Uncovering supplementary information from questionnaire inquiry on physical ability with the aim to develop psycho-educational intervention: An example of a study using the SF-36 questionnaire among convalescents after *acute pancreatitis*

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ABSTRACT

Purpose: The aim of this paper was to complete a series of our own reports on health-related outcomes of rehabilitation following successful clinical therapy in Poland, based on data from a questionnaire survey using the SF-36 questionnaire, on a group of N = 142 participants hospitalized for *acute pancreatitis* at General Surgery in the Jagiellonian University of Krakow from 2000 to 2006.

Material and methods: The data from the questionnaire survey were used to estimate two auxiliary individual attributes of the survey participants: the predictable ability to accept (PAA) any fixed ordering of scale items; and the inclination to avoid extreme scores (AES).

Results: The participants of the study differed significantly with respect to their individual PF AES, and PAA scores, N=48 persons didn't agree with the standard ordering of PF items of SF-36, N=30 persons agreed with any possible ordering.

Conclusions: The findings of this study have some practical worth: first, in case of a need to reveal the patient's true ordering of the questionnaire items, it can be concluded that the persons with a great predictable ability to accept any ordering should be examined once more with some special technique. It seems to be sensible that patients with a quite different inclination to avoid extreme scores need a somewhat distinct style of motivation for healthy behavior.

Key words: acute pancreatitis, quality of life, physical functioning, SF-36

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INTRODUCTION

The concept of psycho-educational intervention (PEI) had been introduced into the health sciences, because there was a perceived need for a clear distinction between clinical therapy and the undertaken activities aimed at changing the health status through changes in the knowledge, attitudes and behaviors of patients. A significant part of PEI is the self-empowerment of patients and their families and helping them adapt to the effects of disease. PEI can be used as supplementary or primary treatment to relieve the negative outcomes of mental and physical illnesses. Nurses are considered appropriate interveners of PEI [1]. The huge numbers of studies evaluating the effectiveness of PEI, conducted in the past several decades, have been summarized in numerous reviews, cited in 'review of reviews [2,3,4].

It is rather generally accepted that convalescence after hospitalization should be conducted in accordance with the individual needs of the patient. In spite of this, it is not clear how to obtain reliable predictions of the needed scope and course of rehabilitation, or how to modify it according to the progress of the patient's return to health. Generally, it should be noted that the motivation of the patient to a healthy lifestyle is more dependent on psycho-social factors rather than current threats. Thus, even an excellent rehabilitation program may fail if the participants do not believe either in its effectiveness or in their own ability to complete it.

With respect to convalescents after *acute pancreatitis*, the manifold effects of rehabilitation in the study group (in Poland), reported in their entirety in [1], didn't differ significantly from analogous effects in foreign countries known from literature [5- 8].

Beyond proper clinical scores, a variety of questionnaires are widely used by interveners of PEI. The progress of a patient's rehabilitation after hospitalization and the needed scope of future rehabilitation, in practice, is usually evaluated in terms of health-related quality of life, with special attention to functional independence, ability to conduct daily living activities and social functioning [9-11]. However, deficiencies of health-related skills and knowledge can be found with different specific tools [12,13]. What about the strategy of rehabilitation? It can be defined under social and psychological approaches, such as the Model of Planned Behavior [14] or the ASE model (Attitude–Social influence–Efficacy) [15], both with their specific tools. For economic reasons, the responses from patients are usually obtained via mail or the internet, with only a slight loss of effectiveness compared with face-to-face interviews [16,17].

Psycho-educational intervention (PEI) is very challenging to manage in daily practice, and also in statistical studies. PEI by its nature is influenced by the personal characteristics of each patient as well as the environmental context that represents a patient's social and physical circumstances. As a result, PEI should be investigated as a compound continuous process rather than a fixed discrete variable such as the designation of an applied intervention. Moreover, for ethical reasons and because of the great autonomy of participants, different modifications of an initially chosen treatment are not assigned at random. This may affect the observed outcomes and cause unperceived bias, [18]. Some of these difficulties can be overcome only through unconventional approaches, such as the propensity score method [19].

Nevertheless, the information acquired with any multi-item psychometric scale can be used not only to estimate this specific property, but also to estimate some other properties, unspecified by the developers of this scale. For instance, the physical functioning (PF) scale in the SF-36 questionnaire incorporates 10 items (i.e. 10 questions for the respondent), scored by the respondent on the three-level Likert scale: L = 1, 2, or 3. An overall raw score of PF was defined simply as the sum of scores to separate the items of this scale, thus, an overall raw score of PF must lie at an interval of $10 \leq PF \leq 30$, [20]. It is easy to notice that some fixed values of PF can be achieved in several different ways, for instance: overall value of PF = 20 can be obtained as the sum of ten scores equal to 2; then as the sum of eight scores equal to 2, plus a pair of 1+3; and so on, until reaching zero scores equal to 2 plus five pairs of 1+3 scores. In this study, we proposed to estimate with formulas (1) or (2) the inclination to avoid extreme scores (AES) as unspecified by the developers of the scale.

$$AES = (maxE|OS - E)/(maxE|OS - minE|OS). \quad \text{for } maxE|OS > minE|OS \quad (1)$$

$$AES = 0. \quad \text{for } maxE|OS = minE|OS \quad (2)$$

where: OS – overall score of an individual respondent; maxE (minE) – maximal (minimal) number of extreme item's scores needed to express fixed SO; E –actual number of extreme scores in response to the questionnaire used made by an individual respondent.

With respect to physical functioning on the SF-36 questionnaire, OS is the overall raw score of PF; extreme evaluation items are equal to 1 and to 3, so maxE for PF = 20 is equal to maxEe|20 = 10; minE|20 = 0. As a result, there are six possible values of the estimated AES for PF = 20: AES = 0, 0.2, 0.4, 0.6, 0.8, 1. [21]. According to the Rasch approach, it is assumed that if the K items form a one-dimensional scale than these K items can be

definitely put into the order in relation to a particular aspect of the scores from the first item of rank equal to k = 1, increasing by one, to the last item of rank equal to k = K. For the PF scale on the SF-36 questionnaire, the standard ordering of K = 10 items of this scale were published in [9], and then reanalyzed for the Polish population in [22]. With this approach, an individual respondent can be characterized by his/her or her level of compliance to standard ordering [9] or to specific population ordering [22]. In this study, we estimated the PAA probability that one cannot exclude arbitrarily selected arrangement of K items using the formula (3) based on a given single set of K scores made with the use of Likert scale with L levels. Estimated PAA can be used as a supplementary score of validity of the estimated level of compliance to some reference ordering, considered an attribute of an individual respondent.

$$PAA = (k_1! * k_2! * \ldots * k_L!) / K!. \quad (3)$$

where: K - number of items; L - number of levels of the Likert scale; k_j – number of items with a score equal to j, j = 1, 2, …, L; $K = k_1 + k_2 + \ldots + k_L$.
For example, for K = 7 and L = 3, min(PAA) = (2!* 2!*3!)/7! = 24/5040 @ 0.00476 = 0.476%; but max(PAA) = (0!*0!*7!)/7! = 1 = 100%, because 0!=1.

It is easy to notice that both proposed coefficients, AES and PAA, can be easily calculated with formulas (1) or (2), and (3), without getting any supplementary data from the respondent, beyond his/her or her answers to the questionnaire used. It seems to be quite reasonable that patients with different levels of individual inclination to AES may need different styles of motivating to adopt proper healthy behaviors [23]. Then, the estimated PAA creates the possibility to distinguish between situations in which compliance with the standard ordering was determined as a result of the high value of PAA versus a situation in which compliance occurred in spite of the strong preferences of the respondent. The aim of this paper was to complete a series of our own reports on health-related outcomes of rehabilitation following successful clinical therapy in Poland, based on data from a questionnaire survey using the SF-36 questionnaire, on a group of N = 142 patients hospitalized for *acute pancreatitis* at General Surgery in the Jagiellonian University of Krakow from 2000 to 2006.

MATERIAL AND METHODS

The initial sample included 422 patients hospitalized for *acute pancreatitis* at the 1st Department of General Surgery in the Jagiellonian University of Krakow (Poland) from 2000 to 2006. Some exclusion criteria caused a gradual reduction of the initial sample, first to a survey sample of N = 266 participants, then to a final sample of N = 142 participants (Tab. 1). Data flow and exclusion criteria. The final sample can be considered representative at least for the initial sample, because the clinical and demographic data for the responders and the non-responders were quite similar, so adjusting for a nonresponse was unnecessary there, see [24]. Moreover, the response rate in the study, RR = 142/266 = 53.4%, was not too low for a mail survey, see [16].

Subjects

The subjects of the study [1] can be summarized into four general phases: recruitment involving selecting the study participants, data collection with questionnaires administrated to the participants, data analysis, data validation and comparative analysis of the study findings. The main particular subject of this study was defined as uncovering the auxiliary properties of a respondent from his/her answers to a questionnaire designed to measure its other features.

Measures

At the stage of recruiting participants to the initial study sample, the candidates were enrolled based on their clinical and demographic characteristics extracted from their clinical records as a result of a systematic review of the clinical records of all patients hospitalized at the 1st Department of General Surgery in the Jagiellonian University of Krakow (Poland) from 2000 to 2006. At the stage of the questionnaire survey the data were collected using our own original questionnaire and the standard SF-36 questionnaire. Our own questionnaire was used to measure the participants' socio-demographic data; the perceived by the participant support from his kin and from health care provides; the perceived by the participant state of his health; the participant's health-related behavior, beliefs and knowledge. The SF-36 questionnaire was used to measure the participants' actual individual health-related quality of life.

At the stage of data validation and comparative analysis of the study findings, the templates for comparisons with general populations were abstracted from original reports of the developers of the SF-36 questionnaire, [9,20], and [25], but the templates for comparison with other populations of convalescents after acute pancreatitis was obtained from a systematic review of the literature on quality of life of convalescents after acute pancreatitis, [5-8].

All 36 items of the SF-36 questionnaire produce only 9 variables (health-related quality of life domains): GH – general health; HT – change in health; VT – energy/vitality; MH – mental health; RP – role limitation-physical; SF – social functioning; BP – bodily pain; RE – role limitation-emotional, and PF – physical functioning. The raw SF-36 data were standardized as usual to a range of

0-100% capacity separately for each the above 9 scales, according to [20]. The SF-36 outcomes were measured on an ordinal scale without any a-priori hypothesis about the pattern of the SF-36 items. The SF-36 consist of 36 items, but only 10 of them are designed to score PF. A respondent should asses his self-rated ability of PF on a scale of 1 (Yes, very limited) to 3 (No, not limited at all), answering the question 'your health now limits you in these activities: PF1: vigorous activities, PF2: moderate activities, PF3: lifting or carrying groceries, PF4: climbing several flights of stairs, PF5: climbing one flight of stairs, PF6: bending/kneeling/stooping, PF7: walking more than a mile, PF8: walking several blocks, PF9: walking one block, PF10: bathing or dressing. The overall PF raw score was equal to sum of 10 of the above sub-scores. Finally, it can be standardized to a 0-100 scale, where: 0 = worst health state, 100 = best health state, so the higher scores indicate better health. The core analyses in this study dealt with the PF scale shortened only to 7 grouped items: walking (PF_07, PF_08, PF_09), climbing stairs (PF_04, PF_05), and vigorous versus moderate activities (PF_1, PF_2).

Data collection procedure

Our own original questionnaire and the standard Polish version of the SF-36 questionnaire with standard instructions [20] was mailed to all 266 survivors with known addresses. Known strategies for promoting participants' attitude to the investigation were applied in the data collection procedure, [4,16]. A covering letter accompanying each questionnaire also included an explanation of the purpose of the survey and the possible health benefits for the respondent. Phone consultation in completing the form was offered, if needed. N = 124 participants didn't return a worthy answer, but N=142 survivors (81 men and 61 women) returned complete enough forms, of these N = 134 without missing data on the PF-10 scale of the SF-36 questionnaire. Eight participants didn't score all 7 items on the PF scale under consideration in this paper, so they were excluded from the analysis, see Table 1.: Data flow and exclusion criteria. The response rate RR = 142 / 266 = 53.4% was considered not too low for a mail survey, [16]. The clinical and basic demographic data for non-responders and responders were quite similar, so adjusting for non-response can be considered unnecessary, see [24].

Scope of data preparation and further analyses

In this study, the scope of analyses was limited exclusively to physical functioning, and, to some extent, to associated with physical ability vitality and perceived limitation of the social role, as measured with three scales on the SF-36 questionnaire: PF (physical functioning), RP (role limitation due to physical reasons), and vitality (VT). All preparatory transformation and standardization of the raw data were made following the standard recommendations [20]. The two new variables being studied were computed based on their own definitions. The scope of further analyses was determined following the procedures applied in the discussed reference literature, [5-9, 25], in particular, the construct one-dimensionality was supported with the principal components (PC) analysis; the concurrent validity of the PF data was examined using the Rasch approach.

Statistical analyses

Data preparatory transformations, descriptive statistics, basic statistical tests, and correlation and regression analyses were made with Excel software. Structural equation modeling (SEM) and principal components (PC) analysis were both made using Statistica-8 software. The reference level for significance was equal to $p = 0.05$.

RESULTS

Descriptive statistics of physical functioning and associated properties

The mean values and standard deviation (SD) of the three domains of quality of life, PF - physical functioning, RP - role limitation, VT - vitality, as measured with the SF-36 questionnaire, were computed for the Polish group of studied convalescents, and then compared with analogous findings for three other groups known from literature, [5], [20]. All three scores of the studied group, PF = 64.5 ± SD = 27.1; RP = 59.0 ± SD = 30.9; and VT = 52.5 ± SD = 16.8, were distinctly lower than analogous scores of other populations, particularly compared with scores of the USA general population, PF = 83.29 ± SD = 23; RP = 82.51 ± SD = 25; and VT = 58.31 ± SD = 20; (Tab.2. Descriptive statistics of PF, RP, and VT scores of patients in the studied group in Poland and Finland, versus controls in Finland and the USA). Nevertheless, the Z-test, recommended in [20], showed that these differences between the studied group and the USA general population are all non significant, with significances equal to $p = 0.21$; $p = 0.18$; and $p = 0.39$ respectively (see Table 2. Descriptive statistics of PF, RP, and VT scores of patients in the studied group in Poland and Finland, versus controls in Finland and the USA).

Distribution of PF scores and estimates of PAA and AES

The core analyses in this study dealt with the PF scale shortened from 10 items on the original PF10 scale to only 7 grouped items: walking (PF_07, PF_08, PF_09), climbing stairs (PF_04, PF_05), and vigorous versus moderate

activities (PF_1, PF_2) on the PF7 scale. In this section, the predictable ability to accept (PAA) any fixed ordering of scale items and the inclination to avoid extreme scores (AES) were considered with respect to their distribution in the studied group, (see Table.3. Distribution of scores and estimates of PF, PAA and AES). The PF7 score was calculated as the sum of the responses to the seven chosen items on the physical functioning (PF) scale of the SF-36 questionnaire. The coefficients PAA and AES were calculated with formulas (1) and (3) for each participant of the studied group separately. For N = 1 + 5 + 13 + 15 = 34 persons with overall PF7 score equal to 7, 8, 20, or 21, AES cannot be estimated with formula (1) because of the number of extreme scores equal to E = 7 or E = 6, which is the bottom/ceiling effect in the study group. If necessary, it can be estimated with formula (2). The distributions of all four variables under consideration, PF7, F, PAA, and AES, can be considered near to normal distributions, because of the moderate values of skewness: -0.85 < skewness < +1.29; and the moderate values of kurtosis: –0.92 < kurtosis < +0.00. N = 8 + 10 + 18 + 8 + 17 = 61 participants (45.5% from N = 134; 95%CI: from 36.9% to 54.3%) showed PAA $\leq$ 0.025; and the remaining N = 20 + 23 + 30 = 73 (54.5% from N = 134; 95%CI: from 45.7% to 63.1%) showed PAA > 0.025, so the median of PAA can be considered near to PAA = 0.025. In the study sample, participants with the maximal value of AES = 1 prevailed, N = 51 (38,1% from 134; 95%CI from 29.8% to 46.8%), but the minimal value of AES = 0 characterized N = 15 participants (11.2% from 134; 95%CI from 6.4% to 17.8%). With respect to only N = 100 participants with an estimable level of AES, N = 51 participants presented exactly 51% (95%Ci from 42.3% to 59.6%), so the median of AES can be considered close to AES = 1 (Tab. 3)

Clusters in the studied group with respect to PAA and AES.

Based on the estimated individual values of PAA and AES, (see Table 3. Distribution of scores and estimates of PF, PAA and AES), the hidden structure of the studied group with respect to these coefficients was revealed, (see Table 4. Clusters in the studied group with respect to PAA and AES). The study group of N = 134 participants can be divided into five clusters. Let us order the clusters with respect to the estimated mean PF7 scores, (see Table 5. Descriptive statistics of PF7 in clusters defined with regard to PAA and AES). The first cluster included N = 16 participants with PAA > 0.14 and AES =1; the second cluster included N = 36 participants with PAA < 0.025 and AES < 1; the third cluster of N = 35 participants with 0.025 $\leq$ PAA < 0.14 and AES =1; the fourth cluster of N = 13 participants with 0.025 $\leq$ PAA < 0.14 and AES < 1; and the fifth cluster of N = 34 participants with PAA > 0.14 and AES not estimated with formula (1) due to bottom/ceiling effects. The mean values of PF7 in separate clusters differed slightly in the studied group, (see confidence intervals 95%CI for mean values of PF7 in Table 5. Descriptive statistics of PF7 in clusters defined with regard to PAA and AES). Because of the significant correlation between means and standard deviations, R = 0.94; p = 0.016 for K = 5 clusters; the analysis of variance should be treated with caution here, [26], and was omitted in this paper. Nevertheless, it seems that the observed differences between the estimated mean values of PF7 for the fifth cluster (N = 34 participants), equal to PF7 = 18.2 versus PF7 in first and second clusters (N = 16 + 36 = 52 participants), equal to PF7 = 14.0 and PF7 = 14.6, respectively, can be considered of some practical significance.

Correlation between PF7, E, PAA, AES

It was shown that the individual level of PF7 was not correlated with the individual level of AES, R = -0.06; p = 0.50; nor with the individual level of PAA, R = 0.08; p = 0.33; but it was correlated significantly with the number E of extreme Likert's scores used by an individual to express a given value of PF7, R = 0.37; p < 0.001; (see Table 6. Correlation between PF7, E, PAA, AES). Somewhat surprisingly, the correlation between AES and PAA was also significant, R = 0.31; p = 0.002; (Tab. 6). It seems that this may be an artefact resulting from using only a three-level Likert scale, which led to a diagonal matrix of two-dimensional distribution of AES and PAA in the study group (Tab. 4). Clusters in the studied group with respect to PAA and AES). It is easy to notice that the same value of some given the overall PF7 score can be expressed with either pair of two different extreme scores, 3 + 1 = 4, or with a pair of two of the same non-extreme scores, 2 + 2 = 4; which must cause a higher PAA. In the case of the Likert scale with four values, the above artefact should disappear, because the sum of two extreme scores, 1 + 4 = 5, and the sum of two non-extreme scores, 2 + 3 = 5, are both expressed with a pair of different scores.

Table 1. Data flow and exclusion criteria.

Exclusion criteria / sample	**N**		**Excl.N**	**Excl.%**
initial sample	412	excluded:	156	37.9
age: < 18 years or > 70 years			66	16.0
death			34	8.3
incomplete clinical data			20	4.9
complication with other illness			36	8.7
initial sample for the SF-36 survey	266	excluded:	124	46.6
unknown true address			2	0.8
refused to answer			122	45.9
sample for SF-36 analyses	142	excluded:	8	5.6
missing data on PF scale			8	5.6
sample for PF-10 analyses	134	-	-	-
Excl – excluded (N % of participants) from the considered sample				

Table 2. Descriptive statistics of PF, RP, and VT scores of patients in the studied group in Poland and Finland, versus controls in Finland and the USA.

group	**country**	**PF**	**RP**	**VT**
Patients	Poland	64.5 ± SD = 27.1	59.0 ± SD = 30.9	52.5 ± SD = 16.8
Controls	USA	83.29 ± SD = 23	82.51 ± SD = 25	58.31 ± SD = 20
Patients	Finland	83.0 ± SD = 21.6	69.4 ± SD = 27.8	60.4 ± SD = 23.4
Controls	Finland	83.9 ± SD = 11.6	72.4 ± SD = 5.1	64.5 ± SD = 5.7
Z-score	Poland	-0.79	-0.92	-0.29
p | Z-score	Poland	0.21	0.18	0.39

PF - physical functioning, RP - role limitation, VT - vitality, as measured with the SF-36;
Controls – random sample from the general population;
Patients – sample of convalescents after acute pancreatitis;
SD - standard deviations;
Z-score – score for the Polish group of the study standardized to the USA general population;
p | Z-score – probability that a random sample from the USA controls show a Z-score less than the mean Z-score for the Polish group

Table 3. Distribution of scores and estimates of PF, PAA and AES.

PF7	#_1	#_2	#_3	E	N	PAA	AES
7	7	0	0	7	5	1	-
8	6	1	0	6	1	0.143	-
9	6	0	1	7	1	0.143	0
10	4	3	0	4	8	0.029	1
10	5	1	1	6	1	0.024	0
11	3	4	0	3	2	0.029	1
11	4	2	1	5	1	0.010	0.5
12	3	3	1	4	6	0.007	0.5
12	2	5	0	2	2	0.048	1
13	3	2	2	5	4	0.005	0.3333
13	1	6	0	1	3	0.143	1
13	2	4	1	3	1	0.010	0.6667
14	0	7	0	0	10	1	1
14	3	1	3	6	1	0.007	0
14	2	3	2	4	1	0.005	0.3333
14	1	5	1	2	1	0.024	0.6667
15	1	4	2	3	6	0.010	0.6667
15	0	6	1	1	3	0.143	1
15	2	2	3	5	3	0.005	0.3333
16	1	3	3	4	3	0.007	0.5
16	2	1	4	6	2	0.010	0
16	0	5	2	2	1	0.048	1
17	1	2	4	5	8	0.010	0.5
17	2	0	5	7	2	0.048	0
17	0	4	3	3	1	0.029	1
18	0	3	4	4	6	0.029	1
18	1	1	5	6	6	0.024	0
19	0	2	5	5	15	0.048	1
19	1	0	6	7	2	0.143	0
20	0	1	6	6	13	0.143	-
21	0	0	7	7	15	1	-
Total	**178**	**324**	**436**	**614**	**134**	**0.26**	

PF7 – overall level of individual physical functioning, based on seven chosen items from ten items on the PF scale of the SF-36 questionnaire; #1, #2, #3 – number of Likert scores L = 1; L = 2, L = 3 respectively, used to express a given value of PF7; E = #1 + #3; N – number of a given combination of the Likert scores on the database under consideration; PAA – estimated value of predictable ability to accept any fixed orderings of the seven items of the PF scale; AES – estimated value of the inclination to avoid extreme scores.

Table 4. Clusters in the studied group with respect to PAA and AES.

PAA	AES < 1	AES =1	AES = ?	Total
PAA < 0.025	36	-	-	36
0.025 ≤ PAA < 0.14	13	35	-	48
PAA > 0.14	-	16	34	50
total	49	51	34	134

PAA – estimated value of predictable ability to accept any fixed orderings of the seven items of the PF scale; AES – estimated value of the inclination to avoid extreme scores.

Table 5. Descriptive statistics of PF7 in clusters defined with regard to PAA and AES.

Cluster	N	Min(PF7)	Max(PF7)	Mean(PF7)	SD	95%CI
1	16	13	15	14.0	0.63	13.69-14.31
2	36	11	17	14.6	1.88	14.02-15.25
3	35	10	19	15.8	3.94	14.47-17.08
4	13	9	19	16.4	3.31	14.59-18.18
5	34	7	21	18.2	5.20	16.43-19.92
total	134	7	21	15.9	3.9	15.27-16.58

PF7 – overall level of individual physical functioning, based on seven chosen items from ten items on the PF scale of the SF-36 questionnaire.

Table 6. Correlation between PF7, E, PAA, AES.

Parameter	PF7	E	PAA	AES
PF7	1	R = 0.37 p< 0.001	R = 0.08 p = 0.33	R = -0.06 p = 0.50
E	R = 0.37 p< 0.001	1	R = 0.03 p = 0.27	R = -0.64 p< 0.001
PAA	R = 0.08 p = 0.33	R = 0.03 p = 0.27	1	R = 0.31 p = 0.002
AES	R = -0.06 p = 0.50	R = -0.64 p< 0.001	R = 0.31 p = 0.002	1

PF7 – overall level of individual physical functioning, based on seven chosen items from ten items on the PF scale of the SF-36 questionnaire; E – number of extreme Likert scores used to express PF7; PAA – estimated value of predictable ability to accept any fixed orderings of the seven items of the PF scale; AES – estimated value of the inclination to avoid extreme scores.

Table 7. Loadings of the principal components of the physical functioning (PF) score in the studied group.

PF	PF_1	PF_2	PF_4	PF_5	PF_7	PF_8	PF_9	PF_6	PF_3	PF_10	V	%V
PC_1	-0.55	-0.84	-0.69	-0.81	-0.85	-0.87	-0.77	-0.80	-0.78	-0.76	6.04	60%
PC_2	-0.61	0.00	-0.49	0.25	-0.12	0.18	0.43	-0.30	0.01	0.43	1.18	12%

PC_1, PC_2 – first (second) principal component of the PF variable; V – variance of PF explained with PC_1 (PC_2); %V – percent of explained variance from all variance of PF.

Table 8. Standard vs. estimated orderings of PF items.

Item	S7:1-2	E7:1-2	Delta	S7:2-3	E7:2-3	Delta
PF09	7	7	0	7	7	0
PF05	6	6	0	6	5	1
PF08	5	5	0	5	6	-1
PF02	4	4	0	2	3	-1
PF04	3	2	1	3	2	1
PF07	2	3	-1	4	4	0
PF01	1	1	0	1	1	0

where: S denotes the standard pattern, and E the sample data, respectively; 1-2 denotes the decision threshold between scores 1 and 2, and 2-3 denotes the decision threshold between scores 2 and 3, respectively.

DISCUSSION

Methodological and practical importance

The estimates of health-related quality of life (QOL) in the study group were compared with scores known from literature for Finnish patients, [5], and with the norms for the USA healthy population, [20], especially with respect to physical functioning (PF), limitation of the social role due to physical problems (RP), and vitality (VT), (Tab.2. Descriptive statistics of PF, RP, and VT scores of patients in the studied group in Poland and Finland, versus controls in Finland and the USA). Patients had somewhat reduced QOL compared with healthy controls, but it was generally less than a single standard deviation, so it can be considered non-significant.

In this study, we proposed a slight broadening of the usual scope of data extracted from the questionnaire survey, see e.g. [9, 20, 25], with the aim to estimate the two new coefficients, the inclination to avoid extreme scores (AES), and the probability PAA that one cannot reject any freely chosen ordering of K items based only on a given single set of K scores made using the Likert scale with L levels.

Estimated individual scores of AES and PAA can be considered supplementary attributes of an individual respondent, unspecified by developers of a considered scale. Estimated PAA can be used as a supplementary score of validity of the estimated level of compliance to some reference ordering, for instance, estimated using the Rasch approach, [9,22].

Both of the above coefficients, AES and PAA, correspond to known social and psycho-logical approaches, such as the Model of Planned Behavior [14], or the ASE model (Attitude–Social influence–Efficacy) [15], and cognitive approach [26,27]. Nevertheless, it seems that they express somewhat different aspects associated with the methodology of questionnaire surveys. From a practical point of view, it should be noticed that both proposed coefficients, AES and PAA, can be easily calculated without getting any supplementary data from a respondent under investigation, beyond his/her answers to the questionnaire used. In this study, the basic properties of AES and PAA were

explained based on the data from [1]. It was proved than AES and PAA, considered together, provide an opportunity to divide a group of responders with different mean scores of physical functioning. This can be considered an initial phase of some more compound analyses, e.g. the propensity score method, [19].

Nevertheless, with respect to strategy of rehabilitation, it seems to be quite reasonable that patients with different levels of an individual inclination to avoid extreme scores (AES) may need different styles of motivating to adopt proper healthy behaviors. Then, the estimated PAA creates the possibility to distinguish between situations in which compliance with the standard ordering was determined as a result of the high value of PAA versus a situation in which compliance occurred in spite of the strong preferences of the respondent.

Validity of the data

It was proved that all 9 of the SF-domains in the study had near to normal distributions, particularly with respect to the physical functioning (PF) scale it was confirmed by the moderate values of skewness for overall PF, and for the separate items of PF: $-1.50 < \text{skewness} < +0.52$; and $-1.36 < \text{kurtosis} < +1.20$. Then, the internal consistency was supported with overall Cronbach alpha of 0.92. The construct one-dimensionality was supported with the principal components (PC) analysis, (see Table 7. Loadings of the principal components of the physical functioning (PF) score in the studied group); it was proved that the first principal component of the PF variable explained 60% of all variance of PF, but the second component explained only 12%.

This paper only examined seven items of the PF scale. There were two reasons we only examined seven items. First, these items were grouped into three kinds of physical activity; and second, this made the results easier to percept. Moreover, it had been previously proved that in the study sample the regression PF_7 = 0.7*PF_10 explained $R^2 = 0.97$ of the PF variance, where: PF_k was scored of PF based on k items of PF scale, k = 7 or 10, respectively.

The concurrent validity of the PF data was examined using the Rasch approach, (see Table 8. Standard vs. estimated orderings of PF items). The Rasch procedure applied to the sample data led to two linear orderings of the 7 considered items of the PF scale, somewhat different from the standard ones provided in [9], (see Table 8). Standard vs. estimated orderings of PF items). Nevertheless, the standard procedures showed that differences between these four orderings are not significant. First, Kendall's coefficient of concordance equal to $W = 0.92$ led to a significance of $p = 0.001$ for hypothesis $W = 0$. Then, the coefficient of intra class correlation equal to $ICC = 0.97$, with $F < 0.00001$ (between orderings), led to a significance of $p > 0.9999$ for hypothesis $ICC = 0$.

The above results of the standard statistical test can be interpreted in two possible and equiponderant ways, the first one that the all four orderings were generated by the same 'proper' ordering of the items (in the sense: the most of all likely orderings); and second one that the differences between the factual orderings were generated by random errors in the items' scores, e.g. due to transient changes in the feelings, moods, and mental states of the participants over time [21, 22, 25].

Limitations

The study presents certain methodological limitations. It is based on a single questionnaire survey, performed on convalescents after one acute disease, at one clinic. Then, the estimations are based on a single psychometric scale. Thus, it remains unknown if the patients recruited to the study are typical of other rehabilitation patients in these or other regions of the country, nor do we know if the findings obtained in this study can be generalized beyond patients after acute pancreatitis.

Further analyses on data from the inquiry [1] can concentrate on other scales of the SF-36 questionnaire. Then, some confirmatory inquiry should be undertaken in the study group. Nevertheless, future longitudinal studies should be conducted with new cohorts of rehabilitation patients with different major impairments to determine if the pattern of the participants' properties and their determinants observed in this investigation can be replicated.

CONCLUSIONS

The main conclusion is that the group of convalescents after acute pancreatitis cannot be considered a homogenous group not only with respect to their individual physical ability, expressed with the PF score, and to the perceived ordering of the PF items, but also with respect to both auxiliary individual attributes: predictable ability to accept any ordering (PAA), and inclination to avoid extreme scores (AES). Because in practice the progress of a patient's rehabilitation after hospitalization is usually evaluated in terms of health-related quality of life, with special attention paid to functional independence and ability to perform daily living activities, the findings of this study have some practical worth. First, in the case of a need to reveal a patient's true ordering of the questionnaire items, it can be concluded that the persons with a higher PAA score should be examined once more with some special technique. Then, it seems to be sensible that patients with quite different AES scores need a somewhat distinct style of motivation to adopt healthy behaviors.

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