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Assessing adolescents' readiness for action and attitudes toward obesity prevention: Instrument development and psychometric properties

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Summary

Engaging adolescents in obesity prevention is a main objective of the CO-CREATE project. This paper presents the development of a questionnaire to assess readiness for action and attitudes toward obesity prevention among adolescents. The questionnaire was developed based on literature searches and internal discussions with experts in the CO-CREATE consortium. The questionnaire was translated, back translated, and pretested for time and comprehensiveness by adolescents from five countries (the Netherlands, Norway, Poland, Portugal, and the United Kingdom). Exploratory factor analysis was performed, and internal reliability of the resulting factors was determined using baseline data from Poland and Norway. Furthermore, test–retest reliability was assessed in a sample of Norwegian adolescents. The exploratory factor analysis on readiness for action identified four factors. Analysis on attitudes toward obesity prevention identified four factors on responsibility and five factors on drivers of behavior. Six of the factors had a Cronbach's alpha value above 0.70, five factors had a value between 0.60–0.70, whereas the remaining two factors were below 0.60. The test–retest correlation ranged from 0.46 to 0.87. The exploratory factor analyzes on readiness for action identified the same factors as hypothesized in the development of the questionnaire, whereas attitudes toward obesity prevention identified more factors than initially assumed. The questionnaire is considered reliable as a tool for measuring adolescents' readiness for action and attitudes toward obesity prevention.

KEYWORDS
adolescents, obesity, prevention, psychometric properties

Abbreviations: CITC, corrected item-total correlation; CO-CREATE, Confronting obesity: Co-creating policy with youth; FAS, family affluence scale; ICC, intra-class correlation coefficient; PAF, principal axis factoring.

1 | INTRODUCTION

Programs to prevent obesity in young people have tended to focus on behavior-oriented prevention programs, mainly school-based, and effects have been limited.[1,2] Combining behavior-based programs with community- or environment-based prevention policies may increase the likelihood of the sustainable success of future obesity prevention programs.

It is important to involve young people in decisions affecting them, especially when it has the potential to enhance promotion of their own health and well-being.[3] In the Confronting obesity: Co-creating policy with youth project (CO-CREATE), which aims to reduce the prevalence of obesity among adolescents in Europe through policy actions to promote a healthier food and physical activity environment, adolescents have not merely been the object of the intervention but have themselves been agents for change by identifying required actions and collaborating to achieve them.[4] The adolescents were involved in participatory action research,[5] which has been found to be an effective tool for young people to address inequalities in various social issues, including health, as well as for promoting civic and political engagement.[6,7]

Although increasing attention is paid to youth involvement and empowerment, there is a dearth of developed and validated measures that can be used to assess adolescents' readiness to engage in action to address obesity and in other intermediary outcomes or process measures within the field of obesity prevention. Some studies have, however, aimed to develop and test such measures, which can be used to evaluate youth advocacy programs,[8] or general measures that can be used to assess youth-led participatory research approaches tackling a wide range of social and community problems.[9] In the present study, a CO-CREATE process evaluation questionnaire was developed to assess to what extent the activities the adolescents participated in influenced their readiness for action and attitudes toward obesity prevention. The underlying hypotheses were that involvement in participatory action research activities would increase the reported readiness for action among participating adolescents, in this case related to primary prevention of overweight and obesity, and that adolescents' participation in a project addressing obesity would lead to a shift in their conceptualization of obesity from a problem grounded at the individual level toward appreciating it as a population-level systems problem. The aim of this paper is to describe the development of this research instrument and to assess the validity and reliability of the questionnaire with respect to readiness for action and attitudes toward obesity prevention.

2 | METHODS

2.1 | Development of the CO-CREATE process evaluation questionnaire

The CO-CREATE process evaluation questionnaire was developed to assess readiness for action and changes in attitudes toward obesity prevention.

De Vet et al.'s six step methods were used for developing the baseline questionnaire; defining and elaborating the constructs intended to be measured, choice of measurement method, selecting and formulating items, scoring issues, pilot testing, and field testing.[10]

Because the study included participants from five different countries (the Netherlands, Norway, Poland, Portugal, and the United Kingdom), the questionnaire was translated from English to Dutch, Norwegian, Polish, and Portuguese following de Vet et al.'s six task methods for translating questionnaires.[10] The questionnaire was back translated into English by a separate translator. To ensure that the questionnaire had the same validity after translation and that cultural issues were considered, a cross-cultural validation was conducted. Cross-cultural validity is defined by Mokkink et al. as "the degree to which the performance of the items on a translated or culturally adopted instrument are an adequate reflection of the performance of items in the original version of the instrument".[11] Translators and developers of the original questionnaires examined thoroughly whether the translated questionnaires were an adequate reflection of the construct, whether the meaning remained the same after translation, and whether the items were relevant.

The questionnaire was pretested in the Netherlands, Norway, Poland, and Portugal, whereas the questionnaire was translated and cross-culturally validated. A total of 17 to 28 adolescents from each country ($n = 90$) participated in the pretest to assess if the pre-final questionnaire was comprehensible and to estimate the duration of completion. The adolescents, aged 16 to 19, were recruited from a school in each country and included adolescents from lower socioeconomic areas. Adolescents participating in the pretest were asked to complete the questionnaire and mark and comment on words/sentences/questions/response alternatives they found to be difficult to understand. Six to eight adolescents from each country ($n = 28$) from the pretest took further part in a cognitive interview after completing the questionnaire. The aim was to understand in detail the adolescents' opinions about the questionnaire's comprehensibility, feasibility, and relevance.[12]

The assessment of the questionnaires' content validity was based on dialogues between translators and developers, written reports from the translation process, and the cognitive interviews with the target group. Extensive field testing beyond translation and cross-cultural validation was not feasible.

2.2 | Measures

A multi-item online questionnaire-based survey suitable for smartphones, tablets, and PCs was developed. Previous studies on either readiness for action or attitudes toward obesity prevention were identified through literature searches. Relevant literature and expert inputs were supplemented by members of the CO-CREATE consortium. Relevant questions and scales for this project were collected in a Microsoft Excel file. Questions originally developed in other surveys and scales that were used were modified to better fit this project. For instance, the item "I feel like I have a pretty good understanding of

the important political issues which confront our society"[9] was modified to "I have a pretty good understanding of important social issues present in my local area." Drafts were made and revised. Articles and reports that were found relevant for developing questions measuring readiness for action and changes in attitudes toward actions to prevent obesity and the final items included in the questionnaire are listed in Appendix A.

The final instrument included 18 items measuring readiness for action (Table 1), with the aim of assessing adolescents' readiness to be involved and engaged in dealing with societal issues. The questions were divided into different concepts based on the literature.[9,13,14] A total of 34 items measured attitudes toward action to prevent obesity. The questions on attitudes toward action to prevent obesity were divided in two concepts: responsibility and drivers of behavior. Items measuring responsibility were further divided into individual (five items) or collective (12 items) responsibility,[15] and drivers of behavior were further divided into two subscales; internal (eight items) and external (nine items) drivers.[16] Dividing the questions in four subscale scores made it possible to track whether the participants thought it was an individual or collective responsibility to reduce the number of people who have overweight or obesity and if they thought unhealthy behavior are dependent on internal or external drivers. For all items, a score from 1 to 5 was given to each item depending on whether the participant *strongly agreed* (5 points) or *strongly disagreed* (1 point).

The baseline questionnaire furthermore included background questions such as birth year, gender, birth country, and socioeconomic position assessed by the family affluence scale (FAS) as well as questions on dietary behaviors and physical activity from the health behavior on school-aged children (HBSC) study.[17,18] These questions were added to provide information to describe the diversity of the participants in CO-CREATE.

2.3 | Data collection

Adolescents from five countries (the Netherlands, Norway, Poland, Portugal, and the United Kingdom) who were part of alliances involved in the CO-CREATE youth alliance activities[4] were invited to complete an online baseline questionnaire in 2019 or 2020. The questionnaire was sent to participants' e-mail addresses or cell phone numbers and it took approximately 10–15 min to complete. A control group from each country was also invited to complete the baseline questionnaire (the UK partner was unable to recruit a control group due to COVID-19). The control groups were recruited through schools. In total, 444 adolescents from the alliances ($n = 159$) and control groups ($n = 285$) completed the baseline questionnaire. The two country baseline questionnaires with the largest sample sizes were chosen to explore the structure of the baseline questionnaire, respectively, the Norwegian ($n = 183$) and Polish questionnaire ($n = 145$).

TABLE 1 Concepts and items included in the CO-CREATE process evaluation questionnaire

Readiness for action
Ways of expressing political voice (6 items)
Competence for civic action (5 items)
Advocacy outcome efficacy (3 items)
Knowledge of resources (4 items)
Attitudes toward action to prevent obesity—responsibility
Responsibility—individual (5 items)
Responsibility—collective (12 items)
Attitudes toward action to prevent obesity—drivers of behavior
Drivers of behavior—internal (8 items)
Drivers of behavior—external (9 items)

2.4 | Test–retest

A test–retest to assess the reliability of the baseline questionnaire was conducted in November 2021 among a group of Norwegian adolescents ($n = 39$) at a school in Oslo. The same group of adolescents answered the baseline questionnaire on two occasions with an interval of 9–14 days.

For all participating adolescents, informed consent was retrieved prior to study participation, and involvement was voluntary. The study protocols were approved by the relevant ethical bodies in each country and for the development study, the main study, the control group, and the test–retest studies separately.

2.5 | Data analysis

Data were stored and analyzed in TSD—services for sensitive data. Background characteristics of the participating adolescents were analyzed. Six questions were included to measure the FAS score: "Does your family own a car, van or truck?", "Do you have your own bedroom for yourself?", "How many computers do your family own?", "How many bathrooms are in your home?", "Does your family have a dishwasher at home?", and "How many times did you and your family travel out of <country> for a holiday/vacation last year?" Each response key was coded from low to high wealth, with 1 being the least of the item in question. The responses on the six questions were summed up to determine the FAS score. A score between 0 and 6 indicated low FAS, 7 thru 9 medium FAS and 10 thru 13 high FAS.

An exploratory factor analysis was performed to determine the structural validity of the constructs (whether the items included in the questionnaire were grouped into the right concepts). Principal axis factoring (PAF) was used to determine the best factor structure to represent each of the three main concepts in the CO-CREATE process evaluation questionnaire: readiness for action, responsibility, and drivers of behavior. Based on the Kaiser criterion, we extracted all factors with eigenvalues higher than one and applied an oblique rotation (direct oblimin method). Items that had factor loadings of 0.40 or higher were considered satisfactory.[19] Analyses were first performed

separately for Norwegian and Polish adolescents and then for the whole sample. Only analyses on the whole sample are presented in order to present a sufficient number of participants in the final analyses.[20] The results show the sub-concepts derived from PAF for each of the three main concepts.

To assess the psychometric properties of the factors derived from the factor analyses, the internal reliability of the factors was calculated by corrected item-total correlation (CITC) and Cronbach's alpha (α). CITC values above 0.30 were considered good,[21] and values that were lower than 0.15 were considered unreliable because that would indicate lack of homogeneity of the items within an item pool.[22] Cronbach's alpha values of 0.70 or higher were considered satisfactory.[21]

Test–retest was assessed on the total score of each factor that derived from PAF, The test–retest reliability was assessed using the intra-class correlation coefficient (ICC) for agreement between the measures. ICC values above 0.70 indicated good reliability and values less than 0.50 indicated poor reliability.[21,23]

The statistical software package IBM SPSS Statistics version 27.0 was used for all the statistical analyses.

3 | RESULTS

3.1 | Background characteristics

Selected characteristics of the respondents are presented in Table 2. A total of 328 Norwegian and Polish adolescents from the alliances and control groups participated in the baseline study. The adolescents were aged between 14 and 23 with a mean age of 16.7 (± 1.0). A higher proportion of females (73%) participated compared with males (26%). Most of the adolescents were born in Norway or Poland. Around 43% were or had previously been active members of a political or nonpolitical organization (e.g., a student government at school and scouts). A 10% of the adolescents had a low FAS score, and 56% had a high FAS score.

3.2 | Factor analysis

Separate analyses were performed for readiness for action, responsibility, and drivers of behavior. There were four factors related to readiness for action; ways of expressing political voice (5 items), competence for civic action (5 items), advocacy outcome efficacy (3 items), and knowledge of resources (4 items) (Table 3). Factor loadings for "ways of expressing political voice" ranged from 0.55 to 0.74, 0.61 to 0.83 for "competence for civic action," 0.45 to 0.64 for "advocacy outcome efficacy," and 0.47 to 0.85 for "knowledge of resources." Mean factor scores ranged from 3.09 to 3.82. One item was not included in the final factor structure (factor loading <0.40) and that was "using social networking platforms to discuss a social issue."

Four factors related to responsibility were found: local environment (4 items), private business (2 items), food and drink industry/business (3 items), and government/public policy (3 items), as shown in Table 4. Mean factor scores ranged from 2.84 to 4.04. Five items had a factor loading below 0.40 and were not included in the final

TABLE 2 Background characteristics of the Norwegian and Polish adolescents ($n = 328$) who completed the CO-CREATE baseline questionnaire

Characteristics	Norway ($n = 183$)	Poland ($n = 145$)	Total ($n = 328$)
Age mean (SD)			
Age at recruitment ($n = 327$)	16.9 (1.1)	16.5 (0.9)	16.7 (1.0)
Gender % (n)			
Male	37 (68)	13 (19)	26 (87)
Female	62 (114)	86 (124)	73 (238)
Prefer not to say	1 (1)	1 (2)	1 (3)
Birth country % (n)			
Norway/Poland	87 (159)	99 (144)	92 (303)
Country within Europe	4 (8)	1 (1)	3 (9)
Country outside of Europe	8 (15)	0 (0)	5 (15)
Active member of a political or nonpolitical organization % (n)			
No, and I have never been	76 (139)	32 (47)	57 (186)
No, but previously	9 (16)	32 (47)	19 (63)
Yes	15 (28)	35 (51)	24 (79)
Family affluence score[a] (FAS) % (n)			
Low FAS	4 (7)	19 (27)	10 (34)
Medium FAS	24 (43)	43 (62)	32 (105)
High FAS	71 (129)	37 (54)	56 (183)

[a]Assessment of socioeconomic position using the family affluence scale (FAS) from the health behavior on school-aged children (HBSC) study.

TABLE 3 Items and factor loadings[a], mean value, standard deviation (SD), corrected item-total correlation (CITC), and Cronbach's alpha (α) for the factors derived from the principal axis factoring reported by adolescents from Norway and Poland in the CO-CREATE baseline study ($n = 328$)[b]

Readiness for action	F1	F2	F3	F4	Mean[c]	SD	CITC	α
Factor 1 (F1): Ways of expressing political voice					3.09	0.89		0.80
I would feel comfortable giving a public talk to a group of people I do not know about a social issue	.74				2.93	1.25	0.61	
Discussing my views in a group of people I do not know about a social issue	.70				3.38	1.10	0.59	
Interviewing adults to learn their perspectives about a social issue	.70				3.53	1.18	0.61	
Contacting (calling or emailing) someone in a position of influence about a social issue	.59				3.07	1.17	0.56	
Doing an interview on radio, TV, or websites about a social issue	.55				2.56	1.28	0.57	
Factor 2 (F2): Competence for civic action					3.41	0.96		0.89
Contact a local newspaper to get them to address a social issue		.61			3.64	1.14	0.64	
Organize a petition to address a social issue		.83			3.62	1.14	0.76	
Organize a meeting to address a social issue		.83			3.40	1.17	0.78	
Organize a demonstration/strike to address a social issue		.76			3.19	1.19	0.71	
Organize a campaign to get local decision-makers to make changes that solve social issues		.78			3.22	1.13	0.74	
Factor 3 (F3): Advocacy outcome efficacy					3.13	0.76		0.65
I have a pretty good understanding of important social issues present in my local area			.64		3.37	0.96	0.50	
I believe I can make a difference in my local area			.45		3.32	1.02	0.42	
I know how policies are made in my local area			.59		2.71	0.99	0.46	
Factor 4 (F4): Knowledge of resources					3.82	0.77		0.78
I know where to find trustworthy information about overweight and obesity				.47	3.83	1.01	0.47	
Prevent overweight and obesity				.70	3.40	1.14	0.63	
Promote healthy diet				.85	3.83	1.00	0.64	
Promote physical activity				.77	4.23	0.79	0.63	

[a]Only items with factor loadings >0.4 are displayed.
[b]Varied slightly for the different factors ($n = 321–327$).
[c]Responses were given on 5-point scales ranging from *strongly disagree* (=1) to *strongly agree* (=5) with a neutral midpoint.

factor structure. These were "each individual," "schools," "companies that help people diet," "transportation companies," and "town and city planners."

Table 5 shows the factors derived from the analyses on drivers of behavior. A total of five factors were identified: access to unhealthy food (3 items), barriers to healthy food and PA opportunities (3 items), social media (2 items), knowledge/understanding (2 items), and motivation and coping (2 items). The mean factor scores ranged from 3.06 to 4.23. "increased use of motorised transportation," "biological factors," "lack of time to lead a healthy lifestyle," "the lack of policies on preventing overweight and obesity," and "lack of focus on healthy lifestyle among friends and family" were not included in the final factor structure (factor loadings <0.40).

3.3 | Internal reliability

Cronbach's alpha was determined to assess internal consistency. Six of the factors satisfied the criterion of 0.70 or higher, ranging from 0.78 to 0.93 (Table 2–4). Five factors had a value between 0.60 and 0.70, and the remaining two factors were below 0.60. The CITC was above 0.30 for 39 of the 41 items. The remaining two items had a value of 0.27.

3.4 | Test–retest reliability

A 39 Norwegian adolescents participated in the test–retest study. The participants were 17 and 18 y old (17.9 ± 0.3). There were 59% males

TABLE 4 Items and factor loadings[a], mean value, standard deviation (SD), corrected item-total correlation (CITC), and Cronbach's alpha (α) for the factors derived from the principal axis factoring reported by adolescents from Norway and Poland in the CO-CREATE baseline study ($n = 328$)[b]

Responsibility	F1	F2	F3	F4	Mean[b]	SD	CITC	α
Factor 1 (F1): Individual/collective—local environment					4.04	0.63		0.63
Family and friends	.54				4.12	0.80	0.39	
The media	.46				4.01	1.01	0.41	
Gyms/leisure centers	.54				4.00	0.89	0.41	
Health care professionals	.45				4.03	0.93	0.45	
Factor 2 (F2): Individual—private business					2.84	0.84		0.67
Employers		.60			2.91	0.93	0.50	
Farmers		.65			2.77	1.01	0.50	
Factor 3 (F3): Collective—food and drink industry/business					3.39	0.98		0.78
Food and drink manufacturers			−.78		3.41	1.28	0.67	
Supermarkets			−.78		3.50	1.18	0.70	
Restaurants			−.46		3.26	1.06	0.52	
Factor 4 (F4): Collective—government (public policy)					3.45	1.02		0.93
The government (national level)				.80	3.42	1.13	0.82	
The government (regional level)				1.03	3.42	1.07	0.92	
The government (local level)				.84	3.51	1.06	0.82	

[a]Only items with factor loadings >0.4 are displayed.
[b]Varied slightly for the different factors ($n = 325–326$).
[c]Responses were given on 5-point scales ranging from *strongly disagree* (=1) to *strongly agree* (=5) with a neutral midpoint.

TABLE 5 Items and factor loadings[a], mean value, standard deviation (SD), corrected item-total correlation (CITC), and Cronbach's alpha (α)for the factors derived from the principal axis factoring reported by adolescents from Norway and Poland in the CO-CREATE baseline study ($n = 328$)[b]

Drivers of behavior	F1	F2	F3	F4	F5	Mean[c]	SD	CITC	α
Factor 1 (F1): External—access to unhealthy food						4.23	0.70		0.63
High access to unhealthy food	.69					4.45	0.80	0.45	
Marketing of unhealthy food	.63					4.16	0.89	0.51	
Unhealthy food is cheap	.45					4.09	1.06	0.38	
Factor 2 (F2): External—barriers to healthy food and PA opportunities						3.56	0.94		0.63
Limited access to healthy food		.50				3.74	1.27	0.52	
Limited access to physical activity opportunities		.42				3.29	1.35	0.47	
Limited financial resources		.67				3.64	1.10	0.34	
Factor 3 (F3): Internal/external—social media						3.06	0.98		0.48
Being overweight is the new normal			−.55			2.68	1.33	0.32	
Influence from social media			−.53			3.43	1.08	0.32	
Factor 4 (F4): Internal—knowledge/understanding						3.82	0.86		0.80
Lack of knowledge about risk of obesity due to lifestyle choices				−.81		3.76	0.93	0.66	
Lack of understanding of the risk associated with obesity				−.83		3.88	0.95	0.66	
Factor 5 (F5): Internal—motivation and coping						4.18	0.67		0.42
Insufficient personal motivation to act upon knowledge					.52	4.23	0.78	0.27	
Unhealthy coping strategies to stress					.45	4.13	0.89	0.27	

[a]Only items with factor loadings >0.4 are displayed.
[b]Varied slightly for the different factors ($n = 326–328$).
[c]Responses were given on 5-point scales ranging from *strongly disagree* (=1) to *strongly agree* (=5) with a neutral midpoint.

and 41% females participating. Only 10% of the participating adolescents were or had previously been active members of a political or non-political organization. A total of 85% of the participants had a high FAS, and 5% had a low FAS. Table 6 shows the test–retest reliability that was assessed using ICC. The results ranged from 0.46 to 0.87. Seven of the 13 factors had an ICC score above 0.70. One of the factors had a value below 0.50 and that was "ways of expressing political voice."

4 | DISCUSSION

The present study describes the development of the CO-CREATE process evaluation questionnaire and psychometric properties. To our knowledge, this is one of the few studies assessing readiness for action and attitudes toward obesity prevention among adolescents participating in youth-led participatory action research. The process evaluation questionnaire was developed to assess adolescents' readiness to be involved and engaged in dealing with societal issues (in this case obesity) before, during, and after attending activities in CO-CREATE and also to assess if the participation of adolescents in addressing the problem of obesity included a shift in their conceptualization of obesity from an individual problem to a structural or systems problem. A standardized process was followed in the development phase,[10] and our analysis of the questionnaire demonstrated satisfactory results for internal consistency and test–retest reliability.

Exploratory factor analysis identified a total of 13 factors. Items belonging to readiness for action had been divided into different concepts based on the literature.[9,13,14] Due to inconsistency in the ways in which action items were categorized into different concepts in the literature, assigning items to a concept was challenging when developing the questionnaire. However, readiness for action identified four factors that had the same structure as planned for in the development phase. The item "using social networking platforms to discuss a social issue," which was adapted from King et al.[14] had a factor loading below 0.40. The use of social media has grown rapidly and has become an integrated part of daily life. The most active users of social media are adolescents and young adults,[24] and it is also a platform for civic expression and political participation.[25,26] Based on this, the item is considered to be useful to include as a single question in the questionnaire although it did not fit in the factor "ways of expressing political voice."

Responsibility was divided into individual and collective responsibility based on the NHS Health Scotland survey.[15] The Scottish Social Attitudes survey has run annually since 1999; however, the questions in the obesity module in the 2016 survey, which was developed in consultation with NHS Health Scotland had not been asked previously. A number of these questions were derived from the 2015 British Social Attitudes survey,[27] and some were tested on members of the general public to ensure understanding by those of different genders, ages, and employment status.[15] Analyses on this concept resulted in four factors. Three of the items with factor loadings below 0.40 derived from the NHS Health Scotland survey: "each individual," "schools," and "companies that help people diet." According to the NHS Health Scotland survey, a large proportion of the respondents found individuals, schools, and companies responsible for tackling obesity, 85%, 57%, and 25%, respectively.[15] The remaining two items with a loading below 0.40 was included after consultation with the CO-CREATE consortium members: "transportation companies" and "town and city planners." The reason for adding these was to address

TABLE 6 Mean value, standard deviation (SD) and intra-class correlation coefficient (ICC) for each factor in the test–retest among Norwegian adolescents ($n = 39$)[a]

	Test		Retest		
Factor	Mean	SD	Mean	SD	ICC
Readiness for action					
Ways of expressing political voice	3.29	0.92	3.17	0.82	0.46
Competence for civic action	2.91	1.12	2.62	1.11	0.77
Advocacy outcome efficacy	3.18	0.93	3.13	0.89	0.76
Knowledge of resources	3.99	1.10	4.19	0.87	0.86
Responsibility					
Individual/collective—local environment	4.22	0.73	3.76	0.76	0.61
Individual—private business	2.71	1.22	2.51	1.01	0.72
Collective—food and drink industry/business	3.36	1.21	3.08	1.19	0.63
Collective—government	3.68	1.08	3.44	1.18	0.67
Drivers of behavior					
External—access to unhealthy food	3.91	1.00	3.65	0.99	0.83
External—barriers to healthy food and PA opportunities	3.43	1.05	3.38	1.23	0.84
Internal/external—social media	2.67	1.17	2.74	1.08	0.87
Internal—knowledge/understanding	3.47	1.33	3.28	1.17	0.68
Internal—motivation and coping	3.97	0.95	3.55	1.08	0.55

[a]Varied slightly for the different factors ($n = 36$–39).

not only the food environment but also the physical activity environment, as both are relevant for obesity.[28]

Drivers of behavior were divided into internal and external drivers based on the obesity perception and policy survey, a multicountry review and survey of policymakers in 2014.[16] Five factors derived from the analyses, and two of the items with factor loading below 0.40 ("biological factors" and "lack of time to lead a healthy lifestyle") were from the survey, and the remaining three ("increased use of motorised transportation," "the lack of policies on preventing overweight and obesity," and "lack of focus on healthy lifestyle among friends and family") were added after discussions with the CO-CREATE consortium.

Both concepts on attitudes toward obesity prevention identified more factors than anticipated. This may be due to the multiple dimensions of obesity such as genetics, individual behavior, and physical and social environments. The new factors on responsibility may point to beliefs that responsibility for obesity lies with the local environment, private business, or government, and the factors on drivers of lifestyle choices may be related to beliefs accessibility, barriers to healthy food and physical activity opportunities, social media, knowledge, or personal motivation are drivers of behavior. Items with factor loadings below 0.40 may however be relevant to include as single items in the questionnaire, and further testing of the structure should be considered.

The internal consistency of the factors was found to be satisfactory for six factors (0.70). Two factors had a value below 0.6, and these belonged to the concept drivers of behavior ("social media" and "motivation and coping"). A low alpha could be due to a low number of questions, poor interrelatedness between the items or heterogeneous constructs, and if it is low due to poor correlation between items, then some should be revised or discarded.[29] None of the items had a CITC below 0.15, which could indicate that the low number of items in these two factors (two items) may be one of the reasons for the low alpha.

The test–retest showed good or adequate reliability between most of the factors. "Ways of expressing political voice" had an ICC value lower than 0.50. A possible explanation may be that the participants are young and may have difficulty understanding the concept as the participants responding to the test–retest questionnaires did not participate in any CO-CREATE activities. Also, the background characteristics of the participants showed that only a few of the participating adolescents were or had previously been active members of a political or nonpolitical organization.

4.1 | Strengths and limitations

Strengths of the present study are that a thorough step-by-step approach was employed to develop a questionnaire to assess readiness for action and attitudes toward obesity prevention among adolescents across five countries. Web-based surveys have several advantages, such as easy and rapid communication, lower delivery costs, and limited need for data entry,[30] and they may be an easier way to reach adolescents, who tend to be active users of smartphones, tablets, and PCs. Furthermore, throughout the analyses, there were only a few participants with missing data. There are also some limitations concerning this study. Reliability of factor analysis depends on the sample size.[21] Correlation coefficients may fluctuate from sample to sample, and this is much more the case in small samples than large. There are many "rules of thumb," but a sample of 300 or more when performing factor analysis could probably provide a stable factor solution.[20,21] The ideal would have been to perform factor analysis on each country separately; however, due to small sample sizes, exploratory factor analysis was performed using baseline data combined from Poland and Norway only to avoid potential heterogeneity due to country of origin. Information about adolescents who were invited but did not give a response or actively declined to participate was not registered or collected, so it was not possible to assess response rate or selection bias. However, a high proportion of participating adolescents belonged to a high socioeconomic status group based on the FAS score, especially in the test–retest study, which may indicate a lack of diversity among the participating adolescents.

Another limitation may be that the response categories for all items ranged from *strongly agree* to *strongly disagree*. There may have been a mismatch between the response categories, and some of the items included in the questionnaire, making it difficult for the adolescents to answer the questions.

Overall, our findings identified more factors than had been anticipated would be useful for measuring readiness for action, responsibility, and drivers of behavior among adolescents. Further research should be conducted to study these factors to strengthen the reliability and validity of these measures. Nevertheless, this study contributes to the development of measures that can be used to assess adolescents' readiness for action and attitudes within the field of obesity prevention. The measures developed can possibly be adapted by other youth involvement programs working with other complex social issues.

5 | CONCLUSION

The presented study is one of the few studies assessing readiness for action and attitudes toward obesity prevention among adolescents participating in youth-led participatory action research. The study provides insight on the development of the CO-CREATE process evaluation questionnaire and the items measuring readiness for action, responsibility, and drivers of behavior. Analyses on readiness for action identified the same factors as hypothesized, whereas some modifications on responsibility and drivers of behavior should be considered. The questionnaire and the items included is considered valid and reliable as a tool for measuring adolescents' readiness for action and attitudes toward obesity prevention.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

AUTHOR CONTRIBUTIONS

Knut-Inge Klepp, Christian Bröer, Aleksandra Luszczynska, Harry Rutter, and Nanna Lien were involved in designing the CO-CREATE study. Helene Holbæk developed the questionnaire, whereas Anna Banik, Aleksandra Luszczynska, Christian Bröer, Talia Macauley, Harry Rutter, and Nanna Lien were actively involved in the process including pretesting and translation. Navnit Kaur Grewal, Anna Banik, Helene Holbæk, and Talia Macauley conducted the data collection. Navnit Kaur Grewal drafted the paper and was responsible for the analyses. Knut-Inge Klepp and Nanna Lien contributed to the conceptualization of the paper and the interpretation of the analysis. All authors reviewed the paper and contributed to the content. All authors read and approved the final manuscript.

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APPENDIX A

Relevant articles for developing questions measuring readiness for action and changes in attitudes toward obesity prevention and the final items included in the questionnaire

Readiness for action	Reference[9,13,14]
Ways of expressing political voice	
I would feel comfortable giving a public talk to a group of people I do not know about a social issue	Ozer EJ & Schotland M.[9]
Discussing my views in a group of people I do not know about a social issue	Flanagan CA, Syvertsen AK, Stout MD.[13]
Using social networking platforms to discuss a social issue	King et al.[14]
Interviewing adults to learn their perspectives about a social issue	Ozer EJ & Schotland M.[9]
Contacting (calling or emailing) someone in a position of influence about a social issue	Flanagan CA, Syvertsen AK, Stout MD.[13]
Doing an interview on radio, TV, or websites about a social issue	King et al.[14]
Competence for civic action	
Contact a local newspaper to get them to address a social issue	King et al.[14]
Organize a petition to address a social issue	Flanagan CA, Syvertsen AK, Stout MD.[13]
Organize a meeting to address a social issue	Flanagan CA, Syvertsen AK, Stout MD.[13]
Organize a demonstration/strike to address a social issue	Question added after discussion with CO-CREATE consortium
Organize a campaign to get local decision-makers to make changes that solve social issues	King et al.[14]
Advocacy outcome efficacy	
I have a pretty good understanding of important social issues present in my local area	Ozer EJ & Schotland M.[9]
I believe I can make a difference in my local area	Flanagan CA, Syvertsen AK, Stout MD.[13]
I know how policies are made in my local area	Ozer EJ & Schotland M.[9]
Knowledge of resources	
I know where to find trustworthy information about overweight and obesity	Question added after discussion with CO-CREATE consortium
Prevent overweight and obesity	Constance A. Flanagan, A. K. S., and Michael D. Stout[13]
Promote healthy diet	Question added after discussion with CO-CREATE consortium
Promote physical activity	Question added after discussion with CO-CREATE consortium
Attitudes—responsibility	**Reference[15,31]**
Individual	
Each individual	NHS Health Scotland[15]
Family and friends	NHS Health Scotland[15]
Health care professionals	NHS Health Scotland[15]
Employers	NHS Health Scotland[15]
Farmers	Question added after discussion with CO-CREATE consortium

Attitudes—responsibility	Reference[15,31]
Collective	
Schools	NHS Health Scotland[15]
The media	NHS Health Scotland[15]
Gyms/Leisure centers	NHS Health Scotland[15]
Companies that help people diet	NHS Health Scotland[15]
Food and drink manufacturers	NHS Health Scotland[15]
Supermarkets	NHS Health Scotland[15]
Restaurants	NHS Health Scotland[15]
Transportation companies	Question added after discussion with CO-CREATE consortium
Town and city planners	Question added after discussion with CO-CREATE consortium
The government (national level)	Tompson et al.[31]
The government (regional level)	Tompson et al.[31]
The government (local level)	Tompson et al.[31]
Attitudes—drivers of behavior	**Reference[16]**
Internal	
Increased use of motorized transportation	Question added after discussion with CO-CREATE consortium
Being overweight is the new normal	European Association for the Study of Obesity[16]
Biological factors	European Association for the Study of Obesity[16]
Lack of knowledge about risk of obesity due to lifestyle choices	Question added after discussion with CO-CREATE consortium
Lack of understanding of the risk associated with obesity	European Association for the Study of Obesity[16]
Insufficient personal motivation to act upon knowledge	European Association for the Study of Obesity[16]
Lack of time to lead a healthy lifestyle	European Association for the Study of Obesity[16]
Unhealthy coping strategies to stress	Question added after discussion with CO-CREATE consortium
External	
High access to unhealthy food	European Association for the Study of Obesity[16]
Limited access to healthy food	European Association for the Study of Obesity[16]
Marketing of unhealthy food	European Association for the Study of Obesity[16]
Limited access to physical activity opportunities	European Association for the Study of Obesity[16]
Limited financial resources	European Association for the Study of Obesity[16]
The lack of policies on preventing overweight and obesity	Question added after discussion with CO-CREATE consortium
Unhealthy food is cheap	Question added after discussion with CO-CREATE consortium
Influence from social media	Question added after discussion with CO-CREATE consortium
Lack of focus on healthy lifestyle among friends and family	Question added after discussion with CO-CREATE consortium