a patient") and non-specific risks (*i.e.*, "ruin relations with superiors"). Participants are asked to assess risks by seven aspects: 1) riskiness of the situation; 2) its predictability; 3) the likelihood of its occurrence in general and 4) in their practice; 5) the intensity of their experience (emotion); and the probability of a 6) positive and 7) negative outcome.

We also used the Personal Factors of Decision-Making Questionnaire (LFR), the S. Budner Questionnaire, ITR, TIPI, and the Self-esteem of Riskiness (see descriptions in Study 1 and 2).

Study 3. Results

We established the discrepancies between the groups (see *Table 3*). The factors of the Big-Five and the CRR scales showed no significant difference between them.

Table 3
 Significant differences in Personal Factors of Decision-Making, ITR, and MSR between groups of doctors and realtors (Student's T-test)

		t	p	M _{doctors}	M _{realtors}
	Risk-readiness (LFR)	-4.653	.001	-.54	2.51
ITR	Lack of rationality	2.655	.009	22.86	20.60
	Acquisition of value	3.468	.001	18.91	16.57
	Gain or loss	1.881	.063	25.91	23.93
MRS	Average risk	3.673	.000	2.84	2.34
	Average riskiness when finding information	-2.996	.004	2.96	3.44
	Average riskiness when delegating decision	-3.414	.001	2.33	3.16
	Average riskiness when following intuition	-2.615	.011	2.41	3.06

Doctors and realtors do not differ in their *TU-ITU* and *rationality*, but doctors have lower *risk-readiness* in comparison with realtors (similar results obtained in Study 1 and 2).

The two groups demonstrate differences in ITR: doctors see risk more as a *lack of rationality*, a way to *acquire value*, and *gain or loss*.

At the same time, doctors tend to perceive the vignettes of MRS as *riskier*, and they also prefer to follow *intuition* and *delegate* decisions in more dangerous situations, and to find additional *information* in safer cases.

Correlation analysis (see Table 3 in Appendix) shows the relationship between variables. Doctors and realtors both show the link between *TU* and *risk-readiness* ($p = .020$ and $.014$ respectively), but the realtors' *TU* also relates to *risk-readiness* ($p = .021$). The *ITU* of doctors negatively links to *risk-readiness* and positively to *rationality* ($p = .027$). Therefore, more rational and less risk-ready doctors tend to seek clarity. At the same time, the *self-esteem of riskiness* in both groups correlates with *risk-readiness* ($p = .003, .005$), but only in the case of doctors does it link to *ITU* ($p = .028$); for realtors it negatively connects to *rationality* ($p = .007$). Medics also show a positive connection between *risk-readiness* and *extraversion* ($p = .010$).

TU-ITU does not correlate with the Big-Five, but *conscientiousness* positively relates to *rationality* in groups of doctors and realtors ($p = .001$ and $.013$ respectively). *Emotional stability* links to *rationality* in doctors ($p = .003$), and negatively to *risk-readiness* in realtors ($p = .010$).

Table 4 in the Appendix shows correlations between the different scales of cognitive representations of risk. According to our results, doctors are characterized as having more integrated risk assessments when choosing to *find information*, *postpone decisions*, *delegate decisions*, *follow standards*, and *use intuition*. The control group does not show correlations between these parameters.

A similar pattern is shown for the Cognitive Representations of Risk questionnaire findings. Doctors' risk characteristics are more related to each other than those of the realtors.

Finally, the ITRs show more correlations in doctors as well.

Study 3. Discussion

The results allow us to support the hypothesis that ITRs and Cognitive Representations both play a role in regulating DM.

Doctors not only show less *risk-readiness*, but also exhibit a diverse representation of risk in the form of *ITRs*. They see risk primarily as a prerequisite for loss or gain, as a lack of rationality, and a way to achieve higher value (the latter is characteristic of doctors with a high self-assessment of riskiness). Realtors with high *self-esteem of riskiness* are the ones who think a negative outcome is unlikely, and have *ITR conscious choice*.

Correlation analysis showed that the doctors who don't attempt to clarify the situation also consider themselves willing to take risks. The willingness of realtors to take risks relates to their lesser *rationality* and *emotional stability*. Doctors also demonstrate the relationship between rationality and such factors of the Big-Five as *conscientiousness* and *emotional stability*.

The results we obtained suggest that doctors have more integrated representations of risk. At the same time, they also demonstrate more links between different cognitive representations of risk, in particular in their assessment of predictability and probability. This shows that doctors tend to distort the probability estimates of medical risks (Kahneman et al., 1982; Operskalski, Barbey, 2016). Cognitive psychologists tend to consider these characteristics of DM as a cognitive distortion, but we showed that they are a part of the doctor's cognitive representation of risk. Earlier, we assumed that a medic's tendency to over-examine patients reflected their pursuit of full orientation in the situation before him/her (Bogacheva et al., 2017).

Study 3. Conclusion

According to our results, doctors differ from realtors not only in their traits (they are less prone to take risks), but also in their choices and greater integration of CRR.

Personal risk-readiness correlates with the self-esteem of riskiness, and it allows us to consider risk readiness as an integral part of self-concept. The relationships between risk-readiness and ITR as a value, and risk as a conscious choice, allow us to consider ITs as part of the "existential" level of self-awareness.

General Conclusion

1. In general, the results of our three studies demonstrate the multilevel processes behind the personality traits of willingness to take risks and risk acceptance, as well as the relationship between these multilevel characteristics and doctors' assessments of medical risks and their preferences in risky DM.
2. The study established the differences in the motivational profile of doctors (in comparison with paramedics and investigators). At the same time, the different types of motivation in doctors were shown not to be associated with conscious self-regulation (by risk and rationality scales).
3. Risk readiness positively relates to TU (for medical groups and control groups) and with the self-esteem of riskiness.

4. Doctors' self-esteem of riskiness is significantly lower than that among medical students and psychology students; their self-esteem of riskiness also differs in relationships with other personality variables.
5. The comparison of two new medical risk measurements showed that doctors who underestimate the likelihood of a positive outcome see risk as a challenge; the risk is seen as a loss or gain by those who tend to assess a situation as risky, and assume higher predictability and probability of risks in general.
6. Components of different levels of risk representation (from conscious direct assessments to implicit ideas) relate to the ways a person chooses to reduce risk in verbal tasks; at the same time, the intra-level connections are more integrated than inter-level ones.

Limitations

Our samples were not balanced by age and gender, due to the real-life ratio of men and women in different medical specialties; the age differences between students and practitioners were evident as well. These factors can limit our capability of reaching broader conclusions and could have obscured some less noticeable results as well. In the future research, it would be interesting to compare representations of risk in medical professionals of different specialties, and include residents as one of the comparison groups, in order to further understand the dynamics of representations of risk and risk-related personality traits through the process of professionalization of medical doctors.

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Appendix 2: Table 2

Table 2

Correlations between implicit theories of risk, personal decision-making factors, Big Five factors and self-assessments of riskiness in doctors and medical students (Spearman's ρ)

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.
1. Impossibility of prediction	1	-.211	.352**	.241	.266*	.076	.207	.088	.061	-.075	.093	.277*	.073	-.094	.127	.093	-.109
2. Conscious choice	.106	1	-.083	-.355**	-.109	-.151	-.045	-.076	-.190	.380**	-.200	-.007	-.048	.036	-.155	.303*	.232
3. Risk as a challenge	.211*	.177	1	.201	.295*	.018	.321**	.062	.055	-.023	.131	.194	.047	.135	-.024	.186	.005
4. Lack of rationality	.325**	-.197	.187	1	.387**	.511**	.113	.106	.267*	-.121	.363**	.018	-.163	.087	.224	-.016	.067
5. Acquisition of Values	.398**	.058	.286**	.410**	1	.497**	.284*	.262*	.292*	.230	.205	.321**	-.219	-.109	.064	.116	.292*
6. Loss or gain	.188	.033	.183	.262*	.485**	1	.177	.138	.154	.147	.023	.134	-.248*	-.079	.007	-.187	.122
7. Pleasure	.286**	.343**	.450**	.190	.362**	.214*	1	.303*	.152	.200	.146	.334**	.091	-.178	.024	.162	.028
8. TU	.032	.275*	.139	.034	-.001	.020	.160	1	-.066	.184	.004	.123	-.096	-.222	-.127	.127	.006
9. ITU	.122	-.363**	-.150	.266*	.146	.143	-.331**	-.104	1	-.219	.220	-.113	-.042	.118	.173	-.157	-.163
10. Risk-readiness	.002	.238*	.168	-.091	.059	.083	.226*	.130	-.390**	1	-.278*	.316*	-.212	-.221	-.235	.237	.363**
11. Rationality	.279**	-.140	.187	.127	.039	.029	-.015	.074	.403**	-.240*	1	.027	.022	.415**	.368**	.157	-.013
12. Extraversion	-.017	.194	.264*	.069	.132	.255*	.342**	.165	-.393**	.503**	-.321**	1	.040	-.113	-.139	.227	.075
13. Agreeableness	-.008	-.170	.008	-.026	-.066	-.118	-.026	.041	-.002	.069	-.080	-.057	1	.044	.210	-.009	-.185
14. Conscientiousness	-.169	.020	.304**	-.058	-.193	-.054	-.225*	.000	.077	.100	.113	.040	-.014	1	.136	.215	.127
15. Emotional stability	.012	-.037	.058	-.061	-.243*	-.157	.024	.078	-.147	.050	.023	-.107	.230*	.083	1	.027	.127
16. Openness	.014	.129	.188	-.096	.167	.072	.242*	.273*	-.306**	.264*	-.092	.179	.126	.093	.023	1	.163
17. Self-esteem of riskiness	.304**	.161	-.078	.121	.163	.163	.194	.212	-.356**	.289**	-.191	.256*	-.027	-.019	-.009	.283**	1

Medical students

*Note. * - p < .05; ** - p < .01. Doctors are above the diagonal (n = 65), medical students are under the diagonal (n = 125).*

Appendix 3: Table 3

Table 3

Correlations between TU-ITU, personal decision-making factors, Big Five factors, and self-assessments of riskiness in doctors and realtors (Spearman's ρ)

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	
Budner	1. TU	1	-.060	.287*	-.052	.145	-.116	-.186	-.019	.233	.159
	2. ITU	.061	1	-.294*	.274*	-.119	-.014	.082	.089	-.230	-.275*
LFR	3. Risk-readiness	.453*	.052	1	-.278*	.316*	-.212	-.221	-.235	.237	.363**
	4. Rationality	-.401*	-.007	-.387*	1	.027	.022	.415**	.368**	.157	-.013
TIPI	5. Extraversion	.349	.096	.197	-.206	1	.040	-.113	-.139	.227	.075
	6. Agreeableness	.194	.108	.138	-.079	-.089	1	.044	.210	-.009	-.185
	7. Conscientiousness	-.250	-.010	.034	.396*	-.193	.160	1	.136	.215	.127
	8. Emotional stability	-.126	-.093	-.329*	.187	-.121	.043	.151	1	.027	.127
	9. Openness	.176	-.241	.008	.214	.197	-.042	.114	.003	1	.163
	10. Self-esteem of riskiness	.045	-.086	.443**	-.423**	.174	-.252	-.261	-.352*	-.082	1
		Realtors									

Note. * $p < .05$, ** $p < .01$. Doctors are above the diagonal; realtors are under the diagonal.

Appendix 4: Table 4

Table 4

Correlations of cognitive representations factors (Spearman's ρ)

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
1. TU (Budner Questionary)	1	-.060	.287*	-.052	.145	-.116	-.186	-.019	.233	.159
2. ITU (Budner Questionary)	.061	1	-.294*	.274*	-.119	-.014	.082	.089	-.230	-.275*
3. Risk-readiness (LFR)	.453*	.052	1	-.278*	.316*	-.212	-.221	-.235	.237	.363**
4. Rationality (LFR)	-.401*	-.007	-.387*	1	.027	.022	.415**	.368**	.157	-.013
5. Extraversion (TIPI)	.349	.096	.197	-.206	1	.040	-.113	-.139	.227	.075
6. Agreeableness (TIPI)	.194	.108	.138	-.079	-.089	1	.044	.210	-.009	-.185
7. Conscientiousness (TIPI)	-.250	-.010	.034	.396*	-.193	.160	1	.136	.215	.127
8. Emotional stability (TIPI)	-.126	-.093	-.329*	.187	-.121	.043	.151	1	.027	.127
9. Openness (TIPI)	.176	-.241	.008	.214	.197	-.042	.114	.003	1	.163
10. Self-esteem of riskiness	.045	-.086	.443**	-.423**	.174	-.252	-.261	-.352*	-.082	1
	Realtors									

Note. * $p < .05$, ** $p < .01$. Doctors are above the diagonal, realtors are under the diagonal. Avrg – average.

Appendix 5: Cognitive Risk Representations Questionnaire (CRR)

You are given a list of risks that may occur in your activity. Please read each question carefully and evaluate each risk as a percentage by putting the number in the appropriate box.

- How risky does this situation seem to you?

- | | | |
|--|--|---|
| 1. Get a penalty
_____% | 2. Misjudge the situation
_____% | 3. Spoil relations with superiors
_____% |
| 7. Lose your self-esteem
_____% | 8. Overestimate yourself
_____% | 9. Psychological overload
_____% |
| 13. Spend little time with relatives
_____% | 14. Spoil your reputation
_____% | 15. Break your health
_____% |
| 4. Fall from a height
_____% | 5. Become a victim of aggression
_____% | 6. Waste time
_____% |
| 10. Equipment failure
_____% | 11. Make a procedural mistake
_____% | 12. Be sued
_____% |
| 16. Quarrel with colleagues
_____% | 17. Difficult weather conditions
_____% | |