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Getting them through the door: Social and behavioral determinants of uptake and engagement in an obesity intervention

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ABSTRACT

Using data from a large-scale screening program (N = 19634), we aimed to prospectively identify factors predicting uptake (i.e. acceptance of the invitation) and engagement (i.e. participation in at least two sessions) in a multi-component-intensive-behavioral-intervention for obesity-management (MBIOM) intervention targeting adolescents (n = 2862; 12–14 years; BMI ≥90th percentile). Approximately one third of adolescents most in need of weight management declined the initial invitation to enter the MBIOM. Poor diet, sedentary behavior, and parental education predicted willingness to enter and stay in the intervention, however measured body mass index did not matter. Perceived family support, instead of initial motivation, facilitated engagement. Our results provide new insights on the importance of regional socio-geographical factors including trust in local authorities.

Prevalence of obesity among adolescents has soared during the last 40 years [1]. Effective weight management can be achieved via participation in multi-component, intensive behavioral intervention for obesity management (MBIOM) [2]. Yet, lack of participation remains a major problem [3–5] not only reducing public health efficacy and cost-effectiveness, but also raising ethical issues [6].

Though parents have generally altruistic attitudes towards allowing children to participate in research [7] some practical facilitators and barriers were recently identified [5], but socio-geographical factors are unexplored. Participant characteristics influencing uptake of an invitation are generally unknown [8,9] due to missing data owing to refusal to participate especially because previous attempts to identify the factors influencing recruitment are based on non-probability sampling methods. Therefore, a research gap remains in understanding whether obesogenic and socio-geographical factors are relevant for uptake and engagement in MBIOM beyond previously identified individual-level socioeconomic barriers.

We have available data to answer these critical questions. We conducted a large-scale school-based screening program where we measured body composition, cardiorespiratory fitness (CRF), and obtained reports of family, obesogenic behaviors, and sociodemographic factors for nearly 20000 adolescents [10]. Adolescents with body mass index (BMI) ≥ 90th percentile were subsequently personally invited via post to participate in an MBIOM, Pozdro. Thus, availability of complete baseline data from the screening phase allowed us to identify characteristics influencing uptake and engagement based on probability sampling, i.e. when the entire eligible recruitment population is known. We set out to identify factors associated with uptake of the initial invitation

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and secondly to identify factors contributing to engagement using a prospective design. We expected that obesogenic factors (individual- and family-level) would predict both uptake and engagement. We anticipated that individual-level and city-level factors reflecting socio-economic deprivation would act as barriers. We examined whether initial readiness for behavioral change and social support would positively impact engagement.

Material and methods

Adolescents aged 12 to < 14.5 years (N = 19,634) and their Polish-speaking parents in Gdynia, Lublin, Wrocław, and Warsaw were recruited in the general health screening portion of Pozdro between 2014 and 2017 [10]. The detailed design of the PoZdro! screening study has been previously described [10]. Briefly, trained research nurses visited all lower secondary schools in each city and measured adolescents' BMI, fat mass (FM), fat free mass (FFM), and CRF using a standardized protocol [10]. Parents completed a comprehensive questionnaire [10] including sociodemographics, adolescents' obesogenic behaviors, and family factors. Details of the included variables are presented in Table 1 and Supplementary Table 1. This study focuses on all adolescents with BMI ≥ 90th percentile and thus eligible for the intervention.

We used data from Statistics Poland national survey [11] to gain insight on potential variation across socio-geographical regions relevant for participation, namely we hypothesized that city-level variables measuring general life satisfaction and level of trust in local authorities would be positively associated with both uptake and engagement.

We investigated whether level of initial motivation predicted engagement with the MBIOM. Once participants agreed to participate, they were interviewed by a psychologist in their first session. The transtheoretical model [12], a validated framework describing the process of change in five incremental stages in terms of both motivation and actions [12] was used to assess initial readiness for behavior change. The interview also covered parental willingness to make lifestyle changes and perceived availability of social support.

The Independent Bioethics Commission for Research, Medical University of Gdańsk, Poland (NKBBN/301/2014) provided ethical approval. Written and verbal consents/assents were obtained from all participants and their parents. No compensation was provided; the MBIOM was offered gratuitously.

Data were analysed with χ^2, t-statistics, and logistic regression models for the two primary dichotomous outcomes: Uptake of initial invitation (decline=1 and uptake=0) and engagement (drop-out after initial contact=1 and engagement in ≥2 sessions of MBIOM=0). We adjusted the level of significance using the Bonferroni correction for multiple testing. Significant univariate variables were selected and tested in multivariate logistic regression analyses.

Results and discussion

We sent invitation letters to 2862 adolescents, who screened at the ≥ 90th percentile BMI, and their parents and 837 (29.24 %) declined without further contact with the MBIOM team. The remaining 1910 adolescents (i.e. who remained at ≥90th percentile BMI) attended the first session and 86.08 % engaged with MBIOM in ≥ 2 more sessions. Table 1 presents the baseline data including measured obesity in relation to uptake and engagement. Associations exceeding the Bonferroni adjusted p-values are presented in Table 1. Nonsignificant associations between baseline characteristics and uptake and engagement appear in Supplementary Table 1. Fig. 1 shows odds ratios of multivariate analyses for predictors of uptake (panel A) and predictors of engagement (panel B).

We set out to identify factors influencing uptake and engagement in MBIOM for adolescents with BMI ≥ 90th percentile. The availability of comprehensive data from previous screening provided us with distinctive advantages—we were able to prospectively study individual-level body composition measurements, CRF, obesogenic behaviors, and family characteristics as well as sociodemographic and regional socio-geographic factors. Our results showed that there are clear differentiating factors predicting participation and these factors operate primarily at the uptake stage rather than determining engagement. Thus, the challenge for researchers and clinicians offering MBIOM is to attract participants in the first place, i.e. "getting them through the door".

Twenty nine percent and 34 % of adolescents with the classification of obesity or morbid obesity according to IOTF sex and age cut-offs based on measured BMI, declined the invitation to participate. Abdominal adiposity (waist-to-height ratio) was the only measured body composition variable that differentiated uptake in the univariate analyses but was nonsignificant in the multivariate logistic regression analyses. Rather than measured BMI or FM, parents' perception of adolescent BMI and the accuracy of that perception distinguished between those who took up the invitation from those who did not. Reported obesity in the family increased the likelihood of uptake. Those who reported more active lifestyle through engagement in sports and less sedentary time were more likely to reject the invitation, perhaps due to perceived lack of need. Taken together, awareness of obesity and possibly perceived need to change behaviors seem to be critical for uptake, rather than personalized information regarding BMI provided by the study team. Thus, the premise that individual motivation to change is a product of knowledge does not seem to apply.

Decision-making can be rational, based on anticipated cost-benefit [13]. Time and effort to participate in a 2-year multicomponent intervention (=cost) geared at changing behavior (=cost, e.g. effort to change lifestyle) must be weighed against the benefit—weight management. However, our results show providing individual information seems to be insufficient. Emotion is a potent driver of decision-making [14]. Previous research highlights adolescents with obesity may feel stigmatized [9,15] and avoid care concerning obesity. Clinicians should focus on supporting healthy lifestyle changes to avoid stigmatization, which may render early adolescents especially vulnerable given their stage of rapid growth, sexual and psychosocial development.

Multivariate logistic models for uptake and engagement in the MBIOM (Fig. 1) showed that sociodemographic and socio-geographic factors superseded individual-level factors in importance for both outcomes. Adolescents are not autonomous in their decision to participate; they are dependent on parental consent. In the model for uptake, we found lower parental education acted as a barrier. Lower parental education can not only impact health literacy, but also is likely to be associated with other obstacles and lower feelings of efficacy to achieve change [16]. We previously reported city of residence was associated with biomarkers of disease risk in this sample [10]. Here, we found that in comparison to Gydnia, a mid-sized city in the lowest tier on the local deprivation index, residents of the other three cities were less likely to uptake and engage in MBIOM. Interdependence theory posits that individual decision-making is embedded within society and that societal trust is essential. We found that trust in local authorities had an inverted-U shape association. Uptake of MBIOM could be construed as a risk because it requires time, energy, effort to change lifestyle, with uncertainty of success. Low societal trust predicted refusal, in line with the idea that trust promotes approach behavior in a health context [17]. Notwithstanding, we found that living in a region of high level of societal trust also predicted refusal. This could be explained in terms of lower risk-taking propensity in regions with greater societal instability [18]. In Lublin, which had the highest levels of societal trust, yet ranks highest on the social deprivation index, uptake of an MBIOM invitation from private rather than a governmental authority may have been viewed with scepticism.

Engagement was very high (86 %). Socio-geographic factors again were decisive including living in a region of high life satisfaction, which presumably acts as a facilitator for approaching a new behavior. Junk food consumption was the only obesogenic factor related to

Table 1
Comparison of means and standard deviations or frequency distributions of the study population characteristics in the prediction of uptake and engagement.

Characteristic	All data	Uptake of Invitation				Engagement in multi-component, intensive behavioral intervention for obesity management (MBIOM)			
	Missing n =	Decline n = 837	Accept n = 2025	Comparison[a]	p[b]	Drop-out n = 266	≥ 2 sessions n = 1644	Comparison[a]	p[b]
Sociodemographic indicators									
Age	0	13.23 ± 0.42	13.19 ± 0.46	2.240	0.025	13.23 ± 0.45	13.18 ± 0.46	1.650	0.100
Gender	0			0.185	0.667			0.791	0.374
Boys		30 %	70 %			50 %	54 %		
Girls		29 %	71 %			50 %	46 %		
Study site:	0			**28.436**	**0.000**			**22.256**	**0.000**
Gdynia		22 %	78 %			11 %	89 %		
Lublin		31 %	69 %			17 %	83 %		
Warszawa		28 %	72 %			17 %	83 %		
Wrocław		36 %	64 %			8 %	92 %		
Living in area of general life satisfaction	0			1.185	0.553			**21.351**	**0.000**
Low		31 %	69 %			17 %	83 %		
Average		28 %	72 %			17 %	83 %		
High		29 %	71 %			10 %	90 %		
Living in area of general trust in local authorities	0			**17.739**	**0.000**			7.743	0.021
Low		31 %	69 %			14 %	86 %		
Average		22 %	78 %			11 %	89 %		
High		31 %	69 %			17 %	83 %		
Parental education post-secondary or above									
Maternal	608	38 %	50 %	**0.587**	**0.000**	38 %	52 %	**0.541**	**0.000**
Paternal	695	25 %	37 %	**0.587**	**0.000**	26 %	38 %	0.579	0.001
Measured Obesity									
BMI[c]	0	26.7 ± 2.89	26.7 ± 2.8	0.000	0.999	26.78 ± 2.73	26.85 ± 2.81	-0.410	0.684
IOTF[d] BMI, %	0			2.436	0.487			0.206	0.902
Morbid obesity		34 %	66 %			15 %	85 %		
Obesity		29 %	71 %			13 %	87 %		
Overweight		29 %	71 %			14 %	86 %		
Waist-to-height ratio (WHtR)	4	0.5 ± 0.05	0.51 ± 0.05	**-2.660**	**0.008**	0.51 ± 0.05	0.51 ± 0.05	-1.450	0.147
% Fat Mass (FM)[e]	11	0.28 ± 0.08	0.29 ± 0.07	-1.650	0.100	0.29 ± 0.07	0.29 ± 0.07	0.620	0.537
Obesogenic Behaviours									
Junk food snacks, %	585			2.995	0.701			**17.878**	**0.003**
few times per day		26 %	74 %			16 %	84 %		
≤ 1 per day		30 %	70 %			9 %	91 %		
few times per week		30 %	70 %			14 %	86 %		
≤ 1 per week		27 %	73 %			17 %	83 %		
no consumption		28 %	72 %			42 %	58 %		
unknown		25 %	75 %			18 %	82 %		
Number of hours of active sport activity per week, %	608			**12.053**	**0.007**			6.963	0.073
≥ 5		35 %	65 %			13 %	87 %		
3–5		30 %	70 %			11 %	89 %		
1–3		29 %	71 %			13 %	87 %		
< 1		24 %	76 %			18 %	82 %		
Number of hours of Sedentary behaviour per day (%)	587			**9.525**	**0.009**			6.207	0.045
> 3		28 %	72 %			16 %	84 %		
1–3		29 %	71 %			12 %	88 %		
< 1		39 %	61 %			18 %	82 %		
Family factors									
Presence of overweight/obese family members	612	42 %	49 %	**0.363**	**0.000**	49 %	50 %	-0.020	0.899
Perceived adolescent BMI[f]	592			**45.768**	**0.000**			13.535	0.001
normal		43 %	57 %			22 %	78 %		
overweight		29 %	71 %			14 %	86 %		
obesity		21 %	79 %			11 %	89 %		
Accuracy[g] of perceived adolescent weight	592			**31.139**	**0.000**			11.111	0.001
overestimation		0 %	0 %			0 %	0 %		
accurate		27 %	73 %			13 %	87 %		
underestimation		40 %	60 %			21 %	79 %		
Psychological Interview at intake									
Adolescent perceived supporters for change								**24.52**	**0.0002**
Parents						11 %	89 %		
Family/close relatives						9 %	91 %		
Friends/peers						16 %	84 %		
School						24 %	76 %		
Support from experts: psychologists, dieticians, physical fitness experts						14 %	86 %		
Other						20 %	80 %		

[a] Comparison of means using independent t-test or χ^2 for categorical data

[b] Statistical significance is denoted in bold for associations exceeding Bonferroni correction.
[c] Body Mass Index, weight/height (meters)^2.
[d] International Obesity Task Force sex and age-specific classification for BMI in children and adolescents.
[e] Tanita Bioimpedance SC240 scale was used to measure weight, FM, and FFM via foot-to-foot bioelectrical impedance while the adolescent had bare feet and light clothing.
[f] Parental report
[g] Calculated difference between parental perception and measured IOTF BMI classification, coded 1 =accurate, 0 =underestimation of true weight.

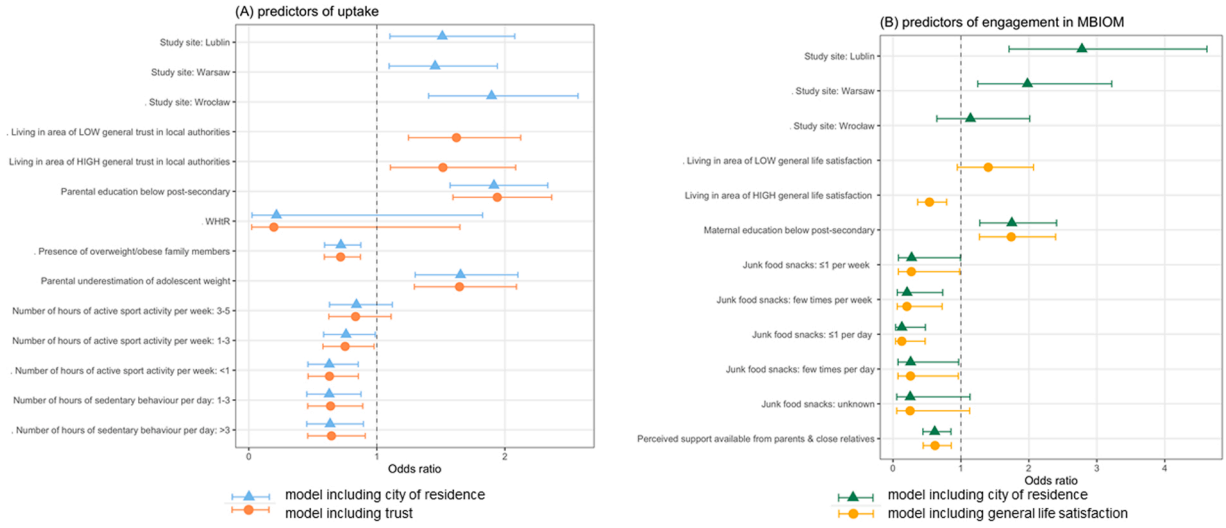

Fig. 1. Forest plot of odds ratio (OR) and 95 % CI (A) predictors of uptake and (B) predictors of engagement in MBIOM. NOTE: Dashed lines represent the reference point to the left are protective factors, i.e. facilitators that increase uptake or engagement and to the right are risk factors i.e. barriers that decrease uptake or engagement. Alternate models were tested to avoid multicollinearity and are shown in blue and red. Legend: Panel A – models including city of residence. – models including trust in local authorities. Panel B – models including city of residence. – models including general life satisfaction.

engagement, whereby those who consumed more were more likely to engage, suggesting that perceived need to improve diet may drive behavior. Readiness for change was unimportant, meaning that once in, other features of MBIOM can maintain participation. This finding is good news for interventions in that their success is not dependent on participants' initial motivation. We found perceived family social support determined engagement suggesting interventions need to make provisions to facilitate support within families.

We sampled socio-demographically diverse areas [10] in Poland which has a predominately white population. Poland has undergone intense socio-political changes and changing societal norms towards sedentary lifestyle and caloric-rich or ready-made processed foods that contribute to obesity being particularly problematic [19].

3. Conclusion

Overall, results highlight that decisions of uptake and engagement in MBIOM are embedded in sociodemographic and socio-geographical contexts. Rather than measured obesity, awareness of obesity and unhealthy behaviors drove participation. Therefore, designers of interventions need to both to increase awareness, without stigmatization, concentrate on changeable behaviors rather than weight, and build trust, to attract those with greatest need.

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Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.orcp.2022.11.002.

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