RESEARCH





A data-driven approach to detect support strategies for children living in households receiving public assistance in Japan: a mixed methods study to establish tailor-made health and welfare care

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Abstract

Background Child poverty adversely affects children's health and social lives. Children in households receiving public assistance have diverse needs regarding their health and lives Therefore, they require tailored support interventions based on individual sociodemographic backgrounds and other personal attributes. However, to the best of our knowledge, no study has identified distinct segments of these children using self-reported data or evaluated the health and social support strategies for the obtained segments. This study aimed to apply a clustering technique to quantitatively identify the distinct segments among children in households receiving public assistance, qualitatively describe the segment characteristics, and suggest potentially effective health and social life support strategies for each segment.

Methods In the quantitative phase, we used the probabilistic latent semantic analysis (PLSA), a machine learningbased soft clustering method, to identify the segments of children aged 10–15 years in households receiving public assistance. We used the segments obtained in the quantitative phase to subsequently conduct seven semi-structured interviews and one focus group with professionals supporting children with complex needs. The interviewees were asked to describe the segment characteristics and propose health and social life support strategies for each segment.

Results In total, 1,275 children were included in the quantitative analysis. PLSA identified all the segments with distinct characteristics that made sense to professionals who supported children in households receiving public assistance, confirmed by qualitative findings: e.g. "children who can do things on their own" (Segment 1), "children living in a facility" (Segment 2), "children who are in *hikikomori* (social withdrawal)" (Segment 3), "children who cannot be bothered to answer conceptual questions about themselves" (Segment 4), and "children from households with intergenerational public assistance use" (Segment 5). The qualitative findings also suggested various support measures not only for physical health but also for the social and mental health of children in households receiving public assistance, for example, "financial support for higher education" for Segment 1, and "whole family support" for Segment 5.

Conclusions Children in households receiving public assistance can be categorized into distinct segments and would consequently benefit from tailored support strategies for their health and social lives.

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Keywords Child health, Public assistance, Segmentation, Mixed methods study, Soft clustering, Tailored support

Background

Childhood poverty is a major global issue. In highincome countries, one in every five children lives in relative poverty [1]. The Organization for Economic Cooperation and Development (OECD) defines poverty rate as the percentage of people whose income is below the poverty line, which is half of the median household income for the entire population. In 2018, Japan's relative child poverty rate was higher than the average rate of the OECD member countries (14.0% and 12.8%, respectively), and it was highly ranked among the seven industrialized countries (G7) [2]. The relative poverty rate of Japanese single-parent households with children is the second worst among OECD countries (50.8%).

Poverty is not simply a lack of income but also a multifaceted deprivation of respect from others and self in society, human rights, and social connections [3]. Townsend developed a deprivation index that is an indicator of poverty [4] and is currently used mainly in Europe as a way to complement the relative poverty rate. The index lists items, such as material goods, services, interaction with friends, lifestyle, that people enjoy as a standard in society; among these, the number of items that the individuals cannot afford/access is added [5]. Many studies have applied the deprivation index to assess child poverty in various countries [6-9]. However, in Japan, only a few studies have reported child poverty using this index [10, 11]. Therefore, child poverty in Japan is yet to be assessed multidimensionally.

Numerous studies have reported that poverty negatively impacts children's health. Herein, we referred to the World Health Organization's (WHO's) definition of health — "Health is a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity" [12]. Child poverty has multidimensional aspects and is associated with various chronic diseases; including obesity [13], asthma [14, 15], chronic kidney disease [16], and mortality [17]; lower educational attainment; poor social relationships [18–20]. Furthermore, childhood poverty is also associated with poor physical and mental health, disability, and mortality in adulthood [21–23].

Although child poverty is an aspect of poverty in society, there are two important reasons for addressing it. First, we need to understand the lives and experiences of children living in poverty to formulate policies that aim to reduce poverty and properly meet children's needs [24, 25]. Second, interventions during childhood can improve children's well-being and consequently enhance healthy adulthood and healthy aging because childhood poverty affects health outcomes in adulthood, as mentioned previously [26].

Social assistance can be considered a reliable indicator of poverty [27]. Approximately 1.6% of the population in Japan is enrolled in a public assistance program (Seikatsu-hogo in Japanese) [28], and 9.6% of them are aged < 19 years [29]. The public assistance program is a welfare program offered by the government designed to guarantee a minimum living standard for people below the poverty line. The municipal welfare office assesses people's eligibility for public assistance by completing a comprehensive means test that examines their assets, ability to work, financial assistance from family members, and use of other social programs. In addition to complete exemption from medical and long-term care expenditures, eligible households can obtain monthly financial assistance. Children of public assistance households are eligible for educational assistance. Expenses for school supplies, class fees, extracurricular club activities, and school lunches are provided to children enrolled in elementary and junior high schools [30].

Children in households receiving public assistance receive in-kind and financial assistance; however, their non-material support is inadequate. These children are more likely to need support for health and social life issues than the general population. For instance, a Swedish cohort study demonstrated that children in households receiving long-term social assistance showed less favorable physical outcomes (all-cause mortality, suicide attempts, alcohol, and drug misuse) and social outcomes (low educational attainment and social assistance in young adulthood) than the rest of the population [27]. Another cross-sectional study from Japan showed that children in families receiving public assistance were more likely to refuse to go to school than those in nonrecipient families [31]. Moreover, disparities in children's health statuses have been observed among those living in households supported by public assistance. A Japanese retrospective cohort study of children in households receiving public assistance revealed that the prevalence of chronic diseases, such as asthma, allergic rhinitis, dermatitis, eczema, and dental diseases, was higher among those living in single-parent households than in non-single-parent households [32]. These findings suggest that children in such households have diverse needs regarding their health and social lives, and thus require tailored health and social life support interventions based on individual sociodemographic backgrounds and other personal attributes.

In Japan, several welfare offices have implemented model projects to support the health and social lives of children and their caregivers in public assistance households since 2018 [33]. Since 2021, a healthcare support program has been implemented to provide health and social care to public assistance recipients of all ages [34]. This program mandates welfare offices to support the health and social lives of public assistance recipients to enhance their health and quality of life. One of the main obstacles in conducting this program is prioritizing targets for support interventions and care planning [35]. Another obstacle is the strenuous task for caseworkers to understand the health and social life of children living in households receiving public assistance. The caseworkers are local government officials in municipal welfare offices. Their tasks mainly comprised administrative tasks, including processing paperwork regarding protection applications and providing public assistance, and assistance through regular home visits and interviews with public assistance recipients. Caseworkers are responsible for an average of 84 households receiving public assistance, and they are preoccupied with their daily duties [36]. In addition, caseworkers at welfare offices are replaced every few years, which makes assistance activities challenging, particularly for new caseworkers [37]. Furthermore, many caseworkers working in welfare offices lack sufficient experience to support children in households receiving public assistance because they mainly focus on supporting the head of the public assistance household and do not have the chance to meet their children who go to school during the home visits. Therefore, innovative approaches should be developed to determine targets and provide appropriate support interventions for children in households receiving public assistance.

As uniform support interventions are not targeted at specific people based on their needs, some people cannot benefit from them. Hence, to offer tailored support interventions to targeted individuals based on their needs, we applied business and social marketing theories and practices [38, 39] wherein the intervention begins by determining the "audience"-that is, certain people or populations to be targeted-then generates a"marketing mix": product, price, place, and promotion of the services to be offered. A marketing mix is created to fit the interests and characteristics of the identified audience. The vital process for selecting prioritized audiences is "segmentation." Segmentation is the process of dividing a population into distinct subgroups of people (segments) with similar characteristics or needs, and it offers appropriate supportive interventions for targeted segments. Theoretically, offering support tailored to each segment is a practical strategy for meeting specific needs [40, 41].

Clustering is a statistical technique widely used to identify homogeneous subgroups within a heterogeneous population. It is an unsupervised classification in which all independent variables are considered simultaneously [42]. The key elements of good segmentation are as follows: the segments should exist in the real world rather than simply being statistical constructs, which means that the segment characteristics should make sense to the people who will utilize them; a manageable number of segments needs to be in the range of three to eight; and the identified segments should not be the final result but have room to add new findings. These elements need to be considered during segmentation [38].

Although the concept of segmentation has not been cited, numerous studies have employed approaches to segment children from impoverished households into distinct subgroups by health, including sleep patterns, psychiatric symptoms, maltreatment, or trauma/violence exposure [43-47]. Furthermore, many studies have identified subgroups of children experiencing multidimensional poverty by employing unsupervised classification techniques such as hard clustering or latent class analysis [48-53]. However, to the best of our knowledge, no study has identified distinct segments of children receiving public assistance, particularly using self-reported data. Furthermore, no previous reports have evaluated the health and social support strategies for the obtained segments. Therefore, using a self-reported questionnaire survey, this study aimed to employ segmentation and a clustering technique to identify distinct segments within the population of children living in households receiving public assistance in Japan. We also aimed to describe the segment characteristics and determine the health and social life support strategies for each segment using a qualitative approach.

Methods

Study design

An explanatory sequential mixed methods design was used [54] wherein a quantitative phase is conducted first, and subsequently, a qualitative phase is implemented to help explain the quantitative results in more depth. This study comprised two phases: a quantitative phase identifying the segments of children in households receiving public assistance and a qualitative phase involving interviews with their supporters.

Quantitative phase

Data

We used cross-sectional data collected through a questionnaire survey of children aged 10–18 years living in households receiving public assistance in Japan as of January 2019. This survey was conducted to investigate the living conditions of children in households receiving public assistance. We selected children aged 10-15 years as the study population for the analysis because their positions in the public assistance program and the support they may receive differed before and after junior high school. That is, children aged 15 years at the end of compulsory education (i.e., when they graduate from junior high school) are deemed to be of working age under Japan's public assistance system and need to work rather than pursue higher education. Enrollment in high school has been accepted as part of "occupational assistance," with a view that it will help them become self-sufficient [55]. We used questionnaire survey data, including age, sex, household composition, sociodemographic characteristics, lifestyle, family life, school life, and subjective information. A research Institute in Japan conducted this questionnaire survey and acquired data. As of January 2019, 140 of the 1,334 welfare offices across Japan agreed to participate in this survey and mailed the survey to public assistance households with children aged <18 years. We used 42 items in this survey, excluding those on height, weight, number of cavities under treatment, waking and sleeping hours, monthly income from employment, and reasons for learning support. All responses to the items were categorical (see table, Additional file 1).

Statistical analysis

Descriptive statistics were used to summarize participants' baseline characteristics. Using probabilistic latent semantic analysis (PLSA), we identified segments of children aged 10–15 years in households receiving public assistance. PLSA was originally developed for document classification and assumes latent clusters (segments) between documents and appearing words to be common topics [56]. The reason for using PLSA in this study is that, compared to latent class analysis (LCA), it assigns two columns of data to each segment simultaneously, and the degree of affiliation of each data to the segments is given based on the probability in a one-step method. In addition, the analytical model is stable even with a large number of variables [57]. LCA is a widely recognized statistical method that assigns individuals to latent classes based on their probability of being in classes, which is determined by the pattern of scores they have on categorical variables (also known as indicator or manifest variables). It provides estimates of class probabilities for each individual belonging to each class (posterior probabilities) [58]. In many LCA studies, it is common to conduct a classify-analyze approach that involves classifying individuals into latent classes using posterior probabilities and then performing a subsequent analysis to estimate the relation between latent class membership and the variables of interest [59]. However, this approach often attenuates the estimated associations between the latent class variable and other variables in the final analytical model [60]. To deal with this problem, an "inclusive" LCA has been proposed [60, 61]. In this approach, all variables to be included in the final analytical model are included as covariates in the classification model; that is, the analysis used to obtain the posterior probabilities is generalized to include all variables used in the final analytical model. However, the analytical model becomes unstable when the number of covariates is large, which requires the selection of covariates [62].

In this study, we used IDs of participants and items (hereafter referred to as variables) obtained from a questionnaire survey of children aged 10–15 years living in households receiving public assistance for two columns of data (Fig. 1). We assume that the ID of a participant (*i*) is characterized by variable (ν) through the latent variable *z* and define its joint probability using the following equation:

$$\mathbf{P}(_{ii,vj}) = \sum_{k=1}^{K} P(_{zk}) \mathbf{P}(_{vi|zk}) \mathbf{P}(_{ij|zk})$$

P(z), P(v|z), and P(i|z) were calculated using the Expectation Maximization (EM) algorithm, which maximizes the log-likelihood function [63]. This method provides



Fig. 1 Probabilistic Latent Semantic Analysis (PLSA). PLSA assigns two columns of data (IDs of participants and variables) to each segment, and the degree of affiliation with the segment is given based on probability

flexibility to individuals and variables belonging to more than one segment and hence is soft clustering.

In this study, the number of segments was increased from 3 to 8 by changing the initial value five times. In soft clustering methods, no single fit index determines the optimal number of segments [64, 65]. Therefore, the recommended procedure for deciding the number of segments should be to jointly consider statistical fit indices, interpretability, and utility [66, 67]. In this study, we used the Akaike information criterion (AIC) [68], segment size [64], and interpretability of the segments [66, 67, 69]. A variable with a higher affiliation probability to a segment indicates the segment characteristics [57]. However, there is no fixed value for "high" affiliation probability. Therefore, we used variables with an affiliation probability of ≥ 0.50 to interpret and describe the segment characteristics because the same variable may belong to another segment with the remaining ≥ 0.50 probability if the affiliation probability threshold for a variable that characterizes a segment is set at ≤ 0.50 .

We used Alkano (NTT Data Mathematical System Inc., Tokyo, Japan) for PLSA and STATA SE V.17.0 (Stata Corp., College Station, Texas, USA) for other statistical analyses.

Qualitative phase

Data

Interviewees were selected purposively from professionals with at least 3 years of experience supporting children with complex needs, including those in households receiving public assistance. Between February and December 2023, the first author, a female physician with clinical experience of 21 years, who had also been trained as a qualitative researcher, conducted seven semistructured interviews and one focus group via a video Zoom conference (Zoom Video Communications Inc., CA, USA). The interviewer did not know the interviewees before the study was conducted. Written informed consent was obtained from all interviewees before participating in this study. They participated in the interview voluntarily and were told they could withdraw anytime.

An interview guide was used for the interviews (see text, Additional file 2). First, the interviewees were asked whether they could think of children aged 10–15 years in households receiving public assistance with similar characteristics in each segment by showing the segments obtained in the quantitative phase. Subsequently, interviewees were asked to describe the segment characteristics and recommend support strategies for each segment. The interviews mostly included open-ended questions to encourage the interviewers to express their ideas. The interviews were conducted, audio recorded, and

transcribed in Japanese. Every interviewee's confidentiality and privacy were ensured during the interview.

Data analysis

All interview data were translated from Japanese into English. Next, we analyzed the data using the qualitative descriptive method described by Yin [70]. After reviewing the verbatim transcripts, text segments were divided into codes. All the identified codes were evaluated and compared to determine content overlap and similarity. The codes were then classified into themes based on similarities and differences. All authors discussed and reviewed the transcribed data and themes throughout the process to establish credibility and trustworthiness. MAXQDA 2022 (VERBI GmbH, Berlin, Germany) was used for the data analysis. Finally, to strengthen the credibility of the results, we asked several interviewees to review a preliminary report for any discrepancies from what they intended.

Integration of quantitative and qualitative results

A joint display that integrated quantitative and qualitative results into a single table was created to show how the qualitative results provided a good explanation and understanding of the quantitative findings [54, 71].

Results

Quantitative results

In total, 10,917 public assistance households with children aged <18 years from 140 welfare offices participated in the survey. From these, 1,972 children aged 10-18 years responded to the questionnaire. Finally, the responses of 1,275 children aged 10-15 years were included in the analysis. Response rates could not be obtained for this questionnaire survey because two copies of the questionnaire were mailed to each eligible household, and there was no data on how many children lived in each household and responded to the questionnaire. The participants' basic characteristics are listed in Table 1. The proportion of boys was almost the same as that of girls. Many participants were from single-mother households and elementary or junior high school students. We included item nonresponse (missing values) in the analysis because we believed they could also represent significant responses from children. The table in Additional file 3 shows the complete characteristics of the participants.

A five-segment model of children aged 10–15 years in households receiving public assistance was determined to be optimal after conducting the PLSA and evaluating the criteria described in the Methods section. Although the lowest AIC value was obtained in the three-segment model, we could not describe the characteristics of each

Table 1 Basic characteristics of partici	pants (<i>n</i> = 1,275)
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Variables		n (%)
Sex	Boys	595 (46.7)
	Girls	649 (50.9)
	Missing	31 (2.4)
Age (years) ^a	10	194 (15.2)
	11	194 (15.2)
	12	203 (15.9)
	13	186 (14.6)
	14	232 (18.2)
	15	266 (20.9)
House composition	Single-mother household	962 (75.5)
	Single-father household	45 (3.5)
	Two parent household	180 (14.1)
	Household living with grandparent(s)	64 (5.0)
	Household living with another person(s)	3 (0.2)
	Other types of households	2 (0.2)
	Missing	19 (1.5)
Attendance status in school	Go to school	1,042 (81.7)
	Tend to skip school often	229 (18.0)
	Dropped out of school	3 (0.2)
	Missing	1 (0.1)
The school I am enrolled in	Elementary school	544 (42.7)
	Junior high school	662 (51.9)
	High school, technical college, or vocational school	45 (3.5)
	Other schools	9 (0.7)
	Not applicable	4 (0.3)
	Missing	11 (0.9)
Employment status	Job hunting or currently seeking a job	1 (0.1)
	Not job hunting	1 (0.1)
	Not applicable	1,272 (99.8)
	Missing	1 (0.1)

PLSA Probabilistic latent semantic analysis

^a Age is not used in the PLSA analysis

segment because of multiple variables from each segment. Next, the segment size and interpretability of segments were considered. The five-segment model was determined to be optimal after discussing the results of the analyses among the authors and professionals (physicians, epidemiologists, social workers, and welfare researchers) and reaching a consensus (see details in Additional file 4).

Figure 2 shows variables with an affiliation probability of ≥ 0.50 in the five-segment model for children aged 10–15 years in households receiving public assistance.

Qualitative results

Seven professionals participated in the semi-structured interviews, and three were in the focus group. Their

years of experience supporting or having supported children with complex needs ranged between 5 and 30 years, with an average of 15.2 years (Table 2). The mean duration of the interview was 59.5 min. The focus group sessions lasted 80 min. According to Malterud's concept of "information power," the number of interviewees in qualitative interview studies depends on their information, which is relevant to the actual study [72]. Ten interviewees were considered adequate because this study's objective was specific, and they belonged to a specific group that supported children with complex needs.

Themes on the segment characteristics of children aged 10–15 years in households receiving public assistance and recommended health and social life support strategies emerged in each segment. Key findings are



Fig. 2 Variables in the five-segment model for children aged 10-15 years in households receiving public assistance. **A** Segment 1, **B** Segment 2, **C** Segment 3, **D** Segment 4, and **E** Segment 5. Note: Variables with an affiliation probability ≥ 0.50 are listed in the figure.

presented in Table 3 and are also discussed in the following sections. The complete results and quotes are shown in Additional file 5.

Integration of quantitative and qualitative results

Table 3 presents a joint display of the quantitative and qualitative results regarding the five-segment model for children aged 10–15 years in households receiving public assistance. The interviewees described distinct characteristics of all identified segments and proposed various support strategies for each segment.

Segment 1

The interviewees mentioned that children aged 10–15 years in households receiving public assistance were described as "children who can do things on their own," "children who have difficulty relying on others," "children who possess high intellectual ability and self-esteem," or "children who are eager to learn."

They seem to be quite responsible and independentminded. I think they are the type of person who can handle various tasks independently by researching

	Page	8	of	1	7
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ID	Sex	Present occupation (Previous occupation)	Years of experience
Focus group (/	n = 3)		
1	Female	Support staff at the Support Center for Children and Youth	15
2	Female	Support staff at the Support Center for Children and Youth (Support staff of welfare office)	16
3	Female	Support staff at the Support Center for Children and Youth (Support staff for the support center and welfare office)	16
Semi-structure	ed interviews ($n = 7$)		
4	Female	Psychological counselor	10
5	Female	Manager of NPO to support "Children's cafeteria"	9
6	Female	School social worker (Child welfare officer)	4
7	Female	Pediatric psychiatrist	22
8	Female	Pediatric psychiatrist	25
9	Male	Support staff for the non-profit organization	3
10	Female	Public health nurse	30

Table 2 Characteristics of interviewee
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things they don't understand or tackling challenges independently. (ID 4)

One recommended support strategy for children in Segment 1 was "supporting them by showing concern," because they tended to perform tasks independently and had difficulty relying on others, especially those from a single-father household.

We need to care about these children, right? I think we do more so because they are from a single-father household. I worry about them. Fathers and their children do not often come to me for advice. (ID 1)

Other support strategies proposed by the interviewees included "free after-school place where they belong" and "financial support for higher education" to create an environment conducive to learning.

For these children, I think it would be beneficial to have scholarships or tuition reduction programs available. (ID 8)

Segment 2

The interviewees described the children in Segment 2 as "children living in a facility," "children living with their relative(s)," or "children living with their foster parents." They reported that the adults who resided with these children ensured they attended school regularly and maintained good health.

You know, they are children in facilities, are they not? Their health is managed, and they are made to go to school, but it makes sense that they do not have the characteristics of what they want to do or be, does it not? (ID 1)

I think they are children who are left with their relative(s) and go to school because they have nowhere else to go. (ID 2)

Interviewees reported various support strategies for the children in Segment 2. However, some expressed concern about forming attachments with these children, given their living arrangements with others, and suggested providing "support to foster interpersonal relationships."

One interviewee mentioned that children in Segment 2 would require "support for experiencing diverse and enriching pleasures together" as this segment lacked the characteristics associated with motivation for life.

I believe that support for children in Segment 2 is not about going to school or not going to school but about building experiences with them to have diverse and rich enjoyment in their lives. (ID 1)

Another interviewee highlighted that children residing in a childcare facility or under the care of foster parents would benefit from "a place where they could vent their frustrations and share their worries," fostering an atmosphere where they feel comfortable voicing complaints.

Segment 3

Many interviewees characterized the children in Segment 3 as "children who were in *hikikomori* (social withdrawal)," observing their tendency to have their rooms, a history of non-attendance at school, and a habit of skipping dinner.

I think of children who usually stay in their rooms, particularly because one of their characteristics is that they do not eat dinner. (ID 8)

Table 3 Joint display	of quantitative and qualitative findings regarding the five-segme	ent model	
Segment	Quantitative results	Qualitative results	
		Segment characteristics of children	Recommended support strategies
-	(A)	- Can do things on their own - Have difficulty relving on others	- Supporting them by showing concern - Free after-school place where they helong
	1 am proficient at presenting my datas in from of people. 1.00 1 am proficient at exploring what1 do not know.	- Possess high intellectual ability and self-esteem - Fager to learn	- Financial support for higher education - No support is required
	1 am proficient at taking the time to tackle with difficult problems.		
	l am in a single-father household. 0.86		
	I go to high school, technical college, or vocational school.		
	I think I am a worthy person.		
	My future goal is clear.		
	No answer regarding house composition		
	0.00 0.20 0.40 0.80 1.00 Affiliation probability		
2	(B)	- Living in a facility	- Support to foster interpersonal relationships
	1 am in a household living with other person(s) 1 am in a household living with other person(s) 1 am in a household living with other person (s) 1 am in a household living with other p	 Living with their relative(s) Living with their foster parents 	- Support for experiencing diverse and enrich- ing pleasures together
	The school I am emoled in is elementary school.		 A place where they can vent their frustra- tions and share their worries
	No answer regarding the school they are emoled in 0.57		- Support to be independent financially
	I have no history of non-attendance at school.		
	I go to school		
	My overal health is excellent.		
	0.00 0.20 0.40 0.80 1.00 Affiliation probability		
m	(c)	- Are in <i>hikikomori</i> (social withdrawal)	- Support for listening attentively to them
	A designated study room is provided at home. 100 I have my own study desk at home. 100	- Experiencing neglect	- Presence of non-family adults for continuous interaction
	A children's room is provided at home. 1.00		- Parenting support for their caregivers
	No answer regarding attendance status for school 1.00 No answer regarding sex 0.70		
	Sometimes I do not eat dinner.		
	I have a history of non-attendance at school.		
	My family does not encourage me when I fail. 0.55 I do not hister I am a worthy presson		
	I often tend to skip school. 0.54		
	I do not cosume vegetables excluding school lunches.		
	0.00 0.20 0.40 0.60 0.80 1.00 Affiliation probability		

Table 3 (continued)			
Segment	Quantitative results	Qualitative results	
		Segment characteristics of children	Recommended support strategies
4	(D)	- Cannot be bothered to answer conceptual gues-	- Support to help them think about them-
	an cohurtaacuuraite	tions about themselves	selves tonether
	To which a more than the second secon		Current for independence
	i de entre		- מחלולתור ותו ווותבליבוותבוורב
	13) The second to the second to the second to the second s	 Lack the ability to reflect on themselves 	
	No arten: "sparlig for our for of the second mean mean when we have a for a containty sub-addition in the second means we want the second means we are local from some our above a second means of the second	- (I cannot recall any children from this seament.)	
	No accurate accurate constant accurate		
	An extreme whether 1 every blog		
	Varyen which with spectral with spectral day		
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	CC1 Ko 26 X 20 X		
	0.00 0.20 0.40 0.60 0.80 1.00		
5	(E)	- From households with unfavorable child-rearing	- Whole family support
	No destimated attrov room is provided at home.	omvironmonte	Cuppert for evention ciper events
	I do not have my own study desk at home.		
	No children's room is provided at home.	 From households with intergenerational public 	 Assistance in acquiring basic lifestyle habits
	I do not consume mest or fish, exclusing school functies.	assistance use	 Providing self-study spaces
	No answer regarding employment status	- I ach anaraw and hone for life	- Maal support
	I consume ready-fo-est food from convenient stores more than fruit trues per week	- במרא בוובו לא מווט ווטטיב וטו וווב	
	I do not have my own books. 0.56	- Have many siblings	
	I do not bathe every day. 0.54		
	l am in other houschold. 0.53		
	I do not porform tasks that I cam capable of accomplicing.		
	I consume vegetables loss than three times per veck, excluding school functios.		
	It'y family does not support what I wish to do. 0.51		
	My overall treatth is poor.		
	I do not eat breakfast every day. 0.50		
	I do not brush my teeth every day.		
	0.00 0.40 0.60 0.80 1.00 Additionant concentration		



Some interviewees referred to the children in this segment as "children experiencing neglect" due to their families' failure to provide them with regular meals.

Perhaps their parents do not cook. This is not due to a lack of appetite or poverty but rather because they are unable to make meals; for example, they are on medicine and in bed. In this circumstance, their children may be unable to ask them to prepare meals. (ID 5)

The interviewees emphasized the need for "support for listening attentively to them" and "presence of non-family adults for continuous interaction" for the children in Segment 3. They highlighted the necessity of psychological support for those who perceived themselves as experiencing *hikikomori* or neglect.

It is crucial for us (supporters) to remain determined and try to connect with the children, even if they want to end the relationship. Despite such an attitude, I believe it is important to be ready to support them whenever they ask for assistance. (ID 4)

In addition, some interviewees observed that "parenting support for their caregivers" was required as a support strategy.

Segment 4

The interviewees described the children in Segment 4 as "children who cannot be bothered to answer conceptual questions about themselves" or "children who do not understand the topic being discussed." This observation was based on the prevalence of unanswered questions associated with this segment's characteristics.

Because there were so many unanswered questions, I wonder if they had become bothered to answer them or tired of answering them. I guess that they can answer yes or no questions, but it may be tedious for them to answer the questions that they need to think about. (ID 4)

I believe they could not understand what they were being asked, and while they could answer specific questions like selecting boys or girls, they could not answer more abstract problems. (ID 8)

Some interviewees identified these children as "children who lacked the ability to reflect on themselves," noting that they appeared to have never considered themselves, which manifested in their minimal responses to questions.

These children tended to stop thinking about who they were in elementary or junior high school. In other words, many did not think about themselves well. I guess they felt that any answer was fine, so they responded this way. (ID 9)

Conversely, three interviewees refrained from describing the segment's characteristics, because they could not recall any children aged 10–15 years from households receiving public assistance from this segment.

It is difficult to understand the characteristics of this segment. Several types of children appear to fall under this segment, do they not? (ID 5)

The interviewees recommended offering "support to help them think about themselves together" as a support strategy for the children in Segment 4. This suggestion stems from children expressing feelings of not adequately contemplating themselves or lacking clarity about their identities.

These children do not know how to live their lives and do not know themselves at all, so I think they need support in "increasing their resolution" (finding out who you are). (ID 1)

It would be helpful for children with many unanswered questions to have someone to discuss with them about themselves and why they have so many unanswered questions. (ID 4)

Some interviewees also proposed providing "support for independence" to help children find a better path toward self-sufficiency with the assistance of supporter(s).

Segment 5

The interviewees described the children in Segment 5 as "children from households with unfavorable child-rearing environments." These children lacked basic lifestyle habits due to caregivers' neglect or inattention to them for various reasons.

It is like the parents do not have the extra energy to care for their children. For any reason, they are totally unable to care for their children. They do not even cook. These families have to live in very small places. It is sad. (ID 5)

Some interviewees described these children as "children from households with intergenerational public assistance use," suggesting that their lack of basic lifestyle habits indicated a pattern passed down from their parents, who likely grew up in a similar living environment.

The persona that comes to mind is children from families with intergenerational public assistance (use). Their grandparents have been on public assistance, as have their parents. I think having a healthy lifestyle is not part of the customs of these families. (ID 1)

These children were also portrayed as "children who lacked energy and hope for life" or "children who had many siblings."

In Segment 5, the interviewees emphasized the necessity of support for the children and the entire family: "whole family support."

In many circumstances, the entire family needs to be supported. We also help caregivers in parenting. We occasionally consult with a child guidance center. (ID 1)

The interviewees also highlighted support strategies such as "support for experiencing events," "assistance in acquiring basic lifestyle habits," "providing self-study spaces," and "meal support" for children in Segment 5.

Some children have never participated in events. They have never been to beaches, rivers, or mountains. I suppose they have been in this situation all along. (ID 7)

Discussion

Using soft clustering analysis, we identified five distinct segments of children aged 10-15 years in households receiving public assistance. From the interviews, professionals supporting children with complex needs could describe the distinctive segment characteristics for all extracted segments; e.g. "children who can do things on their own" (Segment 1), "children living in a facility" (segment 2), "children who are in hikikomori" (Segment 3), "children who cannot be bothered to answer conceptual questions about themselves" (Segment 4), and "children from households with intergenerational public assistance use" (Segment 5). They also proposed various health and social life support strategies for each segment; e.g. "supporting them by showing concern" for Segment 1, "support to foster interpersonal relationships" for Segment 2, "support for listening attentively to them" for Segment 3, "support to help them think about themselves together" for Segment 4, and "whole family support" for Segment 5. The qualitative findings of this study revealed supportive measures for physical health and the social and mental health of children in households receiving public assistance, that is, for their holistic health [73].

In this study, the soft clustering technique successfully identified all the segments with distinct characteristics that made sense to professionals who supported children in households receiving public assistance, as confirmed by the qualitative findings. This finding is notable because it indicates a key element for good segmentation-the segment characteristics should make sense to the people who will apply them, as described previously [38, 40]. The identified segments are also evaluated according to marketing segmentation criteria. These criteria include (1) internal validity, which assesses the match between segment structure and the data itself; (2) external validity, which validates the segmentation performance using external data; (3) identifiability/interpretability, which requires the segments to be recognizable and readily interpreted; (4) substantiality, which ensures that each segment has a sufficient size; (5) actionability/accessibility, which ensures that each segment can be targeted for intervention; and (6) stability, which requires that the segment definition remains relatively consistent over time [74, 75]. The segments obtained in our study did not satisfy the stability and external validity criteria. Hence, it is imperative to conduct a longitudinal study in the future to demonstrate the stability of the identified segments over time. Furthermore, it is necessary to confirm our findings by utilizing a different dataset of children in households receiving public assistance.

Although all identified segments were recognizable and readily interpreted, the results for Segment 4 remain slightly controversial. Three interviewees could not recall children aged 10-15 years from households receiving public assistance because many items nonresponse were included in this segment. Conversely, other interviewees described the segment characteristics clearly as "children who cannot be bothered to answer conceptual questions about themselves," "children who do not understand the topic being discussed," or "children who lack the ability to reflect on themselves." These characteristics of the children in Segment 4 are well explained using Krosnick's satisficing theory, which states that three elements influence the process of answering questions: the respondent's motivation to complete the task, the difficulty of the task, and the cognitive ability to perform the task [76, 77]. Therefore, employing item nonresponse in the analysis provided us with sufficient information to determine the characteristics of the children in Segment 4.

The segments identified in this study present various health and social life support strategies for children in households receiving public assistance. These results support Hayashi's view that children in households need support not only financially but also for their overall family life, places they belong to in addition to home or school, educational activities, and support at school [78]. One interviewee stated that they did not require support because of the reliable and intelligent characteristics of children in Segment 1. However, the remaining interviewees emphasized that they required support due to these characteristics. Regarding "financial support for higher education," the current support measures for children from public assistance households entering higher education remain insufficient. The percentage of high school students (aged 15-18 years) from public assistance households who entered university was much lower than that of the general population (39.9% vs. 75.2%) [29]. This is largely attributable to the public assistance program's requirement that children work after graduating from high school and should be separated from their households. Pursuing higher education, such as attending universities, makes them ineligible for public assistance, leading to financial hardships [55]. Recently, programs have been implemented to support children from public assistance households entering university, such as university preparation benefits and income recognition exemptions for university expenses [29]. In 2020, the Japanese government initiated a new program to support children from economically disadvantaged households in entering higher education. This program includes exempting or reducing tuition and enrollment fees and offering scholarships that do not have to be returned. However, the public awareness remains insufficient [79]. More children in public assistance households are expected to use this system.

One of the support strategies in Segment 2 was "support for experiencing diverse and enriching pleasures together." The Convention on the Rights of the Child establishes children's rights "to rest and leisure, to engage in play and recreational activities appropriate to the age of the child, and to participate freely in cultural life and the arts" [80]. However, disparities in house-hold resources have a significant impact on children's experiences, and being raised in impoverished house-holds restricts their engagement in social activities [81]. This could expose children to the stigma of poverty [82]. Therefore, children's experiences can be provided in their households and by multiple supporters and settings in the community.

The children in Segment 3 were described as "children who were in *hikikomori* (social withdrawal)." "*Hikikomori*" is a condition, wherein a person avoids social participation due to various factors and has remained at home for at least 6 months [83, 84]. The support strategies for Segment 3 proposed by the interviewees aligned with interventions for *hikikomori* in previous studies. Home visits by healthcare professionals or supporters are essential since many withdrawn children are hesitant to seek help. Providing professional support to caregivers is crucial for alleviating their burden [85, 86].

We discovered that support strategies should be provided for the children and the entire family in Segment 5. "Whole family support," one of the proposed support strategies in Segment 5, is commonly referred to as the "whole family approach" in the existing literature [87, 88]. The whole-family approach is a coordinated, holistic approach to service delivery that supports families as a collective unit while acknowledging that individual family members are in need. This approach is particularly critical for "children from households with intergenerational public assistance use." Families are thought to mainly affect children's health through hereditary factors, financial investments, and behavioral investments for their children [89]. Additionally, values and expectations are passed from one generation to another. A Canadian study reported that children whose parents received social assistance were more likely to receive it themselves [90]; therefore, these children may be raised in a similar child-rearing environment in the future. To break the intergenerational transmission of unhealthy behaviors and health problems, it is crucial to encourage children in households that receive public assistance and their caregivers to adopt healthy lifestyles and promote health in childhood. In Japan, some local governments have implemented model projects to support the health and social lives of children and their caregivers in public

assistance households. However, the number of such projects remains low [33]. Welfare offices should help children and caregivers in public assistance families as family units as part of healthcare support programs.

Policy implications

These findings have several policy implications. Considering the demonstrated heterogeneity among children in households receiving public assistance, our results indicate that a single healthcare support program is unlikely to satisfy the complex needs of all child subpopulations. Moreover, these findings suggest that our segmentation approach will enable care providers, such as caseworkers or healthcare providers in welfare offices, to create tailored health and social life support strategies for children in households receiving public assistance based on the identified segments. A recent nationwide survey of welfare offices demonstrated that approximately 63% did not have staff with expertise in children [91]. Therefore, this approach, "tailormade welfare care," would be highly beneficial; inexperienced caseworkers, or those unfamiliar with health and social life support for children, can prioritize these children with the greatest need for support measures.

In the quantitative analysis, we employed PLSA, one of soft clustering methods, that allows individuals to belong to multiple segments simultaneously, with a probability assigned to each segment [92]. Using this method, segmented support measures can give care providers more flexible alternatives. For example, if a measure planned for a certain segment of children in a public assistance household is ineffective, care providers can select an alternative measure for the segment to which they are more likely to belong [42]. This contradicts interventions based on segmentation using hard clustering, wherein individuals belong to only a single segment [92]. A segmentation approach based on hard clustering is unsuccessful if the support measure for the chosen segment is ineffective for the children in that segment.

Strengths and limitations

A major strength of this study was its integrated methodology. We linked the results of a nationwide survey of children in households receiving public assistance to interviews with professionals who support these children to confirm segments that should "make sense" for stakeholders regarding their utility and applicability [38]. It also highlights a theme that has not yet been studied to propose innovative approaches for identifying segments and providing appropriate health and social life support strategies for each segment among children in households receiving public assistance. Another strength is that using a questionnaire survey answered by children in households receiving public assistance enhanced the segment characteristics of these children and amplified the voices of supporters in the interviews.

However, this study had limitations. First, because only children in households receiving public assistance who responded to the voluntary questionnaire survey were included, selection bias may have existed. Children living in challenging environments were less likely to answer the questionnaire; therefore, our sample may have been underrepresented. Second, some characteristics of the children and support strategies for segments may have been missed. However, we were able to characterize them from multiple perspectives by interviewing professionals in various fields. Third, the optimal number of segments may differ based on the data used or individuals involved in interpreting the results. Therefore, we need to determine this number by applying the multiple criteria described in this study every time we analyze the results. Finally, because soft clustering is considered an exploratory analysis method, the latent clusters identified using this model should be viewed as heuristics to depict the population heterogeneity [93].

Conclusions

Children in households receiving public assistance can be categorized into distinct segments that would benefit from tailored support strategies for their health and social lives. Further research is warranted to increase the data for segmentation and improve the matching of segments with health and social life support measures, leading to data-driven, tailor-made health and welfare care for children in households receiving public assistance.

Abbreviations

PLSA Probabilistic latent semantic analysis AIC Akaike information criterion

Supplementary Information

The online version contains supplementary material available at https://doi. org/10.1186/s12939-025-02467-6.

Table S1. List of responses to the items used in the quantitative analysis Additional file 2. Interview quide

Additional file 3: Table S2. Characteristics of participants (complete version)

Additional file 4. Determination of the optimal number of segments. Figure S1. Akaike information criterion scores of the three-to eight-segment models. Figure S2. Number of people in each segment in the three-to eight-segment models.

Additional file 5. Summary of qualitative findings

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Authors' contributions

KU conceptualized and designed the study, analyzed the data, and prepared the manuscript. DN, SK, and NK reviewed the manuscript. KU and NK finalized the manuscript. All the authors contributed to the interpretation of the results, commented on the manuscript, and approved the final submission.

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Data availability

No datasets were generated or analysed during the current study.

Declarations

Ethics approval and consent to participate

The study protocol was approved by the Graduate School and Faculty of Medicine of Kyoto University Ethics Committee (approval no. R3565) following the Declaration of Helsinki Ethical Principles for Medical Research Involving Human Subjects. The Ethics Committee of the Graduate School and Faculty of Medicine of Kyoto University allowed us to perform the quantitative phase of the study without informed consent from the participants due to the anonymized data provided by the Hamagin Research Institute. Written informed consent was obtained from all interviewees in the qualitative phase. Interviewees joined the interviews voluntarily and were allowed to withdraw anytime.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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References

- Brazier C. Building the future: children and the sustainable development goals in rich countries. 2017. https://www.unicef-irc.org/publications/ pdf/RC14_eng.pdf. Accessed 28 August 2024.
- Organization for Economic Co-operation and Development. CO2.2 Child poverty. OECD family database. 2021. https://www.oecd.org/els/CO_2_ 2_Child_Poverty.pdf. Accessed 28 Aug 2024.
- 3. Lister R. Poverty. Cambridge: Polity Press; 2004.
- Townsend P. Poverty in the United Kingdom. Harmondsworth: Penguin Books; 1979.
- Eurostat. Glossary: Material deprivation; 2021. https://ec.europa.eu/euros tat/statistics-explained/index.php?title=Glossary:Material_deprivation. Accessed 28 Aug 2024.
- Kim E, Nandy S. Multidimensional child poverty in Korea: developing child-specific indicators for the sustainable development goals. Child Ind Res. 2018;11:1029–50.
- Chzhen Y, De Neubourg C, De Milliano M, Plavgo I. Child poverty in the European Union: the multiple overlapping deprivation analysis approach (EU-MODA). Child Ind Res. 2015;9:335–56.
- Wong Y, Wang T, Xu Y. Poverty and quality of life of Chinese children: from the perspective of deprivation. Int J Soc Welf. 2014;24:236–47.
- 9. Main G, Bradshaw J. A child material deprivation index. Child Ind Res. 2012;5:503–21.
- Abe A. Comparing the hardship of poor families with children before and after the COVID-19 (in Japanese). 2023. https://beyond.research-miyac ology.tmu.ac.jp/assets/sites-files/child-and-adolescent-poverty/files/wp/ 2023_wp35_%E3%82%B3%E3%83%AD%E3%83%AA%E7%A6%8D%E5% 89%8D%E5%BE%8C%E3%81%AE%E5%AD%90%E3%81%A9%E3%82% 82%E3%81%AE%E7%634%9F%E6%B4%BB%E5%9B%B0%E9%9B%A3% E3%81%AE%E6%AF%94%E8%BC%83.pdf.
- Abe A. Developing deprivation index for children taking into account of adaptive preferences. Child Ind Res. 2019;12:647–65.
- 12. World Health Organization. Summary reports on proceedings minutes and final acts of the international health conference held in New York from 19 June to 22 July 1946. 1948. https://iris.who.int/handle/10665/85573. Accessed 28 Aug 2024.
- Lee H, Andrew M, Gebremariam A, Lumeng JC, Lee JM. Longitudinal associations between poverty and obesity from birth through adolescence. Am J Public Health. 2014;104:e70–6.
- 14. Yang-Huang J, van Grieken A, You Y, Jaddoe VWV, Steegers EA, Duijts L, et al. Changes in family poverty status and child health. Pediatrics. 2021;147:e2020016717.
- Mendes AP, Zhang L, Prietsch SO, Franco OS, Gonzáles KP, Fabris AG, et al. Factors associated with asthma severity in children: a case-control study. J Asthma. 2011;48:235–40.
- Friedman D, Luyckx VA. Genetic and developmental factors in chronic kidney disease hotspots. Semin Nephrol. 2019;39:244–55.
- Petrou S, Fraser J, Sidebotham P. Child death in high-income countries. Lancet. 2014;384:831–3.
- Hair NL, Hanson JL, Wolfe BL, Pollak SD. Association of child poverty, brain development, and academic achievement. JAMA Pediatr. 2015;169:822–9.
- Cooper K, Stewart K. Does household income affect children's outcomes? A systematic review of the evidence. Child Ind Res. 2021;14:981–1005.
- Ge T, Wang L. Multidimensional child poverty, social relationships and academic achievement of children in poor rural areas of China. Children Youth Serv Rev. 2019;103:209–17.

- Lai ETC, Wickham S, Law C, Whitehead M, Barr B, Taylor-Robinson D. Poverty dynamics and health in late childhood in the UK: evidence from the Millennium Cohort Study. Arch Dis Child. 2019;104:1049–55.
- McLaughlin KA, Breslau J, Green JG, Lakoma MD, Sampson NA, Zaslavsky AM, et al. Childhood socio-economic status and the onset, persistence, and severity of DSM-IV mental disorders in a US national sample. Soc Sci Med. 2011;73:1088–96.
- Rod NH, Bengtsson J, Budtz-Jørgensen E, Clipet-Jensen C, Taylor-Robinson D, Andersen AN, et al. Trajectories of childhood adversity and mortality in early adulthood: a population-based cohort study. Lancet. 2020;396:489–97.
- Ridge T. Listening to children: developing a child-centred approach to childhood poverty in the UK. Family Matters (Melbourne, Vic.). 2003;65:4–9.
- Matsumoto I. Chapter 1. Why and how do we make child poverty an issue? (in Japanese). In Matsumoto I & Yuzawa N (Eds.), Birth and upbringing: Child poverty, family, and society. Tokyo; Akashi shobo; 2019. p. 10–84.
- 26. Wise PH. Child poverty and the promise of human capacity: childhood as a foundation for healthy aging. Acad Pediatr. 2016;16:S37–45.
- Weitoft GR, Hjern A, Batljan I, Vinnerljung B. Health and social outcomes among children in low-income families and families receiving social assistance-a Swedish national cohort study. Soc Sci Med. 2008;66:14–30.
- Ministry of Health, Labour and Welfare. National survey on public assistance recipients: summary of results on October 2023 (in Japanese). 2024. https://www.mhlw.go.jp/toukei/saikin/hw/hihogosya/m2023/dl/10-01. pdf. Accessed 28 Aug 2024.
- Ministry of Health, Labour and Welfare. The current state of the public assistance system (in Japanese). 2022. https://www.mhlw.go.jp/content/ 12002000/000977977.pdf. Accessed 28 Aug 2024.
- Public assistance act (act No. 144 of 1950). https://www.japaneselawtran slation.go.jp/en/laws/view/24. Accessed 28 Aug 2024.
- Koyama Y, Fujiwara T, Isumi A, Doi S, Ochi M. The impact of public assistance on child mental health in Japan: results from A-CHILD study. J Public Health Policy. 2021;42:98–112.
- Nishioka D, Saito J, Ueno K, Kondo N. Single-parenthood and health conditions among children receiving public assistance in Japan: a cohort study. BMC Pediatr. 2021;21:214.
- Ministry of Health, Labour and Welfare. Health and life support for children and their caregivers in public assistance households (in Japanese). 2021. https://boshikenshu.cfa.go.jp/assets/files/history/r3/tr6_lecture_3. pdf. Accessed 28 August 2024.
- Ministry of Health, Labour and Welfare. Handbook for the healthcare support program for public assistance recipients (revised in August 2020) (in Japanese). 2020. https://www.mhlw.go.jp/content/12000000/000809908.pdf. Accessed 28 Aug 2024.
- Ueno K, Nishioka D, Kondo N. Expectations and problems of the healthcare management support program for public assistance recipients (in Japanese). Nihon Koshu Eisei Zasshi. 2022;69:48–58.
- Ministry of Health, Labour and Welfare. Creation of a system to provide support and human resource development (in Japanese). 2022. https:// www.mhlw.go.jp/content/12501000/001006553.pdf. Accessed 28 Aug 2024.
- Ministry of Health, Labor and Welfare. Welfare office staffing structure survey (in Japanese). 2016. https://www.mhlw.go.jp/toukei/list/dl/125-1-01.pdf. Accessed 28 Aug 2024.
- French J. Social marketing and public health: theory and practice. 2nd ed. Oxford: Oxford University Press; 2017.
- 39. Lee N, Kolter P. Social marketing: behavior change for social change. 6th ed. Thousand Oaks: SAGE Publications; 2019.
- 40. Grier S, Bryant CA. Social marketing in public health. Annu Rev Public Health. 2005;26:319–39.
- Gordon R, McDermott L, Stead M, Angus K. The effectiveness of social marketing interventions for health improvement: What's the evidence? Public Health. 2006;120:1133–9.
- 42. Everitt B. Cluster analysis. 5th ed. West Sussex: John Wiley & Sons Ltd; 2011.
- 43. Turnbull KLP, Cubides Mateus DM, LoCasale-Crouch J, Lewin DS, Williford AP. Sleep patterns and school readiness of pre-kindergarteners

from racially and ethnically diverse, low-income backgrounds. J Pediatr. 2022;251:178–86.

- Herman KC, Bi Y, Borden LA, Reinke WM. Latent classes of psychiatric symptoms among Chinese children living in poverty. J Child Fam Stud. 2012;21:391–402.
- Warmingham JM, Handley ED, Rogosch FA, Manly JT, Cicchetti D. Identifying maltreatment subgroups with patterns of maltreatment subtype and chronicity: A latent class analysis approach. Child Abuse Negl. 2019;87:28–39.
- 46. Rosen AL, Handley ED, Cicchetti D, Rogosch FA. The impact of patterns of trauma exposure among low income children with and without histories of child maltreatment. Child Abuse Negl. 2018;80:301–11.
- Voisin DR, Kim DH, Michalopoulos L, Patel S. Exposure to community violence among low-income African American youth in Chicago: a latent class analysis. Violence Vict. 2017;32:1116–32.
- Källestål C, Blandón EZ, Peña R, Peréz W, Contreras M, Persson LÅ, et al. Assessing the multiple dimensions of poverty. data mining approaches to the 2004–14 health and demographic surveillance system in Cuatro Santos, Nicaragua. Front Public Health. 2020;7:409.
- Guillén-Fernández YB, Vargas-Chanes D. Multidimensional child poverty from the child rights-based approach: a latent class analysis to estimating child poverty groups in Mexico. Child Indic Res. 2021;14:1949–78.
- 50. Guillén-Fernández YB. Socioeconomic factors determining multidimensional child poverty groups in Central America: a measurement proposal from the wellbeing approach using a comprehensive set of children's rights. Child Ind Res. 2024. https://doi.org/10.1007/s12187-024-10148-z.
- Zhang L, Han WJ. Uncovering multidimensional poverty experiences in shaping children's socioemotional trajectories during the first 6 years of schooling. Fam Process. 2020;59:1837–55.
- Gao J, Huo Z, Zhang M, Liang B. The capability approach to adolescent poverty in China: application of a latent class model. Agriculture. 2022;12:1316.
- 53. Denny S, Lewycka S, Utter J, Fleming T, Peiris-John R, Sheridan J, Rossen F, Wynd D, Teevale T, Bullen P, Clark T. The association between socioeconomic deprivation and secondary school students' health: findings from a latent class analysis of a national adolescent health survey. Int J Equity Health. 2016;15:109.
- 54. Creswell J, Piano Clark V. Designing and conducting mixed methods research. 3rd ed. Los Angeles: SAGE; 2018.
- Masuda M, Wakino K. Understanding public assistance: support for lowincome people and the public assistance system (in Japanese). Kyoto: Houritsu Bunka Sha; 2020.
- Hofmann T. Probabilistic latent semantic analysis. In: UAI '99. Proceedings of the fifteenth conference on uncertainty in artificial intelligence 1999. p. 289–96.
- Hofmann T. Unsupervised learning by probabilistic latent semantic analysis. Mach Learn. 2001;42:177–96.
- Muthén BO, Muthén LK. Integrating person-centered and variable-centered analyses: growth mixture modeling with latent trajectory classes. Alcohol Clin Exp Res. 2000;24:882–91.
- Clogg CC. Latent class models: recent developments and prospects for the future. In: Arminger G, Clogg CC, Sobel ME, editors. Handbook of statistical modeling for the social and behavioral sciences. New York: Plenum Press; 1995. p. 311–59.
- 60. Bray BC, Lanza ST, Tan X. Eliminating bias in classify-analyze approaches for latent class analysis. Struct Equ Modeling. 2015;22:1–11.
- Dziak JJ, Bray BC, Zhang J, Zhang M, Lanza ST. Comparing the performance of improved classify-analyze approaches for distal outcomes in latent profile analysis. Methodology. 2016;12:107–16.
- 62. Clark SL, Muthén BO. Relating latent class anlaysis results to variables not included in the analysis. http://www.statmodel.com/papers.shtml. Accessed 28 Aug 2024.
- 63. Dempster AP, Laird NM, Rubin DB. Maximum likelihood from incomplete data via the EM algorithm. J R Stat Soc B. 1977;39:1–22.
- Pastor DA, Gagné P. Mean and covariance structure mixture models. In: Hancock GR Mueller RO, editors. Structural equation modeling: a second course. 2nd ed. Charlotte: Information Age Publishing, Inc.; 2013. p. 343–93.
- Nylund-Gibson K, Choi AY. Ten frequently asked questions about latent class analysis. Translational Issues in Psychological Science. 2018;4:440–61.

- 66. Weller BE, Bowen NK, Faubert SJ. Latent class analysis: a guide to best practice. J Black Psychol. 2020;46:287–311.
- 67. Muthén BO. Statistical and substantive checking in growth mixture modeling: Comment on Bauer and Curran. Psychol Methods. 2003;8:369–77.
- 68. Akaike H. Factor analysis and AIC. Psychometrika. 1987;52:317-32.
- Grant RW, McCloskey J, Hatfield M, Uratsu C, Ralston JD, Bayliss E, et al. Use of latent class analysis and k-means clustering to identify complex patient profiles. JAMA Netw Open. 2020;3:1–13.
- 70. Yin YK. Qualitative research from start to finish. 2nd ed. New York: The Guilford Press; 2016.
- Guetterman TC, Fetters MD, Creswell JW. Integrating quantitative and qualitative results in health science mixed methods research through joint displays. Ann Fam Med. 2015;13:554–61.
- Malterud K, Siersma VD, Guassora AD. Sample size in qualitative interview studies: guided by information power. Qual Health Res. 2016;26:1753–60.
- Schramme T. Health as complete well-being: the WHO definition and beyond. Public Health Ethics. 2023;16:210–8.
- Jadczaková V. Review of segmentation process in consumer markets. Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis. 2013;61:1215–24.
- Yan S, Kwan YH, Tan CS, Thumboo J, Low LL. A systematic review of the clinical application of data-driven population segmentation analysis. BMC Med Res Methodol. 2018;18:1–12.
- Borgers N, Hox J. Item nonresponse in questionnaire research with children. J Off Stat. 2001;17:321–35.
- 77. Krosnick JA. Response strategies for coping with the cognitive demands of attitude measures in surveys. Appl Cogn Psychol. 1991;5:213–36.
- Hayashi A. Life stories of children from households on public assistance: generational reproduction of poverty (in Japanese). Tokyo: Keiso Shobo; 2016.
- Kobayashi M, Hamanaka Y. The effects of the new student financial aid program on access to higher education (in Japanese). J F Oberlin Univ J Adv Res. 2022;2:52–68.
- United Nations. Convention on the Rights of the Child.1989. https:// www.unicef.org/media/52626/file. Accessed 28 Aug 2024.
- Osawa S. Chapter 1. Poverty and child's experiences: thinking from the child's perspective. In: Konishi Y, Kawata M, editors. Child poverty 2 play, growing up, and experiences: protecting children's worlds. (in Japanese). Tokyo: Akashi Shoten; 2019. p. 47–70.
- 82. Ridge T. Living with poverty: a review of the literature on children's and families' experiences of poverty. London: Great Britain Department for Work and Pensions; 2009.
- Kato TA, Tateno M, Shinfuku N, Fujisawa D, Teo AR, Sartorius N, et al. Does the "hikikomori" syndrome of social withdrawal exist outside Japan? : a preliminary international investigation. Soc Psychiatry Psychiatr Epidemiol. 2012;47:1061–75.
- Ministry of Health, Labour and Welfare. Guidelines for the assessment and support of hikikomori (in Japanese). 2010. https://www.mhlw.go.jp/file/ 06-Seisakujouhou-12000000-Shakaiengokyoku-Shakai/0000147789.pdf. Accessed 28 Aug 2024.
- Kato TA, Kanba S, Teo AR. Hikikomori: multidimensional understanding, assessment, and future international perspectives. Psychiatry Clin Neurosci. 2019;73:427–40.
- Paul WC, Wong and Tim MHL. 27 Hikikomori: risks and consequences of extreme self-imposed social marginalization. In: Coplan RJ, Bowker JC, Nelson LJ, editors. The handbook of solitude psychological perspectives on social isolation, social withdrawal, and being alone. 2nd ed. NJ: John Wiley & Sons, Inc.; 2021. p. 378–89.
- Morris K. Great Britain. Social exclusion task force. Think family: a literature review of whole family approaches. London: Cabinet Office; 2008.
- Scottish Government. A rapid review of the literature on whole family approach. 2023. https://www.gov.scot/binaries/content/documents/ govscot/publications/research-and-analysis/2023/07/rapid-review-liter ature-whole-family-approach/documents/rapid-review-literature-wholefamily-approach/rapid-review-literature-whole-family-approach/govsc ot%3Adocument/rapid-review-literature-whole-family-approach.pdf. Accessed 28 Aug 2024.
- Berger LM, Font SA. The role of the family and family-centered programs and policies. Future Child. 2015;25:155–76.
- Beaulieu N, Duclos JY, Fortin B, Rouleau M. Intergenerational reliance on social assistance: evidence from Canada. J Popul Econ. 2005;18:539–62.

- 91. Ministry of Health, Labour and Welfare. Report of the research project on behavior change in supporting health and life for children and their caregivers (in Japanese). 2021. https://www.mhlw.go.jp/content/12200 000/000790133.pdf. Accessed 28 Aug 2024.
- 92. Kaufman L, Rousseeuw PJ. Finding groups in data: an introduction to cluster analysis. Hoboken: John Wiley & Sons, Inc.; 2005.
- Lanza ST, Cooper BR. Latent class analysis for developmental research. Child Dev Perspect. 2016;10:59–64.

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