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The Impact of Environmental Factors on Families with Disabilities as an Object of Structural Modeling

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Abstract:

This article examines the socio-economic situation of families with children with disabilities, who are considered vulnerable social groups in global social policy. The purpose of the paper is to assess the set of constraints faced by families with children with disabilities in Kazakhstan and the factors, including environmental factors, that have a significant impact on them. The authors use a sociological survey of respondents in five regions of Kazakhstan and subsequently process the results using statistical methods. The survey is based on a methodological approach based on the identification of four types of constraints: direct costs, indirect losses/costs, assessment of the ability to find a job, and assessment of the ability to maintain a parent's health. The authors conduct structural modeling using the PLS-PM model, in which four types of constraints are set as dependent variables. The model allowed eight hypotheses to be confirmed, of which six identify significant factors and the other two reflect the relationships among the dependent variables in the model.

Keywords: environment; families with disabled children; a PLS-PM model; direct costs; indirect losses; employment opportunity; possibility of health support for a parent.

JEL Classification: Q56, Q57.

Introduction

Households with children with disabilities have been singled out as an object of research in terms of demographic, social, and economic parameters since the 1970s.

The environmental conditions of the country, their changes, today should be considered not only as a source of increasingly frequent natural disasters, but also as a reflection of negative changes occurring in the environment and damaging the living conditions of the population, its health, the operation of enterprises, transport, etc. There is considerable uncertainty in the quantitative estimates of how expected climate change will proceed in the future and what impact they will have on ecosystems, economic activity and social processes in different countries and regions. Both positive and negative consequences are possible, depending on the level of development of the region and its climatic affiliation. Unfortunately, the accuracy of existing climate forecasts is not high today. None of the models can model the climate in full.

The World Health Organization's International Classification of Functioning, Disability and Health recognizes that environmental factors affect the well-being and participation in life of children with disabilities (Phoenix *et al.* 2021).

1. Literature Review

According to Chiara Salvatore, Gregor Wolbring (2021), children and youth with disabilities are disproportionately affected by environmental issues and environmental activism.

Emphasizing the importance of such environmental factors, Simplican S.C. (2018) identified interpersonal relationships and social participation as two vital areas that are vital for social integration.

In the past few years, many studies have focused on the impact of early or infancy exposure to environmental pollutants as predictors of future health outcomes (Mastorci *et al.* 2021).

Protection and prevention of health from diseases caused by environmental pollutants are the ultimate goals in human risk assessment and risk management. Typically, these areas of activity focus on adult exposure, with the development and implementation of more innovative risk assessment methodologies (Lanzoni *et al.* 2019). On the contrary, little attention is paid to the embryonic and fetal periods and childhood, although many diseases in later life caused by toxic agents find their origin in these time periods. In this regard, it is incorrect to consider children or adolescents as small adults, but rather as a sensitive target population in which biological systems develop and restructure (Patton *et al.* 2020). In particular, the metabolic processes of absorption and elimination of pollutants from the environment in children are slower than in adults, which makes them more susceptible to the consequences of diseases after even small doses (Ferguson *et al.* 2017). In addition, children's daily crawling activity increases hand-to-mouth swallowing, making them more vulnerable to contact with certain chemicals.

Based on the research conducted by foreign scientists, the consequences of climate change will be as follows:

▪ indirect (for example, disturbance of ecosystems, air pollution and change in the structure of disease vectors);

▪ and direct (*e.g.* droughts, floods, forest fires, rising temperatures) impacts on human health, especially on vulnerable groups such as children (Helldén *et al.* 2021). How these factors influence physical activity in children with disabilities has been less studied. Indeed, children's health is not given priority in policy development at the level required for harm reduction. Therefore, many scientists have concluded that in the coming years, children will experience a high burden of morbidity and mortality due to climate change.

Thus, climate change can have a detrimental effect on the health and well-being of children.

Gradually, scientists followed by practitioners have started confirming the opinion that the birth of such a child affects financial, social, psychological and other resources of the family. In such families, parents often opt for non-standard forms of employment, deterioration of their career opportunities, high costs for maintaining the physiological and mental health of family members. The social policy of the state is beginning to highlight a special type of household identified as a "family with disabilities" (Glidden 2017).

According to the latest WHO estimates, back in 2011, the proportion of children with moderate or severe disabilities in the group of children under 14 years in the world was 93 million or 5.1% (World report on disability). A whole multitude of studies show a dispersion from 0.4% to 12.7% as the actual recognition of disability based on national criteria may differ significantly in different countries (Maulik and Darmstadt 2017; Hartley and Newton 2019; Official resource of CIS). In 2020, Kazakhstan statistics sets the proportion of such children at 1.5% and the value tends to increase (National Statistic Agency).

Scientific and statistical surveys are now conducted quite regularly and note that, despite significant positive changes in household support, households with disabled children remain in a high instability zone (Penne *et al.* 2020, Cullinan *et al.* 2021, Mitra 2017).

With a high degree of reliability, one can argue that during the two decades of the 21st century, these families face the following difficulties in life support:

▪ Poverty due to limited family resources. Reasons include more frequent divorces compared to ordinary families (Daly and Grace 2018; La Placa and Corlyon 2018).

▪ Unemployment, underemployment or low-paid employment. Both parents and children with disabilities after reaching working age are more likely to face constraints in finding permanent jobs (Loprest and Davidoff, 2017), (Bulletin of children with disability).

▪ Parental stress and declining health. In families with disabled children, parental stress is recorded more often while also burdened with financial and situational issues. On average, the state of parental health in a family with disabilities is assessed worse than for ordinary families (Daly 2020; Family policy of EU).

Consequences of the limitations of the family's capabilities due to the birth of a disabled child affect its well-being understood quite broadly, as not just its financial resources, but also social and psychological resources, the state of health and self-realization of all family members (Rimmerman 2018; Giulio *et al.* 2017).

Restraints for a family with a disabled child include the following:

1.Direct expenses related to the child's disability. These include medical, psychological, educational and other expenses, *e.g.*, transportation, which may be required for the child and for which the parents will have to pay. The volume of services required is related to the type of disability and its severity. The availability of services is affected by their price, family income and benefits (including allowances). Associated with direct costs are the costs of ensuring the housing and placement of equipment for therapy (Stabile and Allin 2017; Okon *et al.* 2019; Lukemeyer *et al.* 2020; Bourke-Taylor *et al.* 2018).

2.Indirect costs, or, more correctly, losses are incurred by parents due to the inability to maintain full-time employment and health, which they would have had with a child without developmental limitations (Coleridge 2017; Anderson 2018; Olsson and Hwang 2017).

3.Possibility of realizing the potential of family members (both parents and child) in employment (Lindqvist 2020; Chaplinskaja 2018).

4.Declining parental health associated with a complex of issues that arise after the birth of a child with a disability (Emerson 2017; Temirbayeva 2020).

Since the range of issues for a family with disabled children is quite large, modern countries provide them with a whole range of interrelated measures to compensate, neutralize or prevent restrictions (these can be considered as risky situations).

The novelty of our research is in the fact that we have adapted the international methodology to the conditions of Kazakhstan and, based on the PLS structural model, have identified the factors that have the greatest impact on limitations for families with disabled children (direct costs for a child, indirect losses due to a reduction in income, ability to stay healthy, possibility of parental employment.) This has allowed to draw conclusions about the socio-economic situation of families and their assessment of the current support system in Kazakhstan.

2. Methodology

To analyze the results of an empirical study, we used the SmartPLS model, which enables testing the hypotheses about relationship and mutual influence of variables. The advantage of this model is in its ability to assess not just the influence of factors on dependent variables, but also the influence of dependent variables on each other. As dependent variables, we have considered the family's direct costs for the needs of a child with a disability, indirect losses, the opportunity to work, and the opportunity to maintain health of the family member who babysits the most. The model has enabled identification of the most significant dependencies and description of latent connections affecting the socio-economic situation of the family and the ability of its members to realize their human potential.

Since the factors affecting children's health and well-being are complex and cross-sectoral, comprehensive measures are needed to improve children's health and, therefore, achieve the Sustainable Development Goals, as the number of children with disabilities increases every year, where this is most evident in regions such as Almaty, Karaganda, Turkestan, Nur-Sultan (Table 1).

The practice of recent years shows that the number of families raising children with disabilities at home is increasing. The difficulties that a family with a problem child constantly experiences are significantly different from the daily worries that a family raising a normally developing child lives with.

According to Turlubekova M.B. (2021) there is a need to study the inclusion of different categories of children at the level of preschool education, since the education and upbringing of children begins long before school. When developing the conditions for inclusive education, it is necessary to take into account the violations and peculiarities of the distribution of children with disabilities (Table 2).

Table 1 - Number of children with disabilities

Region	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Republic of Kazakhstan	148652	138513	141952	141821	144783	147396	153230	161156	161 826	162886
Akmola	6 089	6 373	6 845	6 932	6 741	6 848	7 416	10 652	9 788	9 801
Aktuibinsk	4 815	5 124	5 169	5 234	5 410	5 729	5 884	6 344	5 902	5 976
Almaty	9 767	9 222	10 061	9 966	10 527	11 085	11 914	13 255	14 579	14 892
Atyrau	5 312	4 754	4 604	4 507	4 003	4 300	4 701	5 587	5 257	5 327
East Kazakhstan	12 322	11 369	12 651	13 914	15 208	14 901	14 998	15 733	15 528	15 634
Zhambyl	7 174	7 324	7 474	7 630	7 750	7 895	7 911	7 961	7 944	7 975
West Kazakhstan	7 298	6 487	6 091	6 156	6 032	6 025	5 922	5 967	5 893	5 891
Karaganda	13 484	11 120	11 035	10 808	8 904	8 987	11 183	11 672	12 879	12 957
Kostanay	13 170	11 693	11 373	11 103	10 904	10 777	10 779	10 159	9 668	9 692
Kyzylorda	4 365	3 958	4 367	4 903	5 467	6 218	5 888	5 739	5 758	5 789
Mangistau	3 005	3 009	3 353	3 885	4 338	4 968	5 485	6 175	6 482	6 503
Pavlodar	6 161	6 302	6 342	4 685	6 228	6 452	6 630	6 832	6 675	6 717
North Kazakhstan	5 100	4 574	4 605	4 638	4 736	4 521	4 332	4 150	4 060	4 123
Turkestan**	35 819	33 445	32 415	30 023	28 362	28 661	20 051	19 149	19 475	19 497
Shymkent city	-	-	-	-	-	-	8 709	9 429	11 239	11 298
Nur-Sultan city	6 228	7 125	7 927	8 504	9 297	7 874	7 557	9 065	11 453	11 497

Source: compiled by authors according to www.stat.gov.kz

Table 2 - Peculiarities of distribution of children with disabilities, (persons)

Indicator	Total	Including		Of them by age, years			
		boys	girls	before 7 years	7-13 years	14-15 years	16-17 years
Total number of children surveyed	9149	5141	4088	2174	4937	1299	739
of the total number of children surveyed have the following disorders:							
musculoskeletal system	3072	1708	1364	889	1588	395	200
vision	1222	682	540	286	657	184	95
hearing	903	512	391	190	503	134	76
speech	1889	1104	785	534	980	237	138
intellectual development	2214	1328	886	545	1174	319	192
mental condition	2109	1240	869	424	1174	319	192
somatic (impaired functions of internal organs)	2506	1363	1143	582	1353	360	211

Source: compiled by authors according to https://bala.stat.gov.kz/

The existing practice of socialization of children with special educational needs at the moment in Kazakhstan is not sufficiently developed. This weakens the social position of the child and exacerbates his unequal social status.

As a result of the birth of a child with developmental disabilities, relationships within the family, as well as contacts with the surrounding society, are distorted. The causes of violations are associated with the psychological characteristics of a sick child, as well as with the enormous emotional burden that members of his family bear due to long-term stress. Many parents find themselves helpless in this situation. Their situation can be characterized as an internal (psychological) and external (social) impasse.

3. Application Functionality

Based on survey results obtained using SmartPLS, we have constructed a structural model based on variance using the method of partial least squares modeling. The model demonstrates numerical expression of relationships between variables (Figure 1).

Figure 1. Structural Model
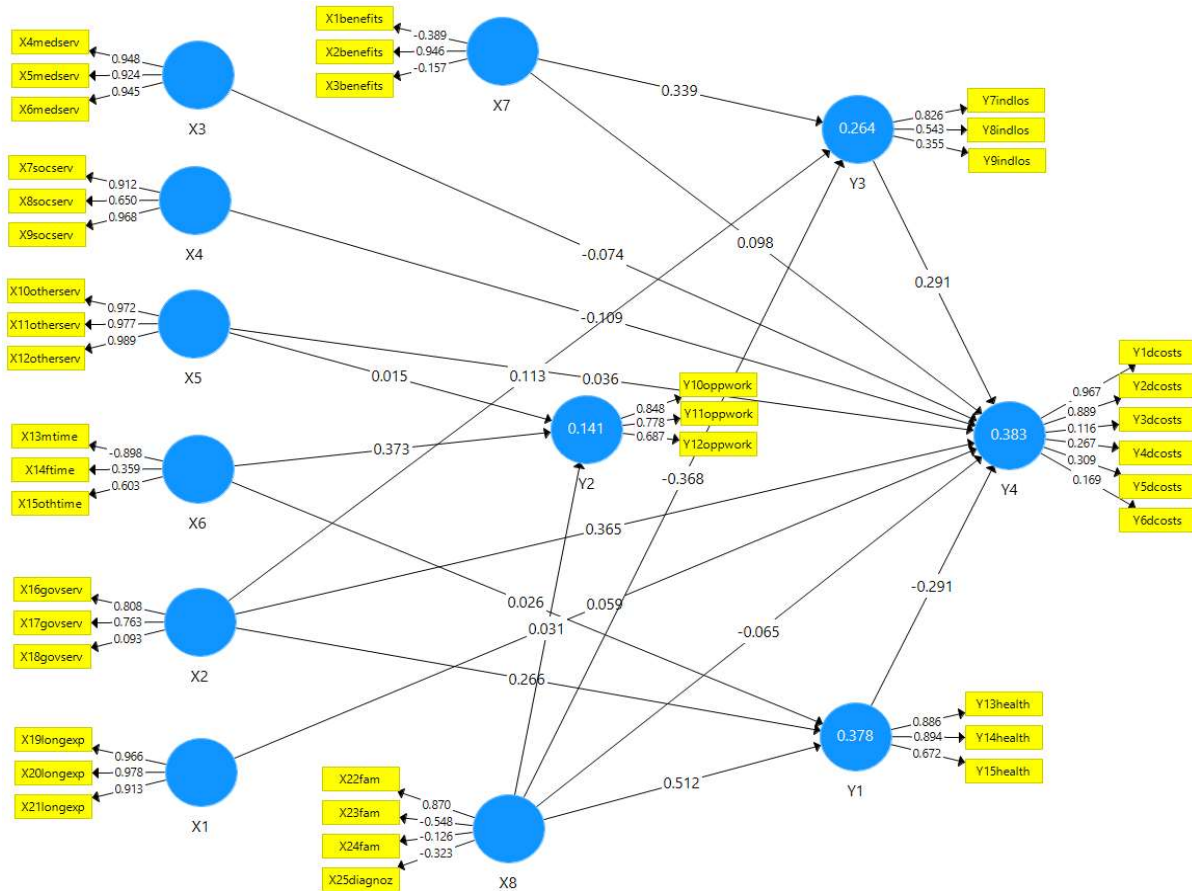
Source: Compiled based on an analysis of the sociological survey data using SmartPLS

The following designations were used for the model parameters (Table 3).

Table 3. Legend

Variables	Legend
The ability to stay healthy	Y1
Opportunity to work	Y2
Long-term family expenses per child	X1
Additional government free of charge family services	X2
Accessibility of health care for children	X3
Accessibility of social services for children	X4
Other services for the child	X5
Spending time of family members for the child care	X6
Indirect family losses	Y3
Allowances	X7
Direct costs for a child	Y4
Family characteristics	X8

Source: compiled by authors

Model testing.

The process of assessing the resulting model consists of two stages:

1) Validation of the measurement model.

2) Testing the structural model

The first step consists in *Confirmatory Factor Analysis*, the second is implemented through *Path* analysis.

Stage 1.

1.1 Assessment of the coefficients of the model indicators for validity shows acceptable indicators of the quality of compliance with the model, since most of them have values above 0.7 (Figure 1). This confirms the correlation between the indicators of latent variables.

The following indicators were an exception:

X14ftime (0.359). Since out of all the family members, the father had practically no recorded time spent on caring for the child;

X18govserv (0.093). "Other" additional free services for the family were practically non-existent (except for a small number of "the opportunity to take an additional unpaid leave");

X3benefits (-0.157). A small number of families with three or more allowances related to a child's disability;

X23fam (-0.548), X25diagnoz (0.323). Heterogeneous characteristics in families (number of children in the family; child's diagnosis);

Y3dcosts (0.116), Y4dcosts (0.267), Y5dcosts (0.309), Y6dcosts (0.169). Low values here are associated with extremely high heterogeneity of costs for families (for psychological, educational, additional developmental, and other related services) in relation to the average monthly income of the family;

Y8indlos (0.355), Y9indlos (0.543). Heterogeneous expenses for medical leave and treatment services for family members, including the child's stay outside the family for this period.

1.2 Next, we have checked the internal consistency of the test questions using Cronbach's alpha (Table 4).

Table 4. Reliability and validity coefficients

Indicator	Cronbach's alpha	rho_A	Composite Reliability (CR)	Average Variance Extracted (AVE)
The ability to stay healthy	0.756	0.790	0.862	0.678
Opportunity to work	0.683	0.708	0.816	0.598
Long-term family expenses per child	0.950	0.976	0.967	0.908
Additional government free of charge family services	0.276	0.391	0.612	0.515
Accessibility of health care for children	0.938	1.033	0.957	0.882
Accessibility of social services for children	0.857	1.151	0.888	0.730
Other services for the child	0.979	1.017	0.986	0.959
Spending time of family members for the child care	0.998	0.456	0.508	0.508
Indirect family losses	0.602	0.175	0.610	0.511
Allowances	0.570	0.692	0.511	0.457
Direct costs for a child	0.599	0.855	0.645	0.422
Family characteristics	0.567	0.145	0.518	0.394

Source: compiled by authors

Cronbach's alpha serves as a homogeneity (internal consistency) rate of the indicator assessment.

Coefficient scale is as follows: low (0.5); satisfactory (0.6); good (0.7); very good (0.8) and high (0.9).

Table 2 shows a sufficiently high level of internal consistency of the test elements and their influence on factors. The exceptions are the following factors: "Additional government free of charge family services," "Family characteristics," "Allowances." This is explained by excessive polarization of values and, conversely, their excessive similarity. Accordingly, almost half of the respondents do not have an officially recognized child disability, which entitles them to receive allowances. Families who receive allowances have two at once. There is no provision for three allowances for the family related to the child's disability.

Generally, Cronbach's alpha shows high values, which indicates an acceptable validity statistic.

The average variance extracted (AVE) is the variance of the indicator elements. AVE should be 0.5 or higher, but less than the cumulative reliability (CR). That is, a variance explained by the design should be higher than both measurement error and cross-loads. Since AVE and the corresponding confidence coefficients are based on factor loads, their values vary depending on the factor model. AVE for a factor or hidden variable should also be higher than its correlation square with any other factor or hidden variable.

CR is the coefficient of structural reliability (Composite Reliability) that determines the overall reliability of the structure. It is calculated using the square of the sum of the standardized factor loads and the sum of the error variance. It values in the range between 0 and 1. A coefficient equal to 1 corresponds to absolute reliability. Threshold CR values: suitable for exploratory studies (0.6), suitable for confirmatory studies (0.7), good reliability for confirmatory studies (0.8 or higher). CR must exceed the AVE value.

1.3 Collinearity check.

Collinearity implies a linear relationship between independent variables of the model. Closely related factors are deduced from the model because they violate the condition of independence between explanatory variables. The remaining factor is the one that, with a sufficiently close connection with the result, has the least close connection with other factors.

Table 5 shows the obtained collinearity statistics. Detection of multicollinearity involves usage of the VIF. The maximum allowable value for this indicator is 5 and the minimum threshold is 0.2.

Table 5. Collinearity Statistics (VIF)

Indicator	The ability to stay healthy	Opportunity to work	Indirect family losses	Direct costs for a child
The ability to stay healthy				1.923
Opportunity to work				
Long-term family expenses per child				1.395
Additional government free of charge family services	1.102		1.052	1.221
Accessibility of health care for children				1.513
Accessibility of social services for children				1.312
Other services for the child		1.039		1.557
Spending time of family members for the childcare	1.067	1.000		
Indirect family losses				1.443
Allowances			1.019	1.215
Direct costs for a child				
Family characteristics	1.035	1.039	1.036	1.684

Source: compiled by authors

The data in Table 3 are in the acceptable range of values, which indicates the absence of multicollinearity between the variables.

1.4 Coefficient of determination.

Multiple correlation squared is the fraction of the variance of a dependent variable explained by the model under study (by independent variables). The R-square is in the range between 0 and 1. Dependence between dependent and independent variables increases with the approximation of the coefficient to one. In regression models, this is interpreted as the correspondence of the model to the data.

R Square Adjusted is the adjusted coefficient of determination. It is used to compare models with a different number of factors in such a way that the number of factors does not affect the R Square statistics.

The correlation coefficient obtained in the model for the variable "Direct costs for a child" is 0.383, that is, the model explains about 40% of the variance of this construction (Table 6).

Table 6. Quality Criteria (R Square)

Indicator	R Square	R Square Adjusted
The ability to stay healthy	0.378	0.365
Opportunity to work	0.141	0.123
Indirect family losses	0.264	0.249
Direct costs for a child	0.383	0.343

Source: compiled by authors

2. Bootstrapping is a tool for verifying the PLS results.

Let us check the efficiency of all the obtained coefficients. To do this, we use the Bootstrapping command within SmartPLS to test the statistical significance of the analysis results. The Bootstrapping procedure initiates phased verification from simple events to complex ones and returns the result of the study. This is how we find out the significance level of the Cronbach's alpha, the R Squared values, and the reliability of the hypotheses set (see Table 7).

Table 7. Path Coefficients

Indicator	Original Sample (O)	T Statistics	P Values	Hypothesis status
The ability to stay healthy -> Direct costs for a child	-0.291	2.650	0.008	Accepted
Long-term family expenses per child -> Direct costs for a child	0.059	0.556	0.579	Rejected
Additional government free of charge family services -> The ability to stay healthy	0.266	2.374	0.018	Accepted
Additional government free of charge family -> Indirect family losses	0.113	0.574	0.566	Rejected
Additional government free of charge family -> Direct costs for a child	0.365	4.203	0.000	Accepted
Accessibility of health care -> Direct costs for a child	-0.074	0.713	0.476	Rejected
Accessibility of social services -> Direct costs for a child	-0.109	1.103	0.271	Rejected
Other services -> Opportunity to work	0.015	0.170	0.865	Rejected
Other services -> Direct costs for a child	0.036	0.372	0.710	Rejected
Spending time of family members for the child care -> The ability to stay healthy	0.026	0.288	0.774	Rejected
Spending time of family members for the child care -> Opportunity to work	0.373	1.972	0.049	Accepted
Indirect family losses -> Direct costs for a child	0.291	2.195	0.029	Accepted
Allowances -> Indirect family losses	0.339	2.404	0.017	Accepted
Allowances -> Direct costs for a child	0.098	0.967	0.334	Rejected
Family characteristics -> The ability to stay healthy	0.512	1.906	0.045	Accepted
Family characteristics -> Opportunity to work	0.031	0.279	0.780	Rejected
Family characteristics -> Indirect family losses	-0.368	1.825	0.047	Accepted
Family characteristics -> Direct costs for a child	-0.065	0.467	0.640	Rejected

Source: compiled by authors

The software tests hypotheses with T Statistics. The empirical T value is compared with the Student's tabular T criterion. Coefficient is significant if the empirical value of T exceeds the tabular value (1.96 for a significance level of 5%). P Values shows the significance of the coefficients; its value should not exceed 0.05.

We have confirmed eight hypotheses, the content of which we shall discuss in more detail below.

Let us group the accepted hypotheses by four dependent variables corresponding to four types of constraints for families with disabled children derived in the model as dependent variables.

1) *Y4: Direct costs* is the most significant dependent value with R Square of 0.383. Coefficient of determination shows that all the variables considered in this model affect direct costs by 38%. This is a quite high value, since this model considers the factors of family characteristics, its income and expenses, as well as government family services. However, since this list of factors to be adequately reflected in the model is far from being complete, the value is quite adequate. Increasing the complexity of the model, e.g., introduction of a child's disability group or parent motivation, psychological climate in the family overly complicates the model and fails to return correct results.

The overwhelming majority of the surveyed families have direct out-of-pocket costs associated with their child's disability (Y1d = 0,967). The most widespread type is the cost of healthcare (this includes massages, physical therapy, instrumentation technologies, etc.) and medication: Y2d = 0.889. The next in terms of volume and frequency of presence in the cost structure are child-development services (Y5d = 0.309) and services related to education (Y4d = 0.267.)

What is the relationship between the direct costs for a child and the accessibility of government, i.e., free services? We have divided all services into three groups: healthcare (including medications), special social (pedagogical, psychological) services, and other services recommended for a child according to an individual

rehabilitation programme (IRP). Each of the positions would be assessed using the criterion of satisfaction of the service recipient according to the following parameters: volume, quality, and conditions (mode, schedule, etc.).

On average, healthcare is within a satisfactory range (x4m-x6m) and the connection with direct costs is negative, i.e., the higher the assessment of the parameters of medical services, the lower the direct costs of the family for them, which makes sense. A similar picture is observed for social special services (x7s-x9s). The difference is that on average, both volume and mode of receiving services are lower. These connections cannot be recognized as unambiguously statistically significant; they are poorly expressed, but it is possible to record the nature of this connection as a whole (as negative or positive). Respondents note other services recommended according to the IRP (x10o-x12o) extremely rarely; they are mostly absent. Naturally, their absence increases direct costs. But since such costs are made by an insignificant number of families in the sample (about 11%), their impact on the aggregated indicator is insignificant.

What is the relationship between the direct costs for a child and the long-term costs of education and independent life of a child in the future (x19l-x21l)? Forward-looking estimates of the future costs of a child's vocational education have a weak and insignificant positive relationship with direct costs, since the overwhelming majority of parents surveyed don't tend to plan the costs of vocational education in the long term. Whilst those who do, find it difficult to accurately imagine the future problems in education for their child and hope that everything goes exactly the ordinary children's way. More confident are those who choose the answers "there is no possibility to hire tutors" (low-income families) and "we do not plan professional training," who believe that the child will not be able to receive professional training. None of the parents who assume the possibility of professional training for their child or want them to adapt to an independent life in adulthood haven't stated in their answers they are saving part of their income for future expenses for this.

What is the relationship between the allowances received by the family in connection with a child's disability (x1b-x3b) and the direct costs for a child?

The relationship is positive, although insignificant. There are two reasons for this. First, 37% of respondents state that the child does not have an official disability: either they are at the stage of registration, or with the established diagnosis of the child allowance is not provided at all. In this case, families do not receive allowances. Secondly, the allowance amount is poorly differentiated by disability groups, i.e., it does not reflect the real expenses of parents with children of more "severe" (including by costs) disability groups.

The most significant factors affecting direct costs are additional government family services (hypothesis 5; P Values = 0.000) and indirect losses (hypothesis 12; P Values = 0.029). This is confirmed using the P Values, the value of which should not exceed 0.05. Thus, two hypotheses mentioned in our model are confirmed.

Additional government family services (short-term timeout, long-term timeout, additional leave for the second family member: x16d-x18d), or rather their almost complete absence, have the greatest impact on the direct costs for a child. Since the costs of a long-term timeout service are estimated at the average monthly income or more, in the absence of this and other government services included in this block, they have the greatest impact on the family's direct costs related to the child's special needs. Since the regulatory framework does not allow simultaneous receiving of a semi-stationary service and a social teacher's service at home, by choosing the first service low-income and single-parent families actually bear, when necessary, the costs of private social workers, since they have no other option. Similar actions take place if additional leave for the second family member is unavailable due to the disability of the child.

Hypothesis 5 has an ideal value of the P Values.

Characteristic of the influence of indirect losses on direct costs (hypothesis 12) will be presented in Paragraph 2.

2) **Y3: Indirect losses** of the family associated with a reduction in income from employment of the family member babysitting the most, paid healthcare/psychological and other services for a child. This is the third most important dependent variable **R Square = 0.264**. This means that indirect losses of the family with the help of the factors included in the model determine them at 26-27%.

For indirect losses, the most significant are the loss of income of the mother (or another family member) due to suspension of work (Y7i = 0.826). Also important are the mother's expenses for her own healthcare/psychological and other services, the need for which arose in connection with raising of a disabled child; child-care leave expenses (related, among other things, to the temporary transfer of care for the child "in different hands").

We feel important to note that indirect losses have the following significant positive relationship with the allowances received (x1-x3): the higher the allowance share in the average monthly income of a family, the higher the estimate of indirect losses. This hypothesis has turned out to be one of the eight correct ones in the model in every way (hypothesis 13, P Values = 0.017).

Because this target group has a high share of low-income, and most importantly, single-parent families (24% of them) with a high share of allowances in total income (up to 100%), this determines the largest indirect losses. If a mother suspends work due to the disability of a child in a single-parent family, and settles for allowances, then this certainly has a significant impact on indirect losses and they are estimated by the respondent as more significant. In addition, 37% of families in the group of respondents have noted that the child's disability was in the process of registration or is not allowed at all. At the same time, many parents have already left or reduced their work. In this regard, the importance of allowances as an alternative income is estimated by many quite highly, which forms a significant positive relationship.

Interestingly, the allowances' impact on direct costs is less (0.098) than the impact of indirect losses on them (0.291).

Families whose indirect losses measured as the loss of a share of the average per capita income before the birth of a child turned out to be large, spend a large share of their current income on the child, respectively. Therefore, indirect losses have a positive relationship with direct costs for a child. This relationship turned out to be significant, because hypothesis 12 was confirmed in the model from the standpoint of verification and coefficient value (P Values = 0.029).

Characteristics of the family have a significant negative relationship with indirect losses: −0.368. This indicates that deterioration of the family characteristics (as it is interpreted in the model: single-parent family, large family, low per capita income) increases its indirect losses. Hypothesis 17 is confirmed because P Values = 0.047.

3) *Y1: The ability to stay healthy of a family member* who babysits the most has the second most important coefficient **R Square = 0.378**. This means that the factors included in the model determine the issue of supporting the health of family members at 38-40%.

Respondents emphasize the importance of receiving healthcare (Y13h = 0.886), psychological (Y14h = 0.894), and wellness (Y15h = 0.672) services.

This dependent variable has confirmed hypotheses of relationship with "Additional government services" (hypothesis 3, P Values = 0.018) and a significant feedback relationship with "Direct costs for a child" (hypothesis 1, P Values = 0.008).

The accessibility of additional free of charge government family services increases its ability to stay healthy for both the babysitting person and other family members.

The negative relationship of health support costs has the same impact as indirect costs: −0,291. The costs of supporting the health of the mother (or the one who is babysitting) negatively affect the direct costs of the family for a child, since they obviously limit the family's capabilities. The mother's receipt of paid healthcare, psychological, and wellness services (physical therapy, massages, etc.) currently limits the family's ability to directly spend on the child. This determines the negative value of the impact coefficient.

The strongest impact on health support has the family characteristics (average per capita income, number of children, single-parent family). Hypothesis 15 is also confirmed, because P Values = 0.045.

4) *Y2: Opportunity to work* has the lowest **R Square = 0.141**.

The coefficient of determination is 14%, which means the factors presented in the model only determine the issue at 15%.

Most of the respondents prefer hired work (Y10op = 0.848). Many respondents are sure that they would find part-time jobs (Y11op = 0.778) if they had the opportunity to work. Some of them work or would like to work as self-employed (Y12op = 0.687).

The "Opportunity to work" variable is characterized by a significant relationship with the "Spending time for the child care." This confirms hypothesis 11 because P Values = 0.049.

Some influence on the opportunity to work is exerted by the family characteristics (the diagnosis of the child; the presence of other family members ready to substitute the parent).

However, this dependent variable is also affected by many other factors not included in this model, e.g., the structure of vacancies in the labor market or the style of work of Employment Centers that cannot provide such individual services. Therefore, no other significant factors of influence have been identified on the part of the model variables.

4. Discussion

Some of the environmental risk factors to which children, especially those with disabilities, are exposed, operate in very specific ways and cause specific health problems. However, most of these disturbances are the combined result of many environmental risks and their interaction with social and economic factors. Understanding which types of hazards are prevalent in which settings children live is a very important rationale for interventions in these

settings. In addition, an understanding of the role of each factor and its contribution to specific adverse health outcomes for children would be very helpful in guiding protective action. Unfortunately, epidemiological and toxicological studies aimed at identifying links between environmental risk factors and specific living conditions have certain limitations. These are both external (for example, lack of resources and available information to conduct potentially important studies) and internal (for example, limitations inherent in the nature of this study that cannot be avoided).

All of these problems can affect children, and some are especially dangerous for them. For example, climate change can indirectly affect exposure to air pollutants. In particular, changes in weather patterns can increase or decrease local concentrations of pollutants, especially ozone, in the air. Changes in the distribution of allergens in the air have recently been proven, and this may also be due to climate change.

Studies by scientists of various specialties indicate a low resistance of a young organism to the effects of harmful environmental factors. The reactions of the child's body to the action of anthropogenic factors differ significantly from the reactions of adults.

There are numerous reports of increased morbidity among children living in environmentally unfavorable areas. In close connection with environmental pollution is the frequency of prematurity, the frequency of malformations, the frequency of chromosomal diseases, the frequency of mental retardation and behavioral abnormalities in children, the frequency and types of oncological pathology in children, the number of disabled children and disabled since childhood. This is evidenced by data that confirms that every year there is a deterioration in the environmental situation. However, in 2020, the indicators did not tend to increase, which may be due to the lockdown caused by the impact of the coronavirus (Table 8).

Table 8. Indicators characterizing the level of the environmental situation in Kazakhstan

Year	Air emissions of pollutants from stationary sources, thousand tons	Emissions of solid pollutants, thousand tons	Emissions of liquid and gaseous pollutants, thousand tons
2010	2 226,6	639,3	1 587,2
2011	2 346,3	631,1	1 715,2
2012	2 384,3	593,8	1 790,5
2013	2 282,7	551,2	1 731,5
2014	2 256,7	494,2	1 762,5
2015	2 180,0	466,0	1 714,0
2016	2 271,6	460,6	1 811,0
2017	2 357,8	475,7	1 882,1
2018	2 446,7	508,0	1 938,7
2019	2 483,1	507,8	1 975,4
2020	2 440,7	500,4	1 940,7
2021	2 397,8	498,6	1 912,4

Source: compiled by authors according to www.stat.gov.kz

Studies of the physical development of a large number of children living in specific environmental conditions make it possible to identify regional features of the formation of their health, as well as factors affecting human health, since when assessing the degree of its influence, it is important to take into account the scale of environmental pollution:

▪ global environmental pollution is a disaster for the entire human society, but for one individual it does not pose a particular danger;

▪ regional environmental pollution is a disaster for the inhabitants of the region, but in most cases it is not very dangerous for the health of one particular person;

▪ local environmental pollution - poses a serious danger both to the health of the population of a particular city / region as a whole, and to each individual inhabitant of this area.

Thus, the achievements of ecology serve as the foundation for solving a number of urgent problems of our time. More and more scientists around the world are inclined to believe that ecology is one of the most important sciences of the future. Ecological principles gradually permeate an ever wider range of problems of science and production. The formation of new synthetic directions is an objective process associated with an increase in the role of ecology in solving a number of problems in the development of modern society, where much attention must be focused on the future healthy generation, solving such problems as:

▪ ecologization and harmonization of relations between humanity and nature,

▪ optimization of nature management,

- conservation and rational use of natural resources,
- Improving the quality of human life.

Conclusion

The structural model allows us to confirm the hypothesis about the existence of significant relationships between the factors included in the model and dependent variables: direct costs (38-40%), family members health support (38-40%), indirect losses (26%), opportunity to work for a family member who babysits the most (14%). Out of eighteen working hypotheses, we have confirmed eight.

1) We have confirmed two hypotheses about a significant positive impact on the direct costs for a child: additional free of charge government family services as a whole, indirect losses of the family due to the loss of labor income by one of its members (especially in case of an incomplete family) and the hypothesis about a significant negative impact on the direct costs of the parents' ability to stay healthy.

This suggests the need to introduce both short-term and long-term timeout services, additional leave for the second parent into the support system, since now they have a significant impact on direct expenses for the child.

It is also necessary to provide quotas for parents raising disabled children when receiving free psychological, general healthcare services (physical therapy, massages), and medical services, since the health of the mother is the well-being of a child.

Families whose indirect losses measured as the loss of a share of the average per capita income before the birth of a child turn out to be large, spend a large share of their current income on the child, respectively, so indirect losses have a positive relationship with direct costs.

2) We have confirmed two hypotheses about the impact on family's indirect losses (loss of family income from the suspension of one of its members' work; expenses for medical, psychological, healthcare and other services due to decrease of well-being and health, child-care leave), family characteristics and the allowances received by the family measured in % of family income. The higher the allowance share in the average monthly income of a family, the higher their assessment of indirect losses. If a mother stops working due to the child's disability in a single-parent family (24% of such families in the sample), and settles for allowances, then this certainly has a significant impact on indirect losses, and they are estimated by respondents as more significant. In addition, 37% of families in the group of respondents have noted that they were in the process of registering a child's disability or it was not allowed at all. At the same time, many parents have already left/reduced their jobs. In this regard, the importance of benefits as an alternative income is estimated by many quite highly, which forms a significant positive relationship.

Family characteristics have a significant negative relationship with indirect losses. This indicates that deterioration of the family characteristics (as it is interpreted in the model: single-parent family, large family, low per capita income) increases its indirect losses.

3) We have confirmed two hypotheses about the positive impact of additional free of charge government family services on the parents' ability to stay healthy and a negative relationship with direct costs for a child. The mother's receipt of paid medical, psychological, and wellness services (physical therapy, massages, etc.) currently limits the family's ability to directly spend on the child. This determines the negative value of the influence coefficient.

4) The opportunity to work within the variables factored in the model is largely determined by the time it takes to care for a child. We have confirmed the hypothesis about the relationship between the time spent on caring for a child and the opportunity to work.

The results obtained will form the basis for further work on the development of recommendations for institutional support for families with disabilities.
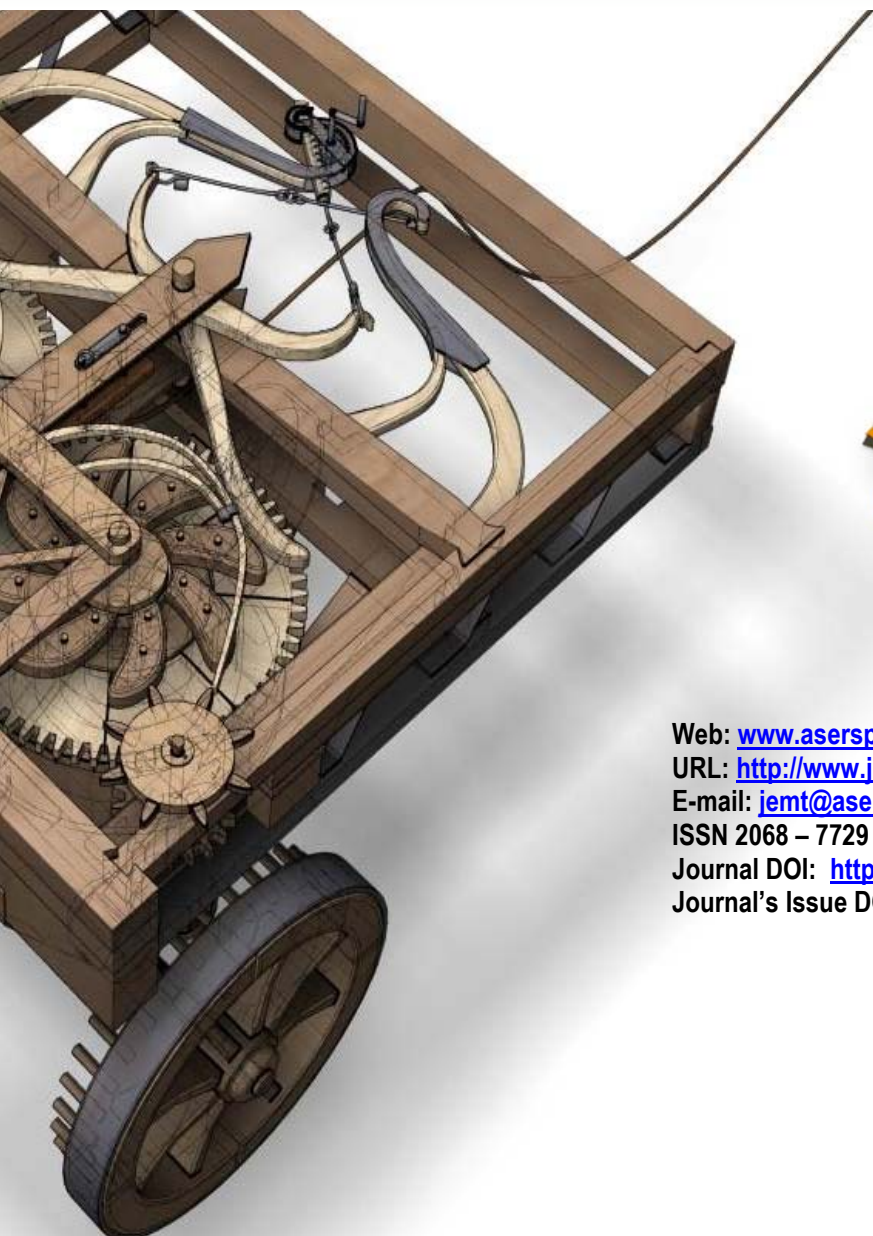
Acknowledgements

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