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Which factors play a role in the decision of mothers to participate in child follow-up examinations after participation in an RCT? – a semi-quantitative study

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Key words: Participation, follow-up

Abstract

Objectives: To determine which factors contribute to the decision of mothers to participate with their child in follow-up (FU) examinations after participation in a randomized controlled trial (RCT) prior to conception.

Design: Cross-sectional survey including Likert-scale items. Comparisons will be made between respondents who participated in all FU rounds of data collection to those who did not participate in any FU round.

Participants: Women who participated in an RCT investigating the effect of a preconception lifestyle intervention were invited for three FU data collection rounds of their child when the children had a mean age of 4.2, 4.6 and 6.5, respectively. FU rounds included a health-questionnaire, physical examination and cardiac assessment, successively.

Results: 67 respondents were included of whom seven (10%) did not participate in any FU round and 24 (36%) participated in all FU rounds. Women who participated with their child in all three FU data collection rounds felt more involved in the FU research (95.8%) and agreed more often that the introduction of the FU was good (91.7%) as compared to women that did not participate in any FU data collection round with their child (14.3% and 28.6%, respectively). Participants of FU rounds more often agreed that participation would feel like a health-check for their child and as compared to non-participants. In addition, participants of the physical examination and cardiac assessment more often let the decision for participation depend fully on their child, as compared to non-participants (39.4% vs 17.7%, and 52.5% vs 24%, respectively)

Conclusions: To increase participation rates in future FU studies of children after maternal participation in an RCT, we suggest to involve women in the design of the FU study, to emphasize possible perceived benefits of participation and stimulating to actively involve the child in the decision of participation.

Article summary

Strengths and limitations of this study

- We identified factors that contribute to the decision of mothers to participate with their child in follow-up (FU) examinations after participation in a randomized controlled trial (RCT) prior to conception.
- Implementing the factors we found to be important for participation in FU of children after a maternal RCT will help to reduce attrition hence increase opportunities addressing causality of effects of interventions before and during pregnancy on child health.
- Our participation rate was low, making our results prone to selection bias.
- All respondents answered the questionnaire at one moment in time, so a change in opinion during FU was not accounted for.

Introduction

Maternal health before and during pregnancy is associated with health outcomes in children throughout the life course (1, 2). Observational studies have shown that maternal health conditions before or during pregnancy, such as obesity and diabetes, are associated with an increased incidence of obesity, type 2 diabetes and hypertension in their children (3-5). Interventions before or during pregnancy could potentially affect children's health in the long run. In order to assess causal effects of such interventions on children's health, long term follow-up (FU) of randomized controlled trials (RCTs) evaluating interventions before or during pregnancy are needed.

Currently only 16% of RCT's evaluating effects of interventions during pregnancy include a FU to evaluate the effect of the intervention on the child's health (6). This low number of FU of children after maternal participation in an RCT before or during pregnancy may be due to the high costs and long timespan that exceeds most funding schemes, as well as logistical and legal challenges (7). An important challenge which hampers the unique ability of trials to assess causality is that such long-term FU studies in children of mothers who participated in RCTs investigating effects of interventions before or during pregnancy face loss-to-FU. Loss-to-FU can induce selection bias, leading to imbalances in the study groups jeopardizing the ability to assess causality (8, 9). Importantly, the degree of loss-to-FU correlates directly with the validity of findings (10).

To minimize loss-to-FU in this type of FU, understanding factors that influence the decision for participation is important. For this semi-qualitative study, we included women who participated in an RCT investigating the effects of a lifestyle intervention before pregnancy on fertility outcomes in women with obesity. During the FU, which was introduced after inclusion for the RCT, children born to these women have been invited to participate in several FU data collection rounds to investigate their long-term health (11). The FU rounds in the children included questionnaires addressing the child's health, to physical examinations near their home and cardiac assessment in a hospital. We will determine which factors play a role for mothers when deciding to participate or not with their child in FU research.

Eventually, our results could be implemented in the design of future FU studies of children after maternal participation in an RCT and eventually limit loss-to-FU.

Methods

Participants

We included children born to women who participated in an RCT assessing the effect of a 6-month lifestyle intervention in women with obesity and infertility before receiving fertility care as usual, or prompt fertility care (12). Women were eligible if they conceived a healthy child within 24 months after randomization in the LIFEstyle study, had given permission to be contacted for FU research of their child and had available contact information (12). The FU study was set up to evaluate the long-term health in both women who participated in the RCT and their children (11). In this study, we will solely focus on the FU the children. The FU in the children consisted of three consecutive rounds of data collection in a period of 8 years after randomization (see Figure 1). Table 1 demonstrates an overview of the mean age and FU rates of the children during the different FU rounds. In summary, during the first FU round the children had a mean age of 4.2 years and mothers were asked to fill in a **health questionnaire** addressing the child's general health and behaviour as well as monitoring the child's food intake for 3 times in a week. In addition an accelerometer was provided to measure physical activity. The second round, the **physical examination**, consisted of a onetime visit to a mobile research vehicle near their own home when children had mean age of 4.6 years. We measured anthropometry, body composition, cardiometabolic health and behavioural components data (13). During the physical examination, participants were asked to give consent for an additional buccal swab, faeces sample and/or blood sample to gain more insight in the biochemical and genetic profiles. The third FU round was a **cardiac assessment** when children had a mean age of 6.5 year. Children were invited to visit a hospital for cardiac examination, consisting of an echocardiography and cardiac magnetic resonance imaging (MRI) study. Participation during this round would take approximately 1 hour for the echo, with an additional 1 hour for the cardiac MRI.

FU Participation questionnaire

The Medical Ethics Committee of the UMC Groningen deemed that the Medical Research Involving Human Subjects Act (WMO) did not apply to this study (METc 2019/221) and official approval was not required. We will use the STROBE guidelines for cross-sectional reporting (14). All eligible participants were asked to complete a questionnaire with statements regarding participation in FU research of their child using a 5-point Likert scale (see Supplementary figure 1) and provide written consent. The participation questionnaire consisted of two parts. The first part addressed topics including (1) experience during the original intervention study, (2) communication to participants, (3) knowledge and stigma regarding the subject of research, and (4) understanding of the research topic. The second part consisted of FU round specific statements and were asked separately for each FU round to determine which factors played a role in participation for each FU round. These statements included: (1) I let the decision of participation depend fully on my child, (2) my child was too young to participate, (3) participation would feel like a health-check for my child, (4) the distance to the research location would be too far, (5) the research visit would be too burdensome for my child and (6) the research visit would take too much time.

In total, the questionnaire included 70 statements, and mothers had to indicate how much they agreed on a 5-point Likert scale. 1 stated 'Strongly disagree, 2; 'Disagree', 3; 'Neutral', 4; 'Agree' and 5; 'Strongly agree'. Apart from the Likert scale, we used multiple choice and open questions.

Patient involvement

Participants were involved in the conduct of this research. During the feasibility stage, we pretested the questionnaire among a subgroup of participants to optimize coverage of questions and assure clarity of the questions.

Data analysis

For analysis we combined 4 (agree) and 5 (strongly agree) to summarize the percentage of agreement. To assess which factors contributed to the decision to participate in the study, we compared the answers of respondents that participated in all 3 FU rounds with respondents that did not participate in any FU round. In addition, we compared level of agreement between participants and non-participants within

each FU round to determine if there were certain factors associated with participation for a specific type of FU. Comparisons between groups were made using Fisher's exact test. The analyses were performed using IBM SPS Statistics 26 (SPSS, Chicago, IL). A p value of <0.05 was considered statistically significant.

Sensitivity analysis

To assess possible selection bias, we compared our group of participant with all eligible non-participants.

Results

In total, 341 children were conceived within 24 months after randomization and 211 dyads were eligible and approached (See Figure 2). Sixty-seven respondents (31.8%) completed the FU participation questionnaire. For an overview of the respondents and their previous participation in FU with their child, see Figure 3. Table 2 demonstrates the baseline characteristics of the respondents who completed the questionnaire. See supplementary table 2 for the STROBE checklist.

Table 3 demonstrates the incidence of agreement between respondents who participated in all FU rounds with their child (n=24) and those who did not participated in any FU round (n=7). The vast majority of both groups wanted to contribute to knowledge regarding both obesity and fertility (Table 3). Women who participated with their child during all FU rounds felt more involved in the FU as compared to those women who did not participate during any FU round (95.8% vs 14.3%, respectively, p<0.001). In addition, women who participated with their child in all FU rounds agreed that the way the FU study was introduced was good as compared to women who did not previously participate (91.7% vs 28.6% respectively, p=0.002). Respondents who did not participate in any child FU data collection round would have appreciated it if the plan for the FU would have been clear at the start of the RCT and agreed more often to be more likely to have participated if someone familiar from the RCT would have introduced the FU as compared to women who participated in all FU rounds (table 3). In addition, respondents who did not participate in any child FU round agreed more often that the subject of the research must be something they personally find interesting. For almost all respondents who participated in all FU rounds

the importance of the FU was clear (95.8%) as compared with 42.9% of the respondents who did not participate in any child FU round.

FU round specific

Table 4 demonstrates the agreement between participants and non-participants per FU round. Overall, women who participated with their child during any FU round agreed more often that participation would be a health-check for their child as compared to non-participants. This difference increased after each FU round, ranging from 55.1% and 38.9% in the questionnaire FU for participants and non-participants, respectively to 68.3% and 28% in the cardiac assessment, respectively.

In the **health questionnaire**, participants and non-participants did not differ significantly on statements such as whether the questionnaire took too much time (16.3% vs 11.2%, respectively) whether the questionnaire was too burdensome for their child (4.2% vs 11.2%) or whether they believed that their child was too young to participate (20.4% vs 11.1%). Participants and non-participants of the **physical examination or cardiac assessment** round differed on these statements. Respondents who participated in these FU rounds let the decision of participation more often fully depend on their child (39.4% for the physical examination and 52.5% for the cardiac assessment) as compared to non-participants (17.7% for the physical examination and 24% for the cardiac assessment).

Non-participants of the physical examination or cardiac assessment agreed more often that the research visit would be too burdensome for their child (24.2% vs 3% for the physical examination and 37.5% vs 0% for the cardiac assessment), take too much time (17.7% vs 3.1% for the physical examination and 25% vs 2.4% for the cardiac assessment) and felt like their child was too young to participate as compared to participants (38.3% vs 6.1% for the physical examination and 52% vs 2.4% for the cardiac assessment) (table 4).

Sensitivity analysis

Supplementary table 1 demonstrates the differences between respondents that participated in our study and all eligible non-respondents. Respondents of our study were older as compared to non-respondents

(30.1 years, standard deviation (SD 3.9) vs 28.8 years (SD 4.6), respectively, p= 0.05) and their children had a higher birthweight (3506.2 g (SD 655.5), vs 3325.5 g (SD 568.8), respectively, p= 0.04).

Discussion

We sought to determine which factors contribute to the decision of mothers to participate with their child in FU examinations after participation in an RCT prior to conception. We found that all women who had been invited for FU of their child wanted to contribute to knowledge of the research topic, regardless of their decision to participate with their child in the FU rounds. Women who participated in all rounds of data collection with their child felt more involved in the study compared to those who did not participate. Women who participated with their child in the physical examination or cardiac assessment more often reported the participation in the study as a health-check for their child. Also, they reported more often that they let their child decide about participation compared to those who did not participate. This suggests that important reasons for participating in FU research are sense of involvement, perceiving the FU as a health-check for their child and actively involving their child in the decision to participate.

Previous research identified altruism and health-related motivations as important factors for participation in research (15), also in pregnant women anticipating to participate in birth cohort studies (16). In our study, both participants and non-participants wanted to contribute to knowledge of the research topic. In addition, half of the respondents that participated in all FU rounds with their child agreed that it is important that the research topic is something that they find personally interested, implying altruism might not be the only driving factor for participation in FU research of their child. Perception of a health-check for their child seemed to positively influence the decision for participation. This is in line with previous research, demonstrating that participation in longitudinal research was not mainly driven by altruism as expected beforehand, but by the perceived benefits during the FU visit, such as the medical care (17). Barnett *et al.* (18) assessed maternal experience of participation in research with children after being included for a longitudinal cohort study during pregnancy. They identified the improvement in the health of their child to be a significant motivator to remain in the study after their

child was born (18). In addition, Garg *et al.* also demonstrated that mothers perceived health benefits for their child, such as having more time with doctors/researchers, regular monitoring of their child and a gain in health-related knowledge, as an important incentive for participation in research (16). Similar to our population included, a large international multicentre study, patients seeking fertility care considered the safety of the assisted reproductive technique, which includes long-term outcomes in their unborn children, the most important research topic (19). This is line with our results, demonstrating that participants more often perceived the FU visit as a health-care check for their child. Therefore, we believe it´s important to emphasize perceived health-care benefits as this seems an important motivator to participate in FU research for their child

In our study, respondents who participated in all FU rounds reported feeling more involved in the study than those who chose not to participate in the FU after their initial participation in the RCT. Previous research exploring reasons for participating in longitudinal health studies demonstrated that a sense of loyalty and membership is positively associated with participation (17). Studies that involved patients in designing the study have higher participation rates (20), and the findings are more readily translated into clinical practice (21). Non-participants in our study would have liked to know at the start of the RCT that there would be a FU study for their future child and that the subject of research should be something they find interesting. This is in line with findings studies assessing the impact of patient and public involvement on enrolment and retention studies, suggesting that patient involvement in setting up studies, for example to discuss direction and priorities leads to more active and involved participants (22-24). This might also lead to a clearer understanding of the importance of the FU, something we found to be twice as high among participants as compared to non-participants. Therefore, we believe that more patient involvement in priority setting, designing and executing research is valuable for the patients as well as for the application of the knowledge gained from research into practice (25).

If we focus on the differences between participants and non-participants per FU round, we demonstrated that women who participated with their child in FU consisting of physical examination or cardiac assessment more often let their child decide if she/he wanted to participate. Thus, when inviting women with their children for FU research, it is important to stimulate to actively involve their child in the

decision of participation and to ensure adequate information for the child, such as a separate invitation letter. A review on the participation of children in research identified that only 15% of research claiming to involve children in the design of studies actually involved them in decision to participate in research (26), even though involving children in all different aspects of research leads to more committed and involved participants (27). In FU of RCTs before or during pregnancy the designated children are yet to be born, but representative children could be involved in the design of the FU enabling research that might appeal to children.

The FU rate in our study was low. It was also significantly lower than the same FU protocol that was carried out by the same team in the FU of an RCT of assisted reproduction techniques (INeS) (33% vs 57%, respectively) (28). The difference in FU rates may be due to the fact that although both FU studies were carried out in the same way, in the same time period and by the same team, the participants and the interventions were different. Both studies investigated subfertile couples aiming to conceive, but the current study only included women who also were overweight and obese, while the INeS trial did not. In additional, the INeS trial only invited children for their FU, whereas our FU study invited both women and children. Moreover, the Lifestyle intervention was aimed at weight loss rather than conception, while the INeS study randomized to different fertility treatments. Although the link between obesity and subfertility was known to most participants in our study, women included in our RCT did not seek medical care for their weight even though our intervention consisted of lifestyle counselling. Obesity is surrounded by stigma (29, 30), and offering a lifestyle intervention for an unfulfilled wish to become a mother might have led to feeling of disconnect between their medical problem and the treatment offered (31). We believe that these factors could have played a role in the reduced willingness to participate in our FU.

Only 32% of all eligible mothers and children participated in this study, making results prone to selection bias. If we compare women who participated in our study with eligible non-participants, we find that participating women were older and gave birth to children with a higher birthweight (Supplementary table 1). This is something reported previously in FU of birth cohorts (32, 33). However, in our cohort the difference was small and non-participants had a few extreme low birth weight children (data not

shown) that attribute to the significant difference. The difference in age between participants and non-participants was approximately one year therefore we don't believe this might have induced selection bias. We found no other differences in relation to maternal and neonatal baseline characteristics. Therefore, we believe that our results are representative of the entire group of participants and the findings are likely to reflect true reasons to participate in FU of children after maternal participation in an RCT.

Conclusion

When designing FU in children after a maternal participation in an RCTs of an intervention before or during pregnancy, loss-to-FU might be limited by emphasizing the possible perceived benefits of participation such as a health-check for their child and to stimulate to actively involve the child in the decision of participation. In addition, it is important to actively involve women and representative children in the design of the FU study to stimulate the sense of involvement and increase understanding of the importance of the FU which seems to increase participation rates. Implementing these factors could contribute to retain as many participants as possible during FU in children after an intervention before or during pregnancy, providing evidence for addressing causality between early life and later health.

Ethical approval statement

The Medical Ethics Committee of the UMC Groningen deemed that the Medical Research Involving Human Subjects Act (WMO) did not apply to this study (METc 2019/221) and official approval was not required.

Contributorship Statement

TdH and AWvD designed the research protocol. TdH was responsible for safely storing all data, extracting and analyzing the data and writing the article. AH, HG, and TJR all carefully reviewed the article. AH, HG, TJR and AWvD were involved in the set-up of the original intervention study and follow-up study. All authors provided intellectual input and were involved in the writing of the article.

Competing interest: We report no conflicts of interest

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Data sharing statement: Data are available on reasonable request. Data for this study are not publicly available. Please contact authors for information on data availability.

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Table 1: Overview follow-up data collection rounds Data is presented as mean (SD) or n (%)			
	Health questionnaire	**Physical examination**	**Cardiac assessment**
Eligible – n(%)	305	156	242
Participated – n(%)	107	48	60
FU rate - %	35.1	30.8	24.7
Intervention group	43 (40.1)	17 (33.3)	24 (40.0)
Age children - years	4.2 (0.8)	4.6 (1.0)	6.5 (1.1)
FU = follow-up			

Table 2: Baseline characteristics Data is presented as mean (standard deviation), or n (%) N= 67	
Mean age mothers – years	39.0 (4.1)
Education mother - %	
Primary education	1 (1.6)
Secondary education	13 (20.3)
Intermediate vocational education	37 (57.8)
Higher vocational education and university	13 (20.3)
Mean age child – years	7.5 (0.8)
Intervention group - %	24 (35.8)
Female (child) - %	30 (44.8)

Table 3: Agreement between respondents who participated in all follow-up (FU) round and respondents who did not participate in any FU round					
	Participated in all FU rounds (n=24)		Did not participate in any FU round (n=7)		p
Statement	n	%	n	%	
The importance of the intervention study was clear	22	91.7	5	71.4	0.21
I want to contribute to knowledge regarding obesity	22	91.7	5	71.4	0.21
I want to contribute to knowledge regarding fertility	24	100	6	85.7	0.23
I felt that during the original trial there was enough attention for my wish to conceive	21	87.5	5	71.4	0.56
I felt involved in the intervention study	18	75	3	42.9	0.17
I felt involved in the follow-up	23	95.8	1	14.3	<0.001
The way in which the intervention study was introduced by the health professional was good	21	87.5	5	71.4	0.56
The way in which the follow-up was introduced by the health professional was good	22	91.7	2	28.6	0.002
The link between the intervention study and the follow-up was clear	17	70.8	2	28.6	0.08
I would have liked it if it was clear at introduction of the intervention study, that there would be a follow-up	3	12.5	6	85.7	0.001
If the follow-up would have been introduced by someone from the RCT, I would have been more likely to participate	0	0	4	57.1	0.001
There was too much time in between the several visits of the follow-up	3	12.5	2	28.6	0.56
I would have wanted to receive more updates during the follow-up	7	29.2	2	28.6	1.0
I think it's important that the subject of research is something that I find personally interesting	11	45.8	7	100	0.03
I knew that obesity and fertility were related	19	79.2	7	100	0.56
I knew that cardiovascular diseases are more common in females	14	58.3	5	71.4	0.68
I knew that the later health of a child may depend on lifestyle during pregnancy	16	66.7	6	85.7	0.64
The importance of the follow-up was clear	23	95.8	3	42.9	0.005
I thought that there was a negative stigma regarding obesity during the introduction of the intervention study	7	29.2	2	28.6	1.0
I think it's important to receive an incentive after participation	10	41.7	3	42.9	1.0

Table 4: Agreement between participants and non-participants per FU round									
	Health questionnaire			Physical examination			Cardiac assessment		
Statement	P (%)	NP (%)	p	P (%)	NP (%)	p	P (%)	NP (%)	p
I let the decision of participation depend fully on my child	14.2	22.2	0.47	39.4	17.7	0.06	52.5	24	0.04
My child was too young to participate	20.4	11.1	0.49	6.1	38.3	0.003	2.4	52	<0.001
Participation would feel like a health-check for my child	55.1	38.9	0.28	63.6	38.2	0.05	68.3	28	0.003
The distance to the research location would be too far	4.1	5.6	1.0	0	26.5	0.002	29.3	48	0.12
The research visit would be too burdensome for my child	4.2	11.2	0.29	3	24.2	0.03	0	37.5	<0.001
The research visit would take too much time	16.3	11.2	0.72	3.1	17.7	0.11	2.4	25	0.009

P= participant
NP= non-participant

Figure 1: Follow-up data collection rounds

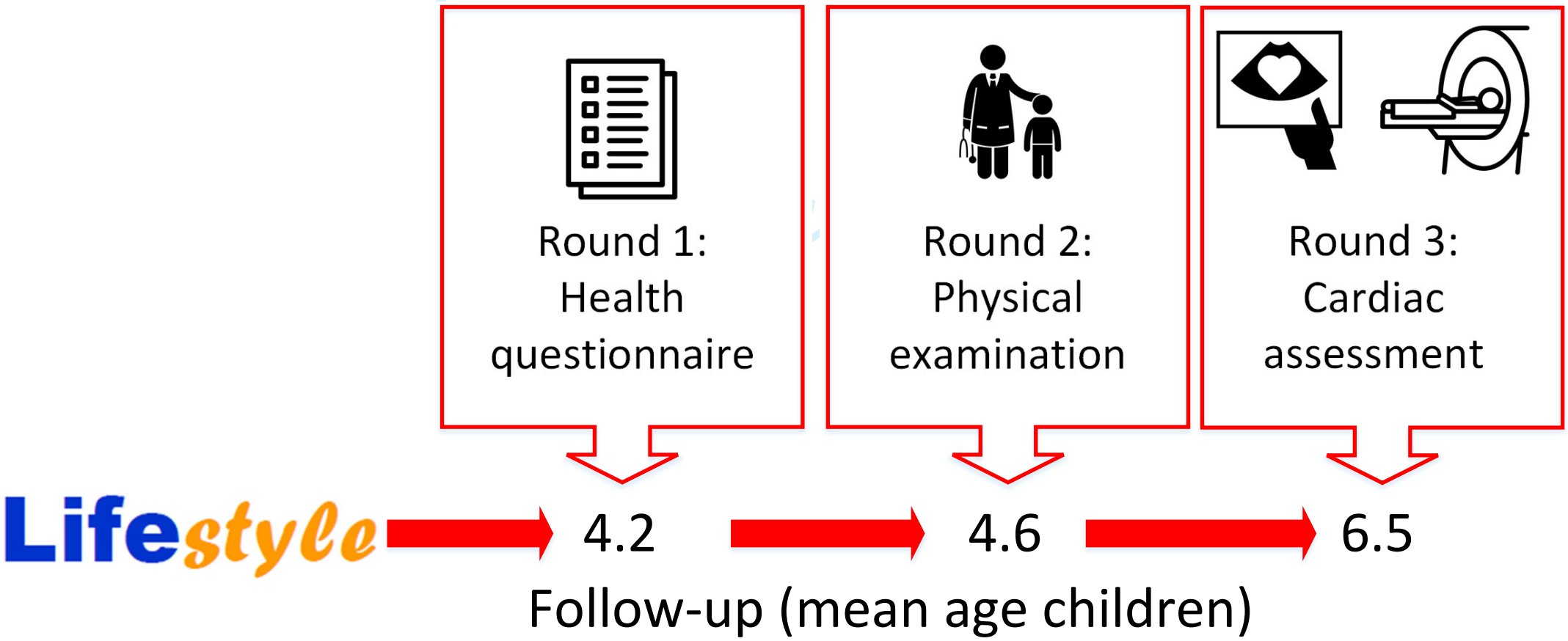


Figure 2: Participation flowchart

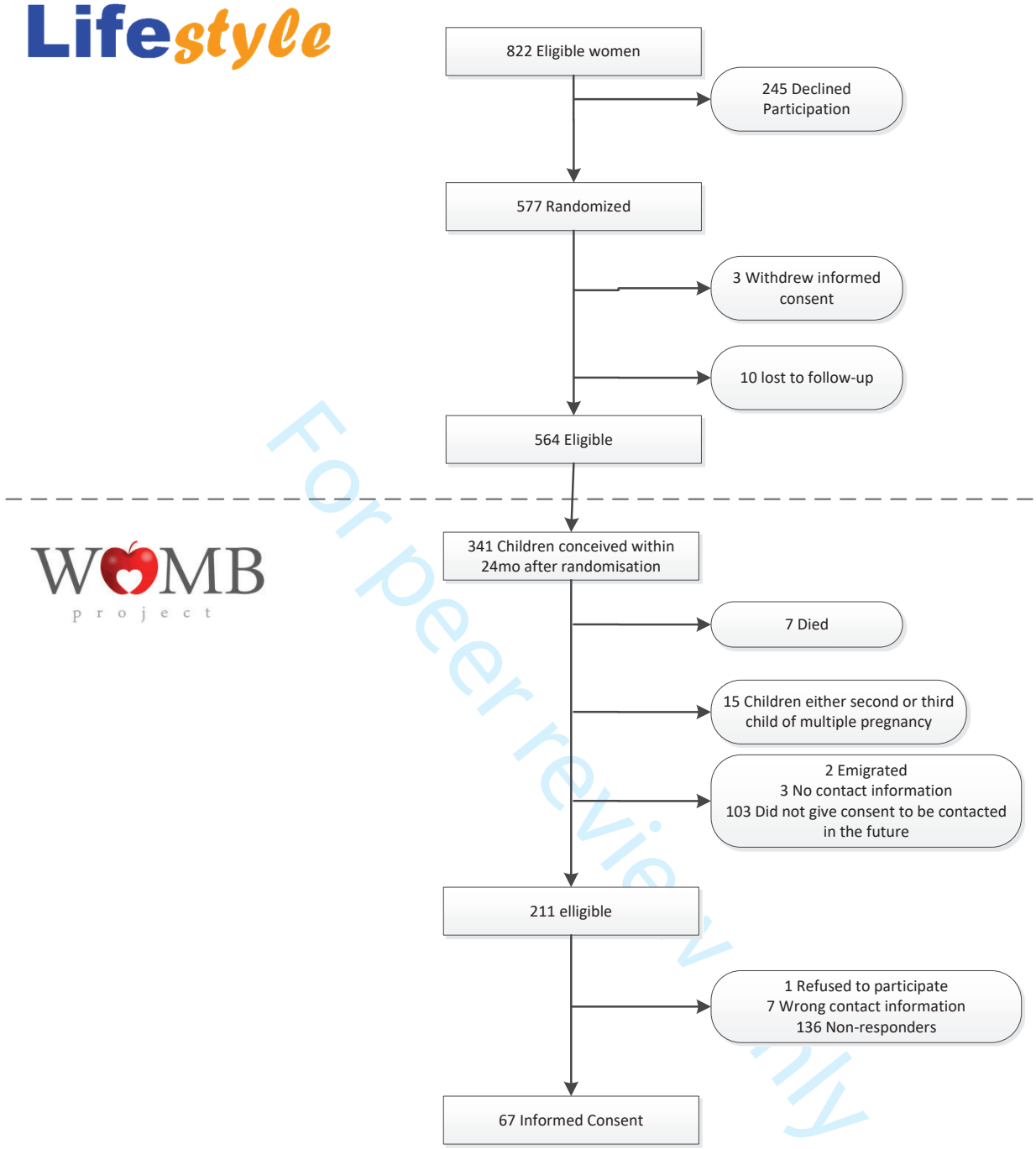
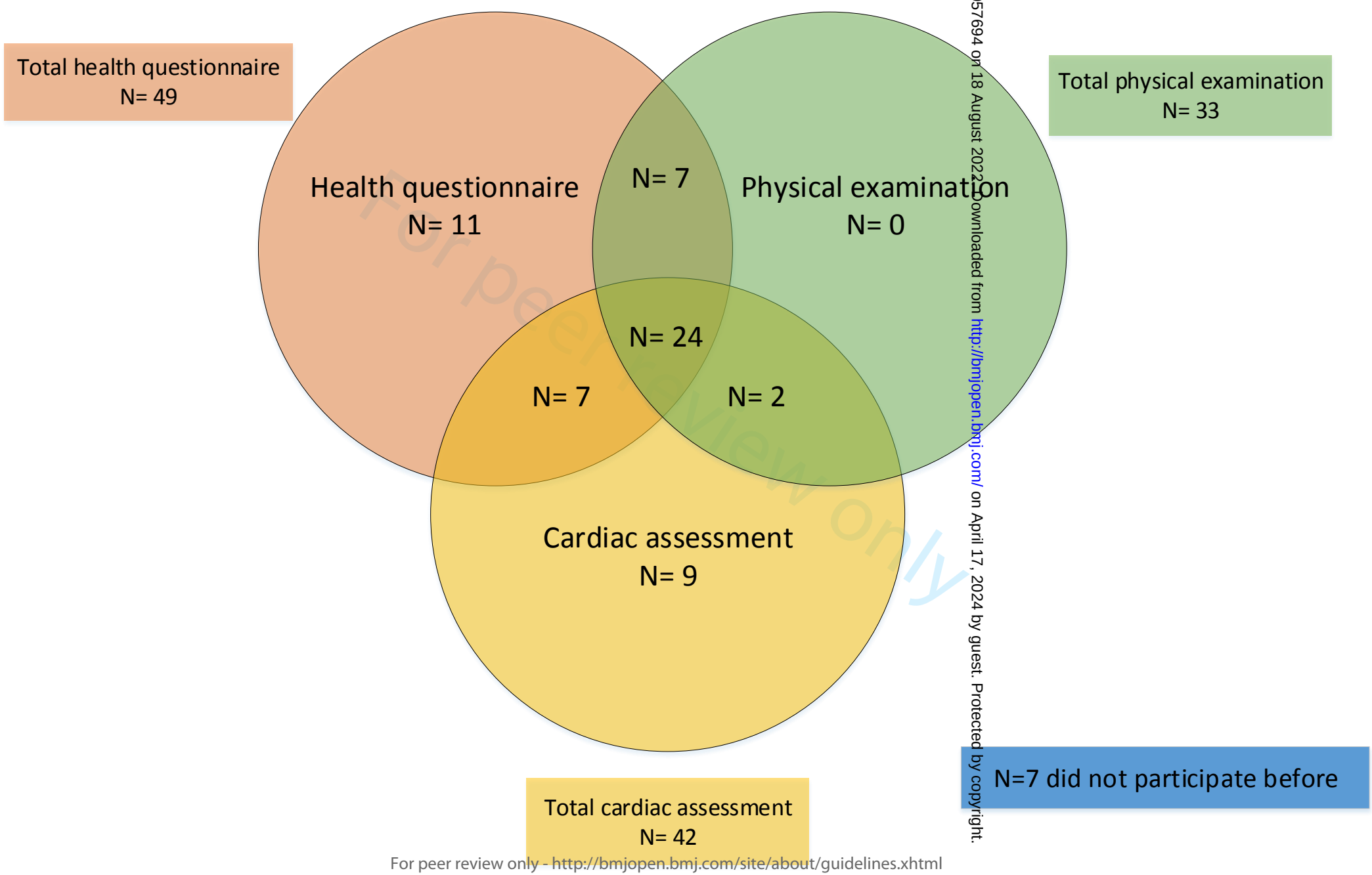


Figure 3: Distribution of respondents (n=67) and previous FU participation with their child



Supplementary table 1: Baseline characteristics respondents compared to eligible non-respondents Data is presented as mean (standard deviation), or n (%)			
	Respondents (n=67)	**Eligible non-respondents (n=144)**	**p**
Maternal characteristics			
Mean age mothers at randomisation – years	30.1 (3.9)	28.8 (4.6)	0.05
Education mother			0.41
Primary education - %	1 (1.6)	5 (3.5)	
Secondary education - %	13 (20.3)	36 (25.0)	
Intermediate vocational education - %	37 (57.8)	63 (43.8)	
Higher vocational education and university - %	13 (20.3)	34 (23.6)	
Mode of conception			0.55
Spontaneous - %	21 (31.3)	56 (39.2)	
Ovulation Induction - %	26 (38.8)	42 (29.4)	
Intra Uterine Insemination - %	9 (13.4)	22 (15.4)	
IVF/ICSI/CRYO - %	11 (16.4)	23 (16.1)	
Intervention group - %	24 (35.8)	69 (47.9)	0.10
Pregnancy complications* - %	32 (48.5)	76 (53.5)	0.46
Child characteristics			
Gestational age – weeks	39.0 (2.3)	39.0 (2.3)	0.95
Birth weight – g	3506.2 (655.5)	3325.5 (568.8)	0.04
Mean age child at start third data wave – years	6.0 (0.8)	5.9 (1.0)	0.41
Female (child) - %	30 (44.8)	67 (46.9)	0.69

*Complications during pregnancy included diabetes gravidarum, hyperemesis, pregnancy induced hypertension, (pre)eclampsia, intra-uterine death or HELLP syndrome
IVF= in-vitro fertilisation
ICSI= intracytoplasmic sperm injection
CRYO= cryopreservation

Supplementary table 2: STROBE Reporting checklist for cross sectional study.			
		Reporting Item	Page Number
Title and abstract			
Title	#1a	Indicate the study's design with a commonly used term in the title or the abstract	1
Abstract	#1b	Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background / rationale	#2	Explain the scientific background and rationale for the investigation being reported	4
Objectives	#3	State specific objectives, including any prespecified hypotheses	4
Methods			
Study design	#4	Present key elements of study design early in the paper	5,6
Setting	#5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5,6
Eligibility criteria	#6a	Give the eligibility criteria, and the sources and methods of selection of participants.	5
	#7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	6
Data sources / measurement	#8	For each variable of interest give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group. Give information separately for for exposed and unexposed groups if applicable.	6,7
Bias	#9	Describe any efforts to address potential sources of bias	7
Study size	#10	Explain how the study size was arrived at	n/a
Quantitative variables	#11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen, and why	6
Statistical methods	#12a	Describe all statistical methods, including those used to control for confounding	6,7
Statistical methods	#12b	Describe any methods used to examine subgroups and interactions	n/a
Statistical methods	#12c	Explain how missing data were addressed	n/a
Statistical methods	#12d	If applicable, describe analytical methods taking account of sampling strategy	n/a
Statistical methods	#12e	Describe any sensitivity analyses	7
Results			

Participants	#13a	Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed. Give information separately for for exposed and unexposed groups if applicable.	7
Participants	#13b	Give reasons for non-participation at each stage	7
Participants	#13c	Consider use of a flow diagram	7
Descriptive data	#14a	Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders. Give information separately for exposed and unexposed groups if applicable.	7
Descriptive data	#14b	Indicate number of participants with missing data for each variable of interest	n/a
Outcome data	#15	Report numbers of outcome events or summary measures. Give information separately for exposed and unexposed groups if applicable.	7
Main results	#16a	Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	n/a
Main results	#16b	Report category boundaries when continuous variables were categorized	n/a
Main results	#16c	If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	n/a
Other analyses	#17	Report other analyses done—e.g., analyses of subgroups and interactions, and sensitivity analyses	n/a
Discussion			
Key results	#18	Summarise key results with reference to study objectives	9
Limitations	#19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias.	2,11
Interpretation	#20	Give a cautious overall interpretation considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence.	9-11
Generalisability	#21	Discuss the generalisability (external validity) of the study results	12
Other Information			
Funding	#22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	2

Supplementary Figure 1: Participation questionnaire

Below you find a few statements regarding participating in research in general. Indicate how much you agree with each statement.					
	Strongly disagree	**Disagree**	**Neutral**	**Agree**	**Strongly agree**
I think it's important the research can take place after work/in the weekend	○	○	○	○	○
I think it's important the research is near my home	○	○	○	○	○
I think it's important to help other people by participating in research	○	○	○	○	○
I think it's important to receive an incentive after participation	○	○	○	○	○
I think it's important that the subject of research is something that I find personally interesting	○	○	○	○	○
I think it's important that my child is old enough to decide if she/he wants to participate	○	○	○	○	○
I think it's important my child agrees to participate in research	○	○	○	○	○

Below you find a few statements. Indicate how much you agree with each statement at time of inclusion for the intervention.					
	Strongly disagree	**Disagree**	**Neutral**	**Agree**	**Strongly agree**
I knew that obesity and fertility were related	○	○	○	○	○
I felt like I could influence my own health	○	○	○	○	○
I felt like I could influence my ownlifestyle	○	○	○	○	○

Intervention study

You participated in the intervention study (the LIFEstyle study). One of the topics of theintervention study was overweight. Below you find a few statements. Indicate how much you agree with each statement.					
	Strongly disagree	**Disagree**	**Neutral**	**Agree**	**Strongly agree**
I want to contribute to knowledge regarding fertility	○	○	○	○	○
I want to contribute to knowledge regarding obesity	○	○	○	○	○
I thought there was a negative stigma regarding obesity during the introduction of the intervention study	○	○	○	○	○
The importance of the interventionstudy was clear	○	○	○	○	○
Namely:					
I felt involved in the intervention study	○	○	○	○	○
I felt that during the original trial there was enough attention for my wish to conceive	○	○	○	○	○
The manner in which the intervention study was introduced by the health-care professional was good	○	○	○	○	○
If not, could you indicate what you would have liked?					

The statements below only need to be answered <u>only</u> if you participated in the 6-month lifestyle intervention before fertility treatment.					
	Strongly disagree	**Disagree**	**Neutral**	**Agree**	**Strongly agree**
I felt like there was enough attention for my personal situation.	○	○	○	○	○
I felt taken seriously	○	○	○	○	○
I felt judged because of my weight	○	○	○	○	○

Follow-up study

You participated in the follow-up research. Below you find a few statements. Indicate how much you agree with each statement.					
	Strongly disagree	**Disagree**	**Neutral**	**Agree**	**Strongly agree**
I knew that cardiovascular diseases are more common in females	○	○	○	○	○
I knew that the later health of a child may depend on lifestyle during pregnancy	○	○	○	○	○
The link between the intervention study and the follow-up was clear	○	○	○	○	○
The importance of the follow-up was clear	○	○	○	○	○
I felt involved in the follow-up	○	○	○	○	○
The manner in which the follow-up was introduced by the health professional was good	○	○	○	○	○
If not, could you indicate what you would you have liked?					

Below you find a few statements. Indicate how much you agree with each statement.					
	Strongly disagree	**Disagree**	**Neutral**	**Agree**	**Strongly agree**
I would have liked to know in advance, e.g. during the introduction of the intervention study, that there would bea follow-up study	○	○	○	○	○
If the follow-up would have been introduced by someone from the intervention study, I would have been more likely to participate	○	○	○	○	○
There was too much time in between the several stages of the follow-up	○	○	○	○	○
I would have wanted to receive more updates during the follow-up	○	○	○	○	○
How would you have liked to receive the updates? Letter/ E-mail / Phone / Text message (circle your answer) How often would you have liked to receive updates? Every 3 months / 6 months / year (circle your answer)					

WOMB project

PART 2: CONTACT WITH RESEARCHERS

Below you find a few statements regarding your experiences during the follow-up visits. Indicate how much you agree with each statement. If you did not participate please indicate n.a.						
	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	n.a.
I could ask all the questions I had						
Intervention study	○	○	○	○	○	○
Follow-up visit 1	○	○	○	○	○	○
Follow-up visit 2	○	○	○	○	○	○
Follow-up visit 3	○	○	○	○	○	○
The researcher clearly explained everything to me						
Intervention study	○	○	○	○	○	○
Follow-up visit 1	○	○	○	○	○	○
Follow-up visit 2	○	○	○	○	○	○
Follow-up visit 3	○	○	○	○	○	○
The researcher clearly explained everything to my child						
Follow-up visit 1	○	○	○	○	○	○
Follow-up visit 2	○	○	○	○	○	○
Follow-up visit 3	○	○	○	○	○	○
The researcher was interested in my personal situation						
Intervention study	○	○	○	○	○	○
Follow-up visit 1	○	○	○	○	○	○
Follow-up visit 2	○	○	○	○	○	○
Follow-up visit 3	○	○	○	○	○	○
The researcher took his/her time						
Intervention study	○	○	○	○	○	○
Follow-up visit 1	○	○	○	○	○	○
Follow-up visit 2	○	○	○	○	○	○
Follow-up visit 3	○	○	○	○	○	○

To answer the statements below, participation in that specific visit is <u>not necessary</u>

Below you find a few statements. Indicate how much you agree with each statement.					
	Strongly disagree	**Disagree**	**Neutral**	**Agree**	**Strongly agree**
The research visit would take too much time					
1. follow-up round 1	○	○	○	○	○
2. follow-up round 2	○	○	○	○	○
3. follow-up round 3	○	○	○	○	○
The research visit would be too burdensome for my child					
1. follow-up round 1	○	○	○	○	○
2. follow-up round 2	○	○	○	○	○
3. follow-up round 3	○	○	○	○	○
The distance to the research location would be too far					
1. follow-up round 1	○	○	○	○	○
2. follow-up round 2	○	○	○	○	○
3. follow-up round 3	○	○	○	○	○
I let the decision of participation depend fully on my child					
1. follow-up round 1	○	○	○	○	○
2. follow-up round 2	○	○	○	○	○
3. follow-up round 3	○	○	○	○	○
My child was too young to participate					
1. follow-up round 1	○	○	○	○	○
2. follow-up round 2	○	○	○	○	○
3. follow-up round 3	○	○	○	○	○
I did not think the research topic was relevant					
1. follow-up round 1	○	○	○	○	○
2. follow-up round 2	○	○	○	○	○
3. follow-up round 3	○	○	○	○	○
Participation would feel like a health-check for my child					
1. follow-up round 1	○	○	○	○	○
2. follow-up round 2	○	○	○	○	○
3. follow-up round 3	○	○	○	○	○

Could you indicate why you did or did not participate in the additional examinations for your child?		
	Why did you participate?	**Why did you not participate?**
Blood sample		
Buccal swab		
Feaces sample		

Last, you can add any suggestions/comments in the below:

Thank you for your participation!

Reporting checklist for cross sectional study.

		Reporting Item	Page Number
Title and abstract			
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	#7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	6
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Study size	#10	Explain how the study size was arrived at	n/a
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Statistical methods	#12c	Explain how missing data were addressed	n/a
Statistical methods	#12d	If applicable, describe analytical methods taking account of sampling strategy	n/a
Statistical methods	#12e	Describe any sensitivity analyses	7

Results			
Participants	#13a	Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed. Give information separately for for exposed and unexposed groups if applicable.	7
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Main results	#16b	Report category boundaries when continuous variables were categorized	n/a
Main results	#16c	If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	n/a
Other analyses	#17	Report other analyses done—e.g., analyses of subgroups and interactions, and sensitivity analyses	n/a
Discussion			
Key results	#18	Summarise key results with reference to study objectives	9
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Which factors play a role in the decision of mothers to participate in child follow-up examinations after participation in an RCT? – a semi-quantitative study

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Key words: Participation, follow-up

Abstract

Objectives: To determine which factors contribute to the decision of mothers to participate with their child in follow-up (FU) examinations after participation in a randomized controlled trial (RCT) prior to conception.

Design: Cross-sectional survey including Likert-scale items. Comparisons will be made between respondents who participated in all FU rounds of data collection and those who did not participate in any FU round with their child.

Participants: Women who participated in an RCT investigating the effect of a preconception lifestyle intervention were invited to participate with their child in three FU data collections when the child had a mean age of 4.2, 4.6 and 6.5 years, respectively. FU rounds included a health questionnaire, physical examination and cardiac assessment, successively.

Results: 67 respondents were included, of whom seven (10%) did not participate in any FU round and 24 (36%) participated in all FU rounds. Women who participated with their child in all three FU data collection rounds felt more involved in the FU research (95.8%) and agreed more often that the FU was introduced well (91.7%) as compared to women that did not participate in any FU data collection round with their child (14.3% and 28.6%, respectively). Participants of FU rounds more often agreed that participation felt like a health-check for their child as compared to non-participants. In addition, participants of the physical examination and cardiac assessment more often let their decision to participate depend fully on their child, as compared to non-participants (39.4% vs 17.7%, and 52.5% vs 24%, respectively).

Conclusions: To increase participation rates in future FU studies of children after maternal participation in an RCT, we suggest to involve women in the design of the FU study, to emphasize possible perceived benefits of participation and to encourage women to actively involve their child in the decision of participation.

Article summary

Strengths and limitations of this study

- We designed a questionnaire to determine which factors influence the decision of mothers to participate with their child in follow-up (FU) examinations after participation in a randomized controlled trial (RCT) prior to conception.
- The questionnaire was piloted amongst randomly-picked women to ensure all possible factors were addressed in the questionnaire.
- We compared respondents who participated in all three FU rounds of data collection to those who did not participate in any FU round with their child.
- All respondents answered the questionnaire at one moment in time and after completion of the FU, thus a change in opinion during FU was not accounted for.

Introduction

Maternal health before and during pregnancy is associated with health outcomes in children throughout the life course (1, 2). Observational studies have shown that maternal health conditions before or during pregnancy, such as obesity and diabetes, are associated with an increased incidence of obesity, type 2 diabetes and hypertension in their children (3-5). Interventions before or during pregnancy could potentially affect children's health in the long run. In order to assess causal effects of such interventions on children's health, long term follow-up (FU) of randomized controlled trials (RCTs) evaluating interventions before or during pregnancy are needed.

Currently only 16% of RCTs evaluating effects of interventions during pregnancy include a FU to evaluate the effect of the intervention on the child's health (6). This low number may be due to the high costs and long timespan that exceeds most funding schemes, as well as logistical and legal challenges (7). An important challenge which hampers the unique ability of trials to assess causality is that such long-term FU studies in children of mothers who participated in RCTs investigating effects of interventions before or during pregnancy often face high loss-to-FU. Loss-to-FU can induce selection bias, leading to imbalances in study groups, which can jeopardize the ability to assess causality (8, 9). Importantly, the validity of the study results correlate directly with the degree of loss-to-FU (10).

The importance of the preconception period in determining the long-term health in children has been well established and recognized by several important authorities, including the World Health Organization and the International Federation of Gynaecology and Obstetrics (2, 11-19). Studies aimed at improving preconception health in women with obesity are conducted more often and should be seen as a public health priority (11, 20-22). With the alarming rise of maternal obesity worldwide, the effect of preventive strategies on the detrimental effects of maternal obesity on long-term health in children are necessary, and high follow-up rates must be ensured (14, 23). To minimize loss-to-FU in this type of FU, an understanding of factors that influence the decision for participation is important. For this semi-qualitative study, we included women who participated in an RCT investigating the

effects of a lifestyle intervention before pregnancy on fertility outcomes in women with obesity. During the FU, which was introduced after inclusion for the RCT, children born to these women were invited to participate in several FU data collection rounds to investigate their long-term health (24). The FU rounds in the children included a questionnaire addressing the child's health, a physical examination near their homes, and a cardiac assessment in a hospital. We aimed to determine which factors play a role for mothers when deciding whether or not to participate with their child in FU research. Eventually, our results could be implemented in the design of future FU studies of children after maternal participation in an RCT, and eventually limit loss-to-FU.

Methods

Participants

We included women who participated in the LIFEstyle study, an RCT investigating a preconception lifestyle intervention (25). The intervention study included infertile women with obesity and these women were randomly assigned to a lifestyle intervention before fertility care or prompt fertility care (25). Women were eligible if they conceived a healthy child within 24 months after randomization in the LIFEstyle study, had given permission to be contacted for FU research of their child, and had available contact information (25). The FU study was set up to evaluate the long-term health in both women who participated in the RCT and their children (24). In this study, we focused solely on the FU of the children. The FU in the children consisted of three consecutive rounds of data collection in a period of 8 years after randomization (see Figure 1). Table 1 demonstrates an overview of the mean age and FU rates of the children during the different FU rounds. In summary, during the first FU round the children had a mean age of 4.2 years and mothers were asked to fill in a **health questionnaire** addressing the child's general health and behaviour as well as monitoring the child's food intake 3 times in one week. In addition, an accelerometer was provided to measure the physical activity of the children. The second round, the **physical examination**, consisted of a onetime visit to a mobile research vehicle near the family's home when the children had mean age of 4.6 years. We measured

anthropometry, body composition, cardiometabolic health and behavioural components (26). During the physical examination, participants were asked to give consent for an additional buccal swab, faeces sample and/or blood sample to gain more insight in the biochemical and genetic profiles. The third FU round was a **cardiac assessment** in a hospital when the children in the study had a mean age of 6.5 years. This cardiac assessment consisted of an echocardiogram and a cardiac magnetic resonance imaging (MRI) study. Participation during this round took approximately 1 hour for the echo and an additional 1 hour for the cardiac MRI.

FU Participation questionnaire

The Medical Ethics Committee of the UMC Groningen deemed that the Medical Research Involving Human Subjects Act (WMO) did not apply to this study (METc 2019/221) and official approval was not required. We used the STROBE guidelines for cross-sectional reporting (27). All eligible participants were asked to complete a questionnaire with statements regarding participation in FU research of their child (see Supplementary figure 1) and provide written consent. The participation questionnaire consisted of two parts. The first part addressed topics including (1) experience during the original intervention study, (2) communication to participants, (3) knowledge and stigma of the subject of research, and (4) understanding of the importance of the research topic. The second part consisted of statements specific for the FU round and were asked separately for each FU round to determine which factors played a role in participation for each round. These statements included: (1) I let the decision of participation depend fully on my child, (2) my child was too young to participate, (3) participation would feel like a health-check for my child, (4) the distance to the research location would be too far, (5) the research visit would be too burdensome for my child and (6) the research visit would take too much time.

In total, the questionnaire included 70 statements and mothers had to indicate how much they agreed on a 5-point Likert scale. 1 stated ‘Strongly disagree’, 2; ‘Disagree’, 3; ‘Neutral’, 4; ‘Agree’ and 5; ‘Strongly agree’. Apart from the Likert scale, we used multiple choice and open questions.

Patient and Public Involvement

Participants were involved in the conduct of this research. During the feasibility stage, we pretested the questionnaire among ten participants to optimize coverage of questions and assure clarity of the questions. Based on their feedback, we added two questions to the questionnaire: "If the follow-up study would have been introduced by someone from the original study team, I would have been more likely to participate" and "The link between the original intervention study and the follow-up study was clear" (Supplementary Figure 1).

Data analysis

For the analysis, we combined 4 (agree) and 5 (strongly agree) to summarize the percentage of agreement. To assess which factors contributed to the decision to participate in the study, we compared the answers of respondents that participated in all three FU rounds with respondents that did not participate in any FU round with their child. In addition, we compared the level of agreement between participants and non-participants within each FU round to determine if there were certain factors associated with participation for a specific type of FU. Comparisons between groups were made using Fisher's exact test. The analyses were performed using IBM SPS Statistics 26 (SPSS, Chicago, IL). A p value of <0.05 was considered statistically significant.

Sensitivity analysis

To assess possible selection bias, we compared our group of participants with all eligible non-participants.

Results

In total, 341 children were conceived within 24 months after randomization and 211 dyads were eligible and approached (See Figure 2). Sixty-seven respondents (31.8%) completed the FU participation questionnaire. For an overview of the respondents and their previous participation in FU

with their child, see Figure 3. Table 2 demonstrates the baseline characteristics of the respondents who completed the questionnaire. See supplementary table 2 for the STROBE checklist.

Table 3 demonstrates the incidence of agreement between respondents who participated in all FU rounds with their child (n=24) and those who did not participate in any FU round (n=7). The vast majority of both groups wanted to contribute to knowledge regarding both obesity and fertility (Table 3). Women who participated with their child during all FU rounds felt more involved in the FU as compared to those women who did not participate in any FU round (95.8% vs 14.3%, respectively, p<0.001). In addition, women who participated with their child in all FU rounds agreed that the way the FU study was introduced was good as compared to women who did not previously participate (91.7% vs 28.6% respectively, p=0.002). Respondents who did not participate in any child FU data collection round would have appreciated it if the plan for the FU would have been clearer at the start of the RCT and agreed more often that they would have been more likely to participate if someone familiar from the RCT would have introduced the FU, as compared to women who participated in all FU rounds (table 3). In addition, respondents who did not participate in any child FU round agreed more often that the subject of the research has to be something they personally find interesting. Almost all respondents who participated in all FU rounds agreed that the importance of the FU was clear (95.8%) as compared with 42.9% of the respondents who did not participate in any child FU round.

FU round specific questions

Table 4 demonstrates the agreement between participants and non-participants per FU round. Overall, women who participated with their child during any FU round agreed more often that participation felt like a health-check for their child as compared to non-participants. This difference increased in subsequent FU rounds, ranging from 55.1% and 38.9% between participants and non-participants in the health questionnaire to 68.3% and 28% in the cardiac assessment, respectively.

In the **health questionnaire**, participants and non-participants did not differ significantly on statements, including if the questionnaire took too much time (16.3% vs 11.2%, respectively), if the questionnaire was too burdensome for their child (4.2% vs 11.2%) or if they believed that their child was too young to participate (20.4% vs 11.1%). Participants and non-participants of the **physical examination or cardiac assessment** round did differ on these statements. Respondents who participated in these FU rounds let the decision of participation more often fully depend on their child (39.4% for the physical examination and 52.5% for the cardiac assessment) as compared to non-participants (17.7% for the physical examination and 24% for the cardiac assessment).

Non-participants of the physical examination or cardiac assessment agreed more often that the research visit was too burdensome for their child (24.2% vs 3% for the physical examination and 37.5% vs 0% for the cardiac assessment) and took too much time (17.7% vs 3.1% for the physical examination and 25% vs 2.4% for the cardiac assessment) and they felt like their child was too young to participate as compared to participants (38.3% vs 6.1% for the physical examination and 52% vs 2.4% for the cardiac assessment) (table 4).

Sensitivity analysis

Supplementary table 1 demonstrates the differences between respondents that participated in our study and all eligible non-respondents. Respondents of our study were older as compared to non-respondents (30.1 years, standard deviation (SD 3.9) vs 28.8 years (SD 4.6), respectively, p= 0.05) and their children had a higher birthweight (3506.2 g (SD 655.5), vs 3325.5 g (SD 568.8), respectively, p= 0.04).

Discussion

We sought to determine which factors contribute to the decision of mothers to participate with their child in FU examinations after participation in an RCT prior to conception. We found that all women who had been invited for FU of their child wanted to contribute to knowledge of the research topic.

Women who participated in all rounds of data collection with their child felt more involved in the study compared to those who did not participate. In addition, women who participated with their child in the physical examination or cardiac assessment more often perceived participation as a health-check for their child and let their child decide to participate as compared to those who did not participate. This suggests that important reasons for participating in FU research are: feeling involved, perceiving the FU as a health-check for their child, and actively involving their child in the decision to participate.

In pregnant women anticipating to participate in a birth cohort study, altruism and health-related motivations are important factors for participation in research (28, 29). In our study, both participants and non-participants wanted to contribute to knowledge of the research topic. In addition, half of the respondents that participated in all FU rounds with their child agreed that it is important that the research topic is something that they find personally interesting, implying altruism might not be the only driving factor for participation in FU research of their child. Perceiving the FU as a health-check for their child seemed to positively influence the decision for participation. This is in line with previous research, demonstrating that participation in longitudinal research was not mainly driven by altruism as expected beforehand, but by the perceived benefits during the FU visit, such as the medical care (30). Barnett *et al.* assessed maternal experience of participation in FU research with children after participation in a longitudinal cohort study during pregnancy (31). They identified health improvements in children as a significant motivator for mothers to remain in the study after their child was born (31). In addition, Garg *et al.* identified perceived health benefits, regular monitoring of their child and a gain in health-related knowledge as important incentives for mothers when participating in research with their children (29). Patients seeking fertility care considered the safety of the assisted reproductive technique, which includes long-term outcomes in their unborn children, the most important research topic (32). Therefore, we believe it is important to emphasize perceived health-care benefits to women participating in FU research for their child.

In our study, respondents who participated in all FU rounds felt more involved as compared to non-participants. Previous research exploring reasons for participation in longitudinal health studies demonstrated that a sense of loyalty and membership is positively associated with participation (30). Studies that involved patients in the study design process have higher participation rates (33), and the findings are more readily translated into clinical practice (34). Non-participants would have been more inclined to participate if the FU would have been introduced at inclusion of the RCT, and if the health outcomes assessed in FU would be relevant to them. This is in line with studies assessing the impact of patient and public involvement on enrolment and retention studies. These studies found that patient involvement in setting up studies, for example in the direction and priorities of studies, leads to more active and involved participants (35-37). This might also lead to a clearer understanding of the importance of the FU, something we found to be twice as high amongst participants as compared to non-participants. Therefore, we believe that patient involvement in priority setting, designing, and execution of research will lead to a higher participation rate and facilitate implementation of knowledge gained by research into practice (38).

Women who participated with their child in the FU consisting of physical examination or cardiac assessment more often allowed their child to decide if she/he wanted to participate. Thus, when inviting women with their children for FU research, it is important to encourage women to actively involve their child in the decision of participation, and to ensure appropriate information for the child, such as a separate invitation letter. A review on the participation of children in research identified that only 15% of research claiming to involve children in the design of studies actually involved them in the decision to participate in research (39), even though involving children in all aspects of research leads to more committed and involved participants (40). When designing a FU of RCTs before or during pregnancy, representative children should be involved to ensure that the research appeals to children.

The FU rates in the data collection rounds were low. The FU rate of the physical examination was significantly lower than the same protocol that was carried out by the same team during the FU of an

RCT of assisted reproduction techniques (INeS) (33% vs 57%, respectively) (41). Importantly, although both FU studies were carried out in the same way, in the same time period, and by the same team, the participation rates differed. Both studies investigated infertile couples aiming to conceive, but the current study only included women who also were overweight and obese, while the INeS trial did not. Moreover, the lifestyle intervention was aimed at weight loss rather than conception, while the INeS study randomized women to different fertility treatments. Although the link between obesity and subfertility was known to most participants in our study, women included in our RCT did not seek medical care for their weight even though the intervention offered to these women consisted of lifestyle counselling. We hypothesize that offering a lifestyle intervention for an unfulfilled wish to become pregnant might have led to a feeling of disconnect between their medical problem and the treatment offered. These factors could have played a role in the reduced willingness to participate in our FU.

Respondents filling out our questionnaire reported not feeling they were being stigmatized due to their weight. However, this may have been different for non-responding women. Previous research has demonstrated that women with obesity are often faced with weight stigma (42, 43). Raising the topic of weight by health care providers requires a sensitive and respectful approach, using neutral terminology (e.g. 'weight' and 'BMI' instead of 'obese') and preferably asking women about their language preferences (44). Moreover, health care providers should not make assumptions about diet, activity levels, motivations and perceived difficulties (45). Women with obesity contemplating a pregnancy are often not aware of the detrimental consequences of maternal obesity on their future child (46-49). However, once they are made aware of these consequences they are often willing to improve their health and postpone their wish to conceive in order to make lifestyle changes (50). Unfortunately, if information about lifestyle is provided by a health care professional, it is often unclear and inconsistent which makes women perceive the message as unimportant (51). Taken together, health care providers working with women with obesity contemplating a pregnancy need to be adequately informed regarding the benefits of a healthy lifestyle during pregnancy and educated to

address this topic in a non-judgmental manner (45, 46). In addition, the social context has a great influence on lifestyle and should be recognized when implementing a lifestyle intervention in women with obesity (52). Furthermore, if the social context is included, women feel supported in daily life and perceive the implementation of a healthy lifestyle during pregnancy as a shared responsibility instead of an individual responsibility (51).

There are limitations to our study. First, only 32% of all eligible mothers and children participated in this study, making our results prone to selection bias. If we compare women who participated in our study with eligible non-respondents, we find that respondents were older and gave birth to children with a higher birthweight (Supplementary table 1). This participation bias is often reported in FU of birth cohorts (53, 54). However, the differences were small and several extreme low birth weight children in the non-respondent group were responsible for the significant difference in birth weight (data not shown). We found no other differences between respondents and eligible non-respondents. Therefore, we believe our results are representative of the entire group of participants and the findings are likely to reflect true reasons to participate in FU of children after maternal participation in an RCT. Second, our study includes women with obesity and infertility which may limit the generalizability of our results. Women with obesity contemplating a pregnancy are not often in contact with health care providers, unless they experience problems to conceive (55). As a result, trials assessing a preconception lifestyle intervention in women with obesity often include women that present with fertility issues (55). However, we expect the motivation to participate in a study that stimulates a healthy lifestyle to optimize child's health is independent of a women's fertility status. Therefore, we believe that our findings also apply to other women.

Conclusion

When designing a FU in children after maternal participation in a RCT of an intervention before or during pregnancy, loss-to-FU might be limited by emphasizing the possible perceived benefits of participation, such as a health-check for their child, and to encourage women to actively involve the

child in the decision of participation. In addition, it is important to actively involve women and representative children in the design of the FU study to stimulate the sense of involvement and increase understanding of the importance of the FU which seems to increase participation rates. Implementing these factors could prevent loss-to-FU and eventually help to assess causality between early life and later health.

Ethical approval statement

The Medical Ethics Committee of the UMC Groningen deemed that the Medical Research Involving Human Subjects Act (WMO) did not apply to this study (METc 2019/221) and official approval was not required.

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Contributorship Statement

TdH and AWvD designed the research protocol. TdH was responsible for safely storing all data, extracting and analyzing the data and writing the article. AH, HG, and TJR all carefully reviewed the article. AH, HG, TJR and AWvD were involved in the set-up of the original intervention study and follow-up study. All authors provided intellectual input and were involved in the writing of the article.

Competing interest: We report no conflicts of interest

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Data sharing statement: Data are available on reasonable request. Data for this study are not publicly available. Please contact authors for information on data availability.

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Figure Legends

Figure 1: Follow-up data collection rounds

Figure 2: Participation flowchart

Figure 3: Distribution of respondents and previous follow-up participation with their child

Table 1: Overview follow-up data collection rounds			
	Health questionnaire	**Physical examination**	**Cardiac assessment**
Eligible – n	305	156	242
Participated – n	107	48	60
FU rate - %	35.1	30.8	24.7
Intervention group – n(%)	43 (40.1)	17 (33.3)	24 (40.0)
Age children - years*	4.2 (0.8)	4.6 (1.0)	6.5 (1.1)
FU = follow-up *Data is presented as mean (standard deviation)			

Table 2: Baseline characteristics Data is presented as mean (standard deviation), or n (%) N= 67	
Mean age mothers – years	39.0 (4.1)
Education mother - %	
Primary education	1 (1.6)
Secondary education	13 (20.3)
Intermediate vocational education	37 (57.8)
Higher vocational education and university	13 (20.3)
Mean age child – years	7.5 (0.8)
Intervention group - %	24 (35.8)
Female (child) - %	30 (44.8)

Table 3: Agreement between respondents who participated in all follow-up (FU) round and respondents who did not participate in any FU round

	Participated in all FU rounds (n=24)		Did not participate in any FU round (n=7)		p
Statement	n	%	n	%	
The importance of the intervention study was clear	22	91.7	5	71.4	0.21
I want to contribute to knowledge regarding obesity	22	91.7	5	71.4	0.21
I want to contribute to knowledge regarding fertility	24	100	6	85.7	0.23
I felt that during the original trial there was enough attention for my wish to conceive	21	87.5	5	71.4	0.56
I felt involved in the intervention study	18	75	3	42.9	0.17
I felt involved in the follow-up	23	95.8	1	14.3	<0.001
The way in which the intervention study was introduced by the health professional was good	21	87.5	5	71.4	0.56
The way in which the follow-up was introduced by the health professional was good	22	91.7	2	28.6	0.002
The link between the intervention study and the follow-up was clear	17	70.8	2	28.6	0.08
I would have liked it if it was clear at introduction of the intervention study, that there would be a follow-up	3	12.5	6	85.7	0.001
If the follow-up would have been introduced by someone from the RCT, I would have been more likely to participate	0	0	4	57.1	0.001
There was too much time in between the several visits of the follow-up	3	12.5	2	28.6	0.56
I would have wanted to receive more updates during the follow-up	7	29.2	2	28.6	1.0
I think it's important that the subject of research is something that I find personally interesting	11	45.8	7	100	0.03
I knew that obesity and fertility were related	19	79.2	7	100	0.56
I knew that cardiovascular diseases are more common in females	14	58.3	5	71.4	0.68
I knew that the later health of a child may depend on lifestyle during pregnancy	16	66.7	6	85.7	0.64
The importance of the follow-up was clear	23	95.8	3	42.9	0.005
I thought that there was a negative stigma regarding obesity during the introduction of the intervention study	7	29.2	2	28.6	1.0
I think it's important to receive an incentive after participation	10	41.7	3	42.9	1.0

Table 4: Agreement between participants and non-participants per FU round									
	Health questionnaire			Physical examination			Cardiac assessment		
Statement	P (%)	NP (%)	p	P (%)	NP (%)	p	P (%)	NP (%)	p
I let the decision of participation depend fully on my child	14.2	22.2	0.47	39.4	17.7	0.06	52.5	24	0.04
My child was too young to participate	20.4	11.1	0.49	6.1	38.3	0.003	2.4	52	<0.001
Participation would feel like a health-check for my child	55.1	38.9	0.28	63.6	38.2	0.05	68.3	28	0.003
The distance to the research location would be too far	4.1	5.6	1.0	0	26.5	0.002	29.3	48	0.12
The research visit would be too burdensome for my child	4.2	11.2	0.29	3	24.2	0.03	0	37.5	<0.001
The research visit would take too much time	16.3	11.2	0.72	3.1	17.7	0.11	2.4	25	0.009

P= participant
NP= non-participant

Figure 1: Follow-up data collection rounds

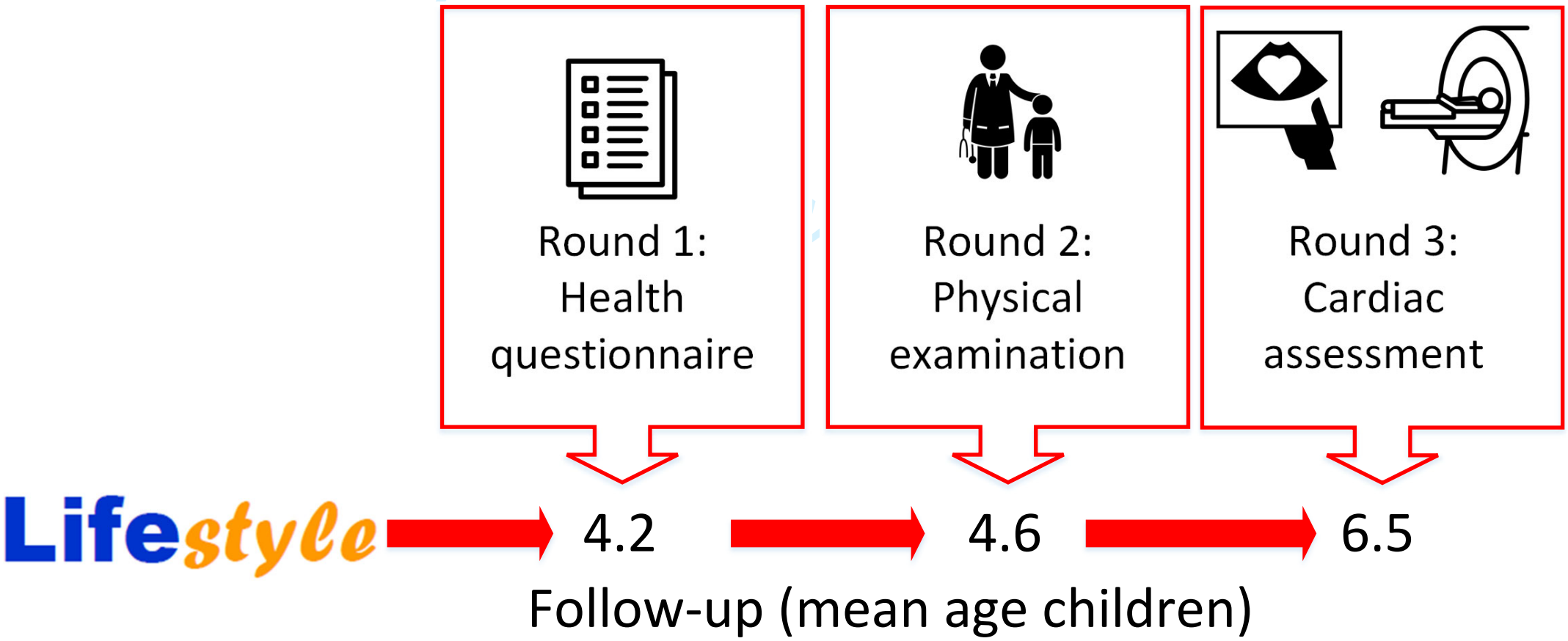


Figure 2: Participation flowchart

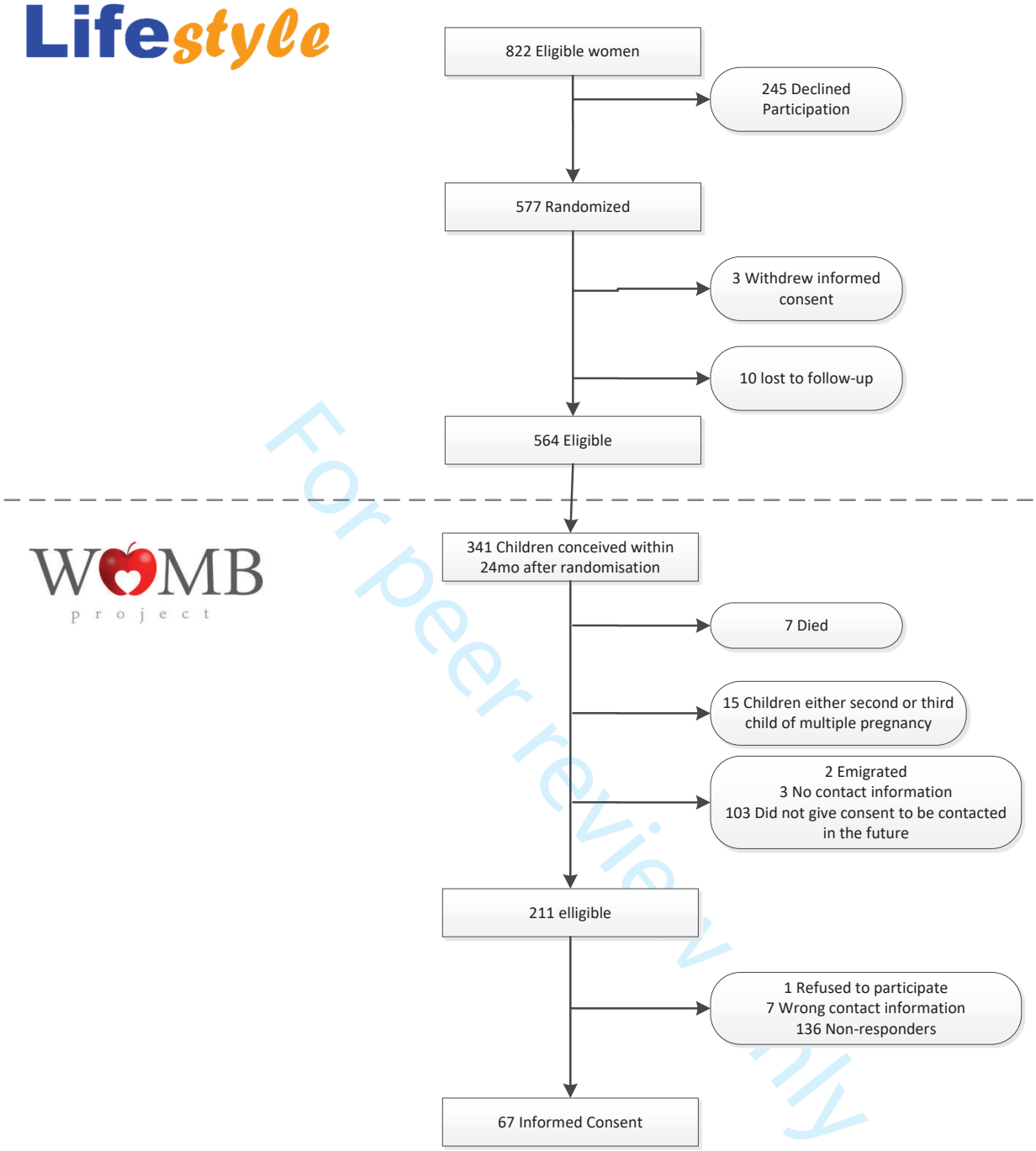
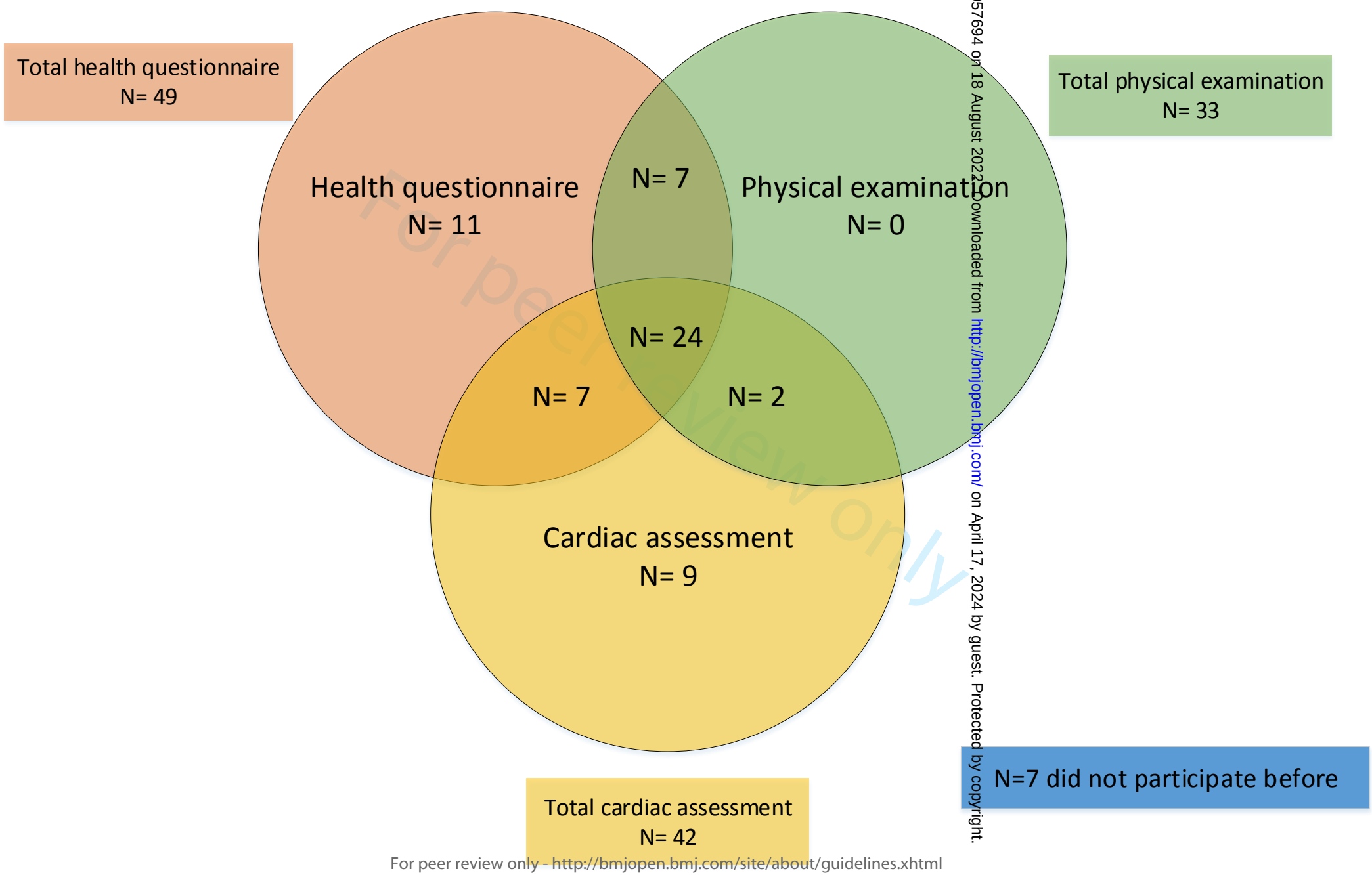


Figure 3: Distribution of respondents (n=67) and previous FU participation with their child



Supplementary table 1: Baseline characteristics respondents compared to eligible non-respondents Data is presented as mean (standard deviation), or n (%)			
	Respondents (n=67)	**Eligible non-respondents (n=144)**	**p**
Maternal characteristics			
Mean age mothers at randomisation – years	30.1 (3.9)	28.8 (4.6)	0.05
Education mother			0.41
Primary education - %	1 (1.6)	5 (3.5)	
Secondary education - %	13 (20.3)	36 (25.0)	
Intermediate vocational education - %	37 (57.8)	63 (43.8)	
Higher vocational education and university - %	13 (20.3)	34 (23.6)	
Mode of conception			0.55
Spontaneous - %	21 (31.3)	56 (39.2)	
Ovulation Induction - %	26 (38.8)	42 (29.4)	
Intra Uterine Insemination - %	9 (13.4)	22 (15.4)	
IVF/ICSI/CRYO - %	11 (16.4)	23 (16.1)	
Intervention group - %	24 (35.8)	69 (47.9)	0.10
Pregnancy complications* - %	32 (48.5)	76 (53.5)	0.46
Child characteristics			
Gestational age – weeks	39.0 (2.3)	39.0 (2.3)	0.95
Birth weight – g	3506.2 (655.5)	3325.5 (568.8)	0.04
Mean age child at start third data wave – years	6.0 (0.8)	5.9 (1.0)	0.41
Female (child) - %	30 (44.8)	67 (46.9)	0.69

*Complications during pregnancy included diabetes gravidarum, hyperemesis, pregnancy induced hypertension, (pre)eclampsia, intra-uterine death or HELLP syndrome
IVF= in-vitro fertilisation
ICSI= intracytoplasmic sperm injection
CRYO= cryopreservation

Supplementary table 2: STROBE Reporting checklist for cross sectional study.			
		Reporting Item	Page Number
Title and abstract			
Title	#1a	Indicate the study's design with a commonly used term in the title or the abstract	1
Abstract	#1b	Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background / rationale	#2	Explain the scientific background and rationale for the investigation being reported	4
Objectives	#3	State specific objectives, including any prespecified hypotheses	4
Methods			
Study design	#4	Present key elements of study design early in the paper	5,6
Setting	#5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5,6
Eligibility criteria	#6a	Give the eligibility criteria, and the sources and methods of selection of participants.	5
	#7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	6
Data sources / measurement	#8	For each variable of interest give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group. Give information separately for for exposed and unexposed groups if applicable.	6,7
Bias	#9	Describe any efforts to address potential sources of bias	7
Study size	#10	Explain how the study size was arrived at	n/a
Quantitative variables	#11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen, and why	6
Statistical methods	#12a	Describe all statistical methods, including those used to control for confounding	6,7
Statistical methods	#12b	Describe any methods used to examine subgroups and interactions	n/a
Statistical methods	#12c	Explain how missing data were addressed	n/a
Statistical methods	#12d	If applicable, describe analytical methods taking account of sampling strategy	n/a
Statistical methods	#12e	Describe any sensitivity analyses	7
Results			

Participants	#13a	Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed. Give information separately for for exposed and unexposed groups if applicable.	7
Participants	#13b	Give reasons for non-participation at each stage	7
Participants	#13c	Consider use of a flow diagram	7
Descriptive data	#14a	Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders. Give information separately for exposed and unexposed groups if applicable.	7
Descriptive data	#14b	Indicate number of participants with missing data for each variable of interest	n/a
Outcome data	#15	Report numbers of outcome events or summary measures. Give information separately for exposed and unexposed groups if applicable.	7
Main results	#16a	Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	n/a
Main results	#16b	Report category boundaries when continuous variables were categorized	n/a
Main results	#16c	If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	n/a
Other analyses	#17	Report other analyses done—e.g., analyses of subgroups and interactions, and sensitivity analyses	n/a
Discussion			
Key results	#18	Summarise key results with reference to study objectives	9
Limitations	#19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias.	2,11
Interpretation	#20	Give a cautious overall interpretation considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence.	9-11
Generalisability	#21	Discuss the generalisability (external validity) of the study results	12
Other Information			
Funding	#22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	2

Supplementary Figure 1: Participation questionnaire

Below you find a few statements regarding participating in research in general. Indicate how much you agree with each statement.					
	Strongly disagree	**Disagree**	**Neutral**	**Agree**	**Strongly agree**
I think it's important the research can take place after work/in the weekend	○	○	○	○	○
I think it's important the research is near my home	○	○	○	○	○
I think it's important to help other people by participating in research	○	○	○	○	○
I think it's important to receive an incentive after participation	○	○	○	○	○
I think it's important that the subject of research is something that I find personally interesting	○	○	○	○	○
I think it's important that my child is old enough to decide if she/he wants to participate	○	○	○	○	○
I think it's important my child agrees to participate in research	○	○	○	○	○

Below you find a few statements. Indicate how much you agree with each statement at time of inclusion for the intervention.					
	Strongly disagree	**Disagree**	**Neutral**	**Agree**	**Strongly agree**
I knew that obesity and fertility were related	○	○	○	○	○
I felt like I could influence my own health	○	○	○	○	○
I felt like I could influence my ownlifestyle	○	○	○	○	○

WOMB project

Intervention study

You participated in the intervention study (the LIFEstyle study). One of the topics of theintervention study was overweight. Below you find a few statements. Indicate how much you agree with each statement.					
	Strongly disagree	**Disagree**	**Neutral**	**Agree**	**Strongly agree**
I want to contribute to knowledge regarding fertility	○	○	○	○	○
I want to contribute to knowledge regarding obesity	○	○	○	○	○
I thought there was a negative stigma regarding obesity during the introduction of the intervention study	○	○	○	○	○
The importance of the interventionstudy was clear	○	○	○	○	○
Namely:					
I felt involved in the intervention study	○	○	○	○	○
I felt that during the original trial there was enough attention for my wish to conceive	○	○	○	○	○
The manner in which the intervention study was introduced by the health-care professional was good	○	○	○	○	○
If not, could you indicate what you would have liked?					

The statements below only need to be answered <u>only</u> if you participated in the 6-month lifestyle intervention before fertility treatment.					
	Strongly disagree	**Disagree**	**Neutral**	**Agree**	**Strongly agree**
I felt like there was enough attention for my personal situation.	○	○	○	○	○
I felt taken seriously	○	○	○	○	○
I felt judged because of my weight	○	○	○	○	○

Follow-up study

You participated in the follow-up research. Below you find a few statements. Indicate how much you agree with each statement.					
	Strongly disagree	**Disagree**	**Neutral**	**Agree**	**Strongly agree**
I knew that cardiovascular diseases are more common in females	○	○	○	○	○
I knew that the later health of a child may depend on lifestyle during pregnancy	○	○	○	○	○
The link between the intervention study and the follow-up was clear	○	○	○	○	○
The importance of the follow-up was clear	○	○	○	○	○
I felt involved in the follow-up	○	○	○	○	○
The manner in which the follow-up was introduced by the health professional was good	○	○	○	○	○
If not, could you indicate what you would you have liked?					

Below you find a few statements. Indicate how much you agree with each statement.					
	Strongly disagree	**Disagree**	**Neutral**	**Agree**	**Strongly agree**
I would have liked to know in advance, e.g. during the introduction of the intervention study, that there would bea follow-up study	○	○	○	○	○
If the follow-up would have been introduced by someone from the intervention study, I would have been more likely to participate	○	○	○	○	○
There was too much time in between the several stages of the follow-up	○	○	○	○	○
I would have wanted to receive more updates during the follow-up	○	○	○	○	○
How would you have liked to receive the updates? Letter/ E-mail / Phone / Text message (circle your answer) How often would you have liked to receive updates? Every 3 months / 6 months / year (circle your answer)					

PART 2: CONTACT WITH RESEARCHERS

Below you find a few statements regarding your experiences during the follow-up visits. Indicate how much you agree with each statement. If you did not participate please indicate n.a.						
	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	n.a.
I could ask all the questions I had						
Intervention study	○	○	○	○	○	○
Follow-up visit 1	○	○	○	○	○	○
Follow-up visit 2	○	○	○	○	○	○
Follow-up visit 3	○	○	○	○	○	○
The researcher clearly explained everything to me						
Intervention study	○	○	○	○	○	○
Follow-up visit 1	○	○	○	○	○	○
Follow-up visit 2	○	○	○	○	○	○
Follow-up visit 3	○	○	○	○	○	○
The researcher clearly explained everything to my child						
Follow-up visit 1	○	○	○	○	○	○
Follow-up visit 2	○	○	○	○	○	○
Follow-up visit 3	○	○	○	○	○	○
The researcher was interested in my personal situation						
Intervention study	○	○	○	○	○	○
Follow-up visit 1	○	○	○	○	○	○
Follow-up visit 2	○	○	○	○	○	○
Follow-up visit 3	○	○	○	○	○	○
The researcher took his/her time						
Intervention study	○	○	○	○	○	○
Follow-up visit 1	○	○	○	○	○	○
Follow-up visit 2	○	○	○	○	○	○
Follow-up visit 3	○	○	○	○	○	○

To answer the statements below, participation in that specific visit is <u>not necessary</u>

Below you find a few statements. Indicate how much you agree with each statement.					
	Strongly disagree	**Disagree**	**Neutral**	**Agree**	**Strongly agree**
The research visit would take too much time					
1. follow-up round 1	○	○	○	○	○
2. follow-up round 2	○	○	○	○	○
3. follow-up round 3	○	○	○	○	○
The research visit would be too burdensome for my child					
1. follow-up round 1	○	○	○	○	○
2. follow-up round 2	○	○	○	○	○
3. follow-up round 3	○	○	○	○	○
The distance to the research location would be too far					
1. follow-up round 1	○	○	○	○	○
2. follow-up round 2	○	○	○	○	○
3. follow-up round 3	○	○	○	○	○
I let the decision of participation depend fully on my child					
1. follow-up round 1	○	○	○	○	○
2. follow-up round 2	○	○	○	○	○
3. follow-up round 3	○	○	○	○	○
My child was too young to participate					
1. follow-up round 1	○	○	○	○	○
2. follow-up round 2	○	○	○	○	○
3. follow-up round 3	○	○	○	○	○
I did not think the research topic was relevant					
1. follow-up round 1	○	○	○	○	○
2. follow-up round 2	○	○	○	○	○
3. follow-up round 3	○	○	○	○	○
Participation would feel like a health-check for my child					
1. follow-up round 1	○	○	○	○	○
2. follow-up round 2	○	○	○	○	○
3. follow-up round 3	○	○	○	○	○

Could you indicate why you did or did not participate in the additional examinations for your child?		
	Why did you participate?	**Why did you not participate?**
Blood sample		
Buccal swab		
Feaces sample		

Last, you can add any suggestions/comments in the below:

Thank you for your participation!

Reporting checklist for cross sectional study.

		Reporting Item	Page Number
Title and abstract			
Title	#1a	Indicate the study's design with a commonly used term in the title or the abstract	1
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Methods			
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Setting	#5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5,6
Eligibility criteria	#6a	Give the eligibility criteria, and the sources and methods of selection of participants.	5
	#7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	6
Data sources / measurement	#8	For each variable of interest give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group. Give information separately for for exposed and unexposed groups if applicable.	6,7
Bias	#9	Describe any efforts to address potential sources of bias	7
Study size	#10	Explain how the study size was arrived at	n/a
Quantitative variables	#11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen, and why	6
Statistical methods	#12a	Describe all statistical methods, including those used to control for confounding	6,7
Statistical methods	#12b	Describe any methods used to examine subgroups and interactions	n/a
Statistical methods	#12c	Explain how missing data were addressed	n/a
Statistical methods	#12d	If applicable, describe analytical methods taking account of sampling strategy	n/a
Statistical methods	#12e	Describe any sensitivity analyses	7

Results			
Participants	#13a	Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed. Give information separately for for exposed and unexposed groups if applicable.	7
Participants	#13b	Give reasons for non-participation at each stage	7
Participants	#13c	Consider use of a flow diagram	7
Descriptive data	#14a	Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders. Give information separately for exposed and unexposed groups if applicable.	7
Descriptive data	#14b	Indicate number of participants with missing data for each variable of interest	n/a
Outcome data	#15	Report numbers of outcome events or summary measures. Give information separately for exposed and unexposed groups if applicable.	7
Main results	#16a	Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	n/a
Main results	#16b	Report category boundaries when continuous variables were categorized	n/a
Main results	#16c	If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	n/a
Other analyses	#17	Report other analyses done—e.g., analyses of subgroups and interactions, and sensitivity analyses	n/a
Discussion			
Key results	#18	Summarise key results with reference to study objectives	9
Limitations	#19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias.	2,11
Interpretation	#20	Give a cautious overall interpretation considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence.	9-11
Generalisability	#21	Discuss the generalisability (external validity) of the study results	12
Other Information			
Funding	#22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	2