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Review article

Changing behaviour in pregnant women: A scoping review

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ABSTRACT

Objectives: Behaviour change programmes (BCPs) for pregnant women are frequently implemented as part of health promotion initiatives. At present, little is known about the types of behaviour change programmes that are being implemented and whether these programmes are designed and delivered in accordance with the principles of high quality maternity care. In this scoping review, we provide an overview of existing interventions related to behaviour change in pregnancy with a particular emphasis on programmes that include empowerment components to promote autonomy and woman-led decision-making.

Methods: A systematic search strategy was applied to check for relevant papers in August 2017 and again in October 2018.

Results: Thirty studies met the criteria for inclusion. These studies addressed weight management, smoking cessation, general health education, nutrition, physical activity, alcohol consumption and dental health. The main approach was knowledge gain through education. More than half of the studies ($n = 17$) included three or more aspects of empowerment as part of the intervention. The main aspect used to foster women's empowerment was skills and competencies. In nine studies midwives were involved, but not as programme leaders.

Conclusions: Education for knowledge gain was found to be the prevailing approach in behaviour change programmes. Empowerment aspects were not a specific focus of the behaviour change programmes. This review draws attention to the need to design interventions that empower women, which may be beneficial through their live. As midwives provide maternal healthcare worldwide, they are well-suited to develop, manage, implement or assist in BCPs.

Introduction

Improving health and wellbeing is a major goal in healthcare all over the world (WHO, 2015). Midwives and other healthcare professionals play a key role in educating women about healthy pregnancies (WHO, 2013a). During the course of pregnancy, women may experience a variety of psychological changes, including developing the motivation to change their lifestyle habits (Lindqvist et al., 2017). To support behaviour change through a life-course approach and to implement the WHO strategy for strengthening nursing and midwifery towards the achievement of the "Health 2020" goals (WHO, 2015, p.4), it is important for healthcare professionals to increase their knowledge of behaviour change programmes (BCPs) during pregnancy.

In antenatal healthcare, different health promotion interventions have been developed and tested (Boyle et al., 2012; Muktabhant et al., 2015). Most interventions target lifestyle changes during pregnancy, e.g. managing excessive gestational weight gain by means of diet or physical activity (Hill et al., 2016; Swift et al., 2017). Other common areas targeted by interventions are antenatal substance use e.g. smoking cessation pro-

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grammes (Boyd and Windsor, 2003; El-Mohandes et al., 2011) or knowledge gaps, e.g. on nutrition habits to prevent toxoplasmosis (Carter et al., 1989). These interventions are intended to increase health literacy and promote lifestyle changes that will positively affect mother and baby not only during childbirth, but also across the course of their lives.

Midwives are experts in childbirth, antenatal and postnatal care, and in an ideal position to support health promotion during pregnancy (ICM, 2019). In most high-income countries, midwives provide the majority of maternity care (Shaw et al., 2016). The benefits of midwife-led antenatal care are well documented (Dowswell et al., 2015; Renfrew et al., 2014). Midwives collaborate with other healthcare professionals and health workers, which is valued by both sides (Aquino et al., 2016). In addition to clinical competencies many midwives are trained to consider psychosocial factors when providing care to pregnant women, and this additional training positions them well to develop, manage, implement or support BCPs. These skills include effective interpersonal communication between women, families and healthcare providers, and support of women's autonomy as well as strategies to strengthen and empower women's abilities (ICM, 2019). At the present time, however, little is yet known about the involvement of midwives in BCPs for pregnant women.

Midwifery care is known to increase women's confidence in their ability to give birth through one to one support and an overall woman-centred approach of the midwifery model of care (Neerland et al., 2018). For example, women need to have the ability to make decisions autonomously (Kabeer, 1999, 2005). In midwifery care, women's right to self-determination and their autonomy to make decisions about their care is supported and respected (Hermansson and Martensson, 2011). Empowerment in maternity care is closely linked to the concepts of autonomy and self-efficacy, which means that women have the ability to make decisions and have a sense of control over themselves and what happens (Nieuwenhuijze and Leahy-Warren, 2019; Kliche and Kröger, 2008). Woman-centred care emphasizes the need for self-determination and autonomy in decision-making and is generally linked to women feeling more empowered (Brady et al., 2019). Strong childbirth self-efficacy and feeling empowered during pregnancy can have many positive effects, e.g. it might increase women's motivation and ability to manage one own's health (Fumagalli et al., 2015).

Various factors play a role in women's motivation regarding changes to their health-related behaviours. In respect to knowledge gain through health education, a Cochrane review by Chamberlain et al. (2017) of over 100 trials relating to interventions to give up smoking during pregnancy observed a non-significant impact of knowledge gain on smoking cessation. The effect was even smaller when the education was part of a broader health intervention during maternity care. However, when education-based interventions were combined with supplementary components such as counselling, pregnant women benefited more from the interventions. While many counselling interventions were effective, Chamberlain et al. (2017) indicated that individual psychosocial behavioural interventions (e.g. motivational interviewing, self-supportive materials, advice from midwives, nurses and physicians, telephone counselling) were the most effective ones. Notwithstanding these findings, several factors call into question whether the findings can be translated into practice. For example, while some psychosocial interventions have shown success, the evidence is still limited. Furthermore, the role of factors such as divers cultural and socio-economic backgrounds on the success of the psychosocial interventions is unknown (Chamberlain et al., 2017). In addition to these factors, other studies have emphasised the importance of meeting the needs and expectations of people who are planning to change their lifestyle habits (Gaston and Prapavessis, 2014; Grol et al., 2005). Behaviour change may be affected by individual and environmental factors such as access to health related knowledge or individual outcome expectations, like self-efficacy (Araújo-Soares et al., 2019). The latter can be defined as the consideration of how easy or challenging it will be to make a change, in order to produce a desired outcome that will result in long-term success (Middleton et al., 2013). For instance, the relevance of self-efficacy beliefs has been demonstrated in a Swedish study, where pregnant women were more motivated to change their lifestyles when they felt confident about their chances of succeeding (Lindqvist et al., 2017; Brenning et al., 2015).

Another aspect that might increase the effectiveness of BCPs during pregnancy but is often overlooked is an enhancement of the degree to which women have choices and are able to make decisions throughout the BCP. Facilitating self-determination and autonomy in decision-making for pregnant women is one of the key concepts in midwifery care (WHO, 2013a; Renfrew et al., 2014) and a primary component of respectful maternity care that is linked to more positive birth experiences for women and improved health outcomes (Vedam et al., 2017; Kabeer, 1999).

One of the main goals of the scoping review was to explore whether BCPs include components of empowerment, self-determination and agency. A helpful framework for identifying whether these elements were included in the programmes was proposed by Kliche and Kröger (2008). These writers identified eight dimensions of empowerment in prevention and health promotion: *skills and competencies, innovation, goal-setting and attainment, self-efficacy, reflexive thought, social support and social capital, shared decision-making* that enable health promotion. These dimensions contribute to strengthening women during pregnancy, through the attributes of personal change, enabling process, and self-determination (Castro et al., 2016).

Changes in behaviour during pregnancy are of great interest on a care- and health promotion level. To understand and analyse barriers and drivers for successful behaviour change in practice, we introduce an overarching model on behavioural change, which is called "*Behaviour Change Wheel*" (Fig. 1). It can be used by health care professionals, to guide practice. The *Behaviour Change Wheel* was developed, based on 19 frameworks of behaviour change identified by Michie et al. (2011) in a systematic literature review. The wheel consists of three circles: the inner, the middle, and the outer circle. The *outer circle* includes seven "policy categories" such as childbirth-related guidelines, regulations or environmental/social planning that represent the context-related conditions, which affect behaviour and in respect of which political boundaries might ease or hinder behaviour change (Michie et al., 2011). An example would be the WHO guideline (2013b) on "tobacco use and second-hand smoke exposure in pregnancy", which provides evidence-based recommendations to reduce exposure to tobacco smoke. This guideline, referring to service provision in antenatal care, serves as an exemplary document for the *outer circle* of the Behaviour Change Wheel.

To pursue the same example further, the *middle circle* of the *Behaviour Change Wheel* (Michie et al., 2011) then lists procedures to promote smoking cessation in pregnancy, including "intervention functions" such as training, education, persuasion, coercion (e.g. through legislation or taxation), incentivisation, restrictions, modelling, enablement, and environmental restructuring. For example, in the Cochrane review on smoking cessation (Chamberlain et al., 2017) the intervention strategies were mainly based on counselling ($n = 54$), which in the *Behaviour Change Wheel* falls under the category of "persuasion"; the second biggest group ($n = 12$) falls into the category of "applying health education". Offering incentives was used in thirteen studies, and in one study training was provided to help pregnant women to change their smoking behaviour.

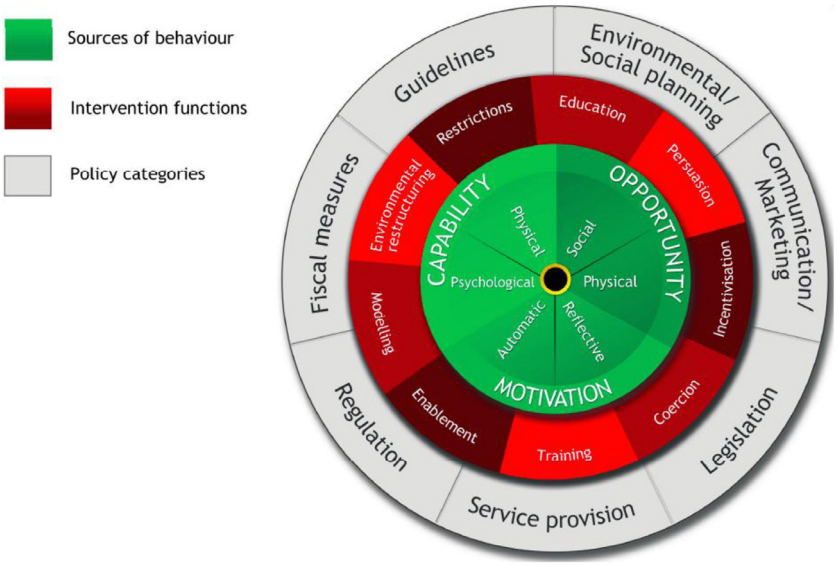

Fig. 1. Behaviour Change Wheel according to Michie et al., 2011 (reproduced with the permission of the author).

The wheel's *inner circle* is labelled source of behaviour as well as "*COM-B Model*" and differentiates capability, opportunity, and motivation as behavioural determinants (Michie et al., 2011). *Capability* refers to the physical and psychological ability of the individual to engage in activities that lead to behaviour change, *opportunity* describes contextual factors that may support or hinder behaviour change, and *motivation* refers to reflective and automatic processes that direct the subject in the direction of the intended behaviour or away from it. For example, evidence from the Cochrane review on smoking cessation (Chamberlain et al., 2017) demonstrated that counselling interventions (e.g. cognitive interventions) are most likely to be successful in stopping smoking (with a success rate of 37%), followed by incentives. These counselling interventions include social, emotional and mental factors aimed precisely at supporting and motivating pregnant women to stop smoking. These aspects are listed in the COM-B Model of the inner circle, please see Fig. 1.

This scoping review's primary goal is to provide an overview of the effectiveness of behaviour change programmes that are currently used during pregnancy and to describe which components of the Behaviour Change Wheel are addressed in the intervention programmes. The secondary aim is to identify the current areas of midwifery involvement in BCPs. And thirdly, the scoping review focusses on the dimensions of health promotion identified by Kliche and Kröger (2008).

Methods

We conducted a scoping review to map the broad area of BCPs during pregnancy and to identify all potential boundaries of BCP in order to be able to facilitate autonomy for pregnant women. The scoping review methods were informed by guidelines outlined by Arksey and O'Malley (2005). The PRISMA flow diagram and checklist (Moher et al., 2009, 2015) were used in this paper, to ensure authors complied with best practice guidelines for conducting scoping reviews.

Search strategies

The electronic databases CINAHL, PubMed, PsycINFO and MIDIRS were searched in August 2017 in order to identify relevant papers. The search was updated in October 2018. The search terms were: *tool* OR *intervention* OR *program** OR *training* OR *session* OR *preparation* OR *workshop* OR *class* OR *education* AND *behaviour change* OR *behavior change AND maternity* OR pregnan* OR *prenatal* OR *antenatal*. No time limit was imposed regarding the year of the publication. Search terms were limited to titles and abstracts, because more than 3,200 records were identified when search terms were applied to all fields. MeSH terms were applied in the initial phase of the search strategy but did not improve the search and were not utilised in the final search strategy.

Inclusion and exclusion criteria

To qualify for inclusion, studies had to be written in English or German. Articles had to address the topic "*Behaviour change programmes during pregnancy*" and were excluded if the topic was not reflected in the title or the abstract. BCPs focusing on pregnant women with mental health disorders and/or substance use issues were excluded from the review, because the therapeutic needs of women affected by these conditions are unique, and were outside the scope of this review (Institute of Medicine, 2015). Articles were included which aimed to evaluate the effectiveness of the behaviour intervention. We only included original studies.

Selection process

The systematic literature search carried out on 6 October 2018 yielded 876 results. After removing duplicates, 663 studies remained. After a screening of the titles and abstracts 614 studies were excluded as they did not fulfil the inclusion criteria. Thus, 49 studies were fully assessed for eligibility: nineteen studies were excluded because they did not describe original studies or did not emphasise the effectiveness of the interventions observed. Consequently, 30 studies were included in the scoping review (see Fig. 2, Table 1).

Data extraction

Following the procedure described by Arksey and O'Malley (2005), a multidisciplinary team of researchers with expertise in the fields of midwifery, psychology and public health carried out a rigorous literature search process. The first author (LZ) screened all titles and abstracts. This approach has been

Table 1
Study characteristics on behaviour change programmes in maternity care.

Reference & Country	Study type	Total number of participants (Intervention/Control)	Investigated topic during womenś pregnancy	Formats of the programme	Intervention delivered by	Intervention length of time	Maternity-related outcome
Al Khamis et al., 2017 ; Kuwait	RCT (three arms)	90 (30/32/28)	Dental health adherence	Education, lecture & pamphlets	Self-directed, i.e. booklet, information sheet, planning	4 weeks	Tooth brushing and flossing showed no significant differences in Plaque index (p=.693) and Gingival index (p=.717) between groups. Simple information sheet improved the frequency of using the floss (p=.001) and the toothbrush (p=.003) in all groups
Arefi et al., 2015; Iran	Quasi-experimental study	140 (70/70)	Reducing caesarean sections	Education, not described	Not mentioned	Not mentioned	Intervention for reducing caesarean section rate showed a significant drop in the intervention group (p<.001) vs control, attitudes towards childbirth (p=.001), knowledge (p=.001) and enabling factors (p<.001) changed significantly in intervention group vs control
Baker, 2011; USA	Observational study, pilot	600	Weight management of pregnant women	Health coaching	Healthy weight advisors	Min. of four visits during pregnancy, 4 visits between 0–6 months postpartum and regular contact between 6–24 months pp (i.e. number of visits not specified)	Intervention for obese pregnant women showed at 38 weeks of gestation mean weight gain of 7.27 kg (n = 75, SD=5.66) by women with pre-pregnancy BMI >30, compared to average general weight gain in pregnancy 10–12.5 kg
Boyd and Windsor, 2003; USA	RCT, pilot	240 (120/120)	Nutrition of pregnant women	Education, lecture	Peer educator (similar to the target population), 3-month training from the partners for life programme	8 consecutive weekly sessions of 60 min. each	The aim to change dietary behaviour of low-income pregnant women showed a significant improvement in dietary behaviour and nutrition knowledge compared to standard care, length of the programme was found to be a problem for participant attrition
Bryce et al., 2009; UK	Action research study	79	Smoking cessation in pregnancy	Health coaching	Midwives	Visits by midwife throughout pregnancy. Start one week after the first appointment by the midwife, amount of contacts are not mentioned	Intervention with ≤ 25-year-old pregnant women on quitting smoking was linked to 22.8% having stopped smoking and 30.4% cut down by the 3rd month. By the 12th month 16.5% had stopped smoking, from them 7.6% had already quitted smoking before the 12th months
Carter et al., 1989; Canada	RCT	52 (26/26)	Prevention of toxoplasmosis	Education, lecture	Antenatal educator	10 min. of education, embedded within antenatal education class	Intervention for prevention of congenital toxoplasmosis showed better behaviour in pet hygiene (p<.05) in intervention group vs control group, both groups had the same food hygiene and personal hygiene scores
Crawford-Williams et al., 2016; Australia	RCT	96 (49/47)	Alcohol consumption of pregnant women	Education, pamphlet	Self-directed, i.e. received booklet	No time specified; participants were asked to read booklet and use recipes	Intervention to change attitudes, behaviour and knowledge on alcohol consumption in pregnancy showed improved knowledge (p<.001) and attitudes towards drinking during pregnancy (p=.017) in intervention group vs control, no differences were found between the two groups with regard to abstaining from drinking (p=.077)
Currie et al., 2015; Ireland	RCT	109 (55/54)	Physical activity of pregnant women	Health coaching	Researcher, trained in delivering physical activity consultations	Three face to face physical activity consultations (one per trimester)	Intervention on physical activity during pregnancy showed no differences in physical activity between the groups (p>.5), physical activity declined with advanced pregnancy in both groups (p<.001)
El-Mohandes et al., 2011; USA	RCT	500 (262/238)	Smoking cessation in pregnancy	Cognitive behavioural therapy	Fieldwork staff	10-sessions delivered during prenatal (8 sessions) and postpartum (2 booster sessions) care visits sessions were 35 min. long	Relapse and smoking cessation intervention for African-American smokers showed no differences in smoking behaviour during pregnancy, the intervention group were less likely to relapse post partal period (p=.053**) ** p value <0.10
Gaston and Prapavessis, 2014; Canada	RCT (three arms)	60 (21/19/20)	Physical activity of pregnant women	Health coaching, with action planning	Research investigator (Psychologist)	All groups: 25 min. PowerPoint slide show on exercise during pregnancy. Group I, II & III: 20 min. attention-control slides information on nutrition in pregnancy. Group II & III:10 min. action planning intervention. Group III: 20 min. combined planning (identify barriers)	Intervention for promoting physical activity showed increased physical activity in groups II & III (p<.001) vs control group I

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Table 1 (*continued*)

Reference & Country	Study type	Total number of participants (Intervention/Control)	Investigated topic during womenś pregnancy	Formats of the programme	Intervention delivered by	Intervention length of time	Maternity-related outcome
Gesell et al., 2015; USA	RCT	87 (44/43)	Weight management of pregnant women	Education, lecture (social learning theory)	Trained healthcare provider (bilingual)	12 weekly 90-min. group sessions (8–10 women and one facilitator) + three 30 min. home visits	Intervention on preventing excessive weight gain by Latina women showed no differences in weight gain by overweight (p=.227) and obese (p=.434) women, but in normal weight women a positive intervention effect was shown (p=.036) vs control condition
Hayman et al., 2017; Australia	RCT	77 (39/38)	Physical activity of pregnant women	Health coaching, (social cognitive theory)	Self-directed, i.e. web-based	4 weeks	Intervention on physical activity reported more viewed pages on the website (p<.05), reported a higher personal relevance of website (p<.05) and had increased physical activity (p<.05) in the intervention vs standard information group
Herring et al., 2017; USA	RCT	56 (27/29)	Weight management of pregnant women and postpartum	Health coaching	Health coach	1) Daily skill- building text messages tailored to each behavioural goal; 2) weekly Facebook posts with links to websites and videos; and 3) weekly to monthly15-min. scripted calls	Intervention for preventing weight retention amongst African-American showed that six months postpartum there was a greater likelihood of being at or below early pregnancy weight (p=.04) in the intervention group. No difference was found at 12 months postpartum (p=.83) vs control group
Hill et al., 2016; Australia	Quasi-experimental study	267 (116/131)	Weight management of pregnant women	Health coaching	Health coach	4 individual HC (each 1 h long) and two group HC/educational sessions (each 2 h long)	Intervention to prevent excessive gestational weight gain showed no differences in weight gain at 36 weeks of gestation (p=.089), control group had lesser weight gain in the first trimester (p<.001) In the second trimester differences in coping strategies for weight management (p=.028) were found in the intervention group, no differences in body attitudes or dietary and physical activity motivation vs control condition
Hughes et al., 2017; USA	RCT	187 (124/63)	Risk behaviour for maternal cytomegalovirus (CMV)	Motivational interviewing + Education, information	Research assistant	5 min. information video + < 5 min. motivational interviewing. + weekly text messages	Intervention on risk behaviour for CMV showed a modest increase in behaviour compliance vs control care that are informed in a standardised way by means of a brochure (p=.007), reported change in severity, susceptibility, self-efficacy, perceived norms (p<.05) were found in the intervention group
Kaufman et al., 2017; Tanzania	Post-hoc evaluation	1708	Antenatal care attendance and birth planning	Campaign (social cognitive theory)	TV spots, billboards, magazine articles, advertisements, radio spots, promotional materials, health facility	TV 3 spots per station per day. 4–12 radio spots on 19 national and regional radio stations per day, 3400 health facilities with promotional materials (campaign messages on stickers, t-shirts, bags), free text messages	35.1% of women attending antenatal care or postnatal care (past 6 months) had contact with the campaign in the last month. The more contact the women had with the messages of the campaign the more they planned for their birth (p=.001), greater contact with messages showed an increase in antenatal care visits (p=.004), timing of first antenatal care visit or HIV tests was not associated with the exposure

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Table 1 (*continued*)

Reference & Country	Study type	Total number of participants (Intervention/Control)	Investigated topic during womenś pregnancy	Formats of the programme	Intervention delivered by	Intervention length of time	Maternity-related outcome
Kendall et al., 2017; USA	Controlled study	550 (312/238)	Nutrition of pregnant women	Education, lecture	Trained peer educators	2.5 h of instruction embedded within 8 lesson curriculum about Eating Smart and Being Active	Intervention to protect against food-borne illnesses in pregnancy, showed in both groups improvement behaviour in food safety. Pathogen-specific intervention had an improvement ($p<.01$) for foods at high risk for safety in usage of the thermometer, refrigeration and consumption in the treatment group
Khan et al., 2013; India	Controlled study	200 (100/100)	Behaviour change amongst pregnant women regarding neonatal care	Education, counselling + pamphlet	Research investigator (Medicine)	6–8 visits each 30–35 min.	Intervention about neonatal care in India showed an improvement in delivery practices, warm room, ($p<.05$), decreases removal of vernix ($p<.05$), delayed bathing of baby ($p<.05$) breastfeeding practices on 7 and 28 days postpartum ($p<.05$), increased knowledge of physiological conditions of baby ($p<.05$) were found in the intervention group vs control group
Lau et al., 2014; Africa	Mixed method study	206 (102/104)	Health education in pregnancy, general	Education, information	Health care workers	3–4 text messages per week	Intervention on antenatal health promotion showed a high loss of follow up (43%), no statistical differences between knowledge level about pregnancy and childbirth were found ($p>.05$) between the intervention and the control group
Naughton et al., 2015; UK	Controlled study	174	Smoking cessation in pregnancy	Health coaching (cognitive behaviour therapy)	Self-help intervention, automated text messages	Self-help leaflet + 80 text messages over 11 weeks	Intervention on prevention strategies against smoking showed that leaflet and text message self-help supports quitting smoking, strategies like avoiding spending time with other smokers ($p=.02$) and self-talk, e.g. "I can do it" ($p=.04$), are helpful for smoking cessation
Olson et al., 2018; USA	RCT	1689 (1126/563)	Weight management of pregnant women	Education, information	Website (self-directed)	Access on website 199 days	The electronic intervention on excessive gestational weight gain did not show any differences vs placebo control group ($p=.12$)
Osterman et al., 2014; USA	RCT	122 (62/60)	Alcohol consumption of pregnant women	Motivational interviewing	Researcher, certified psychiatric-mental health clinical nurse specialist trained in MI	25–30 min. Motivational interviewing	Intervention to decrease alcohol consumption showed no differences between drinking behaviour between intervention and control group, increased autonomous motivation for decreasing drinking behaviour ($p<.05$) in Intervention group
Poston et al., 2013; UK	RCT, pilot	183 (94/89)	Weight management of obese pregnant women	Health coaching	Health trainers	8 weekly group sessions	Intervention to reduce dietary glycaemic load and saturated fat intake, and increase physical activity showed a reduced saturated fat load (−1.6% energy, 95% CI −2.8 to −0.3) and dietary glycaemic intake (−33 energy, 95% CI −47 to −20), no differences in physical activity compared to standard care, attendance dropped over the sessions
Rasouli et al., 2017; Iran	RCT (three arms)	234 (78/78/78)	Childbirth preparation in pregnancy	Motivational interviewing	Midwife counsellor	8 sessions childbirth preparation classes	Childbirth preparation increased with the intervention to encourage the participation in childbirth preparation classes ($p<.001$), the intervention group considered childbirth preparation to be more important than the control group ($p<.001$) did

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Table 1 (*continued*)

Reference & Country	Study type	Total number of participants (Intervention/Control)	Investigated topic during womenś pregnancy	Formats of the programme	Intervention delivered by	Intervention length of time	Maternity-related outcome
Secker-Walker et al., 1998; USA	RCT	276 (135/141)	Smoking cessation in pregnancy	Education, counselling	Physician + counselling nurse	One Structured advice from physician + 5 individual counselling	Intervention for reducing or quitting smoking showed a reduction or quitting at all time points (second visit p=.02, 36th week of gestation p<.01, 1 year postpartum p=.02) a significant difference between the intervention group and the control group who received a self-help booklet
Shivalli et al., 2015; India	Quasiexperimental study	86 (45/41)	Nutrition of pregnant women	Education, counselling, visual reinforce-ment material	Not mentioned	3 home visits over 12 weeks + reminder materials	Intervention for enhancement of the iron-folate and dietary intake showed in the intervention group a 50% reduction in anaemia, a higher weight gain (p<.01) and an increased protein intake (p<.05) compared to control group without education on dietary and iron-folate intake
Villadsen et al., 2016; Ethiopia	Effectiveness study	1357	Health education in pregnancy, general (facility level intervention)	Education, pamphlet	Health care providers	Folder with education material introduced in first antenatal care visit; usage through antenatal care	Intervention on strengthening antenatal care showed a positive effect on preventive health check-ups for the infant (OR 2.4, CI 95% 1.5–3.5) and breastfeeding practices (OR 3.0, 95% CI 1.4–3.6) increased in the intervention group vs control group, no effects on immunisation coverage were found between the groups, a negative impact on the frequency of antenatal visits was identified in the intervention group with information on danger signs in pregnancy, healthy behaviour, antenatal care
Wilkinson and McIntyre, 2012; Australia	RCT	242 (113/129)	Health education in pregnancy, general	Education, lecture + pamphlet	Maternity dieticians	60 min. workshop	Intervention tried to influence a healthy pregnancy start through good nutrition, physical activity and knowledge of guideline on gestational weight gain and smoking, the intervention had higher diet quality (p=.027), increased fruit (p=.004) and vegetable (p=.006) intake vs standard care and met the fruit guideline (p<.001)
Wilkinson et al., 2010; Australia	Quasi-experimental study	304 (163/141)	Health education in pregnancy, general	Education, pamphlet	Self-directed with the possibility to seek assistance from doctor/midwife	Interactive booklet for 3 month	Intervention on smoking, fruit & vegetable servings, physical activity measured an increase intake of fruit in the intervention group vs control condition (p=.05), no differences were found in other health behaviour guidelines for the intervention group
Windsor et al., 2014; USA	Quasi-experimental study	518 (259/259)	Smoking cessation in pregnancy	Education, counselling	Trained provider to deliver intervention and systematic reinforcement by all providers	1) Assessment 2) manual to quit smoking 3) 8 min. counselling video 4) providing SCRIPT method during antenatal visit 5) promotion of telephone counselling sessions 6) encouragement of non-smoking home policy	Intervention treatment on quitting and reducing smoking showed a significant cessation rate (p<.001) and reduction rate for smoking (p<.001) in the intervention group vs control

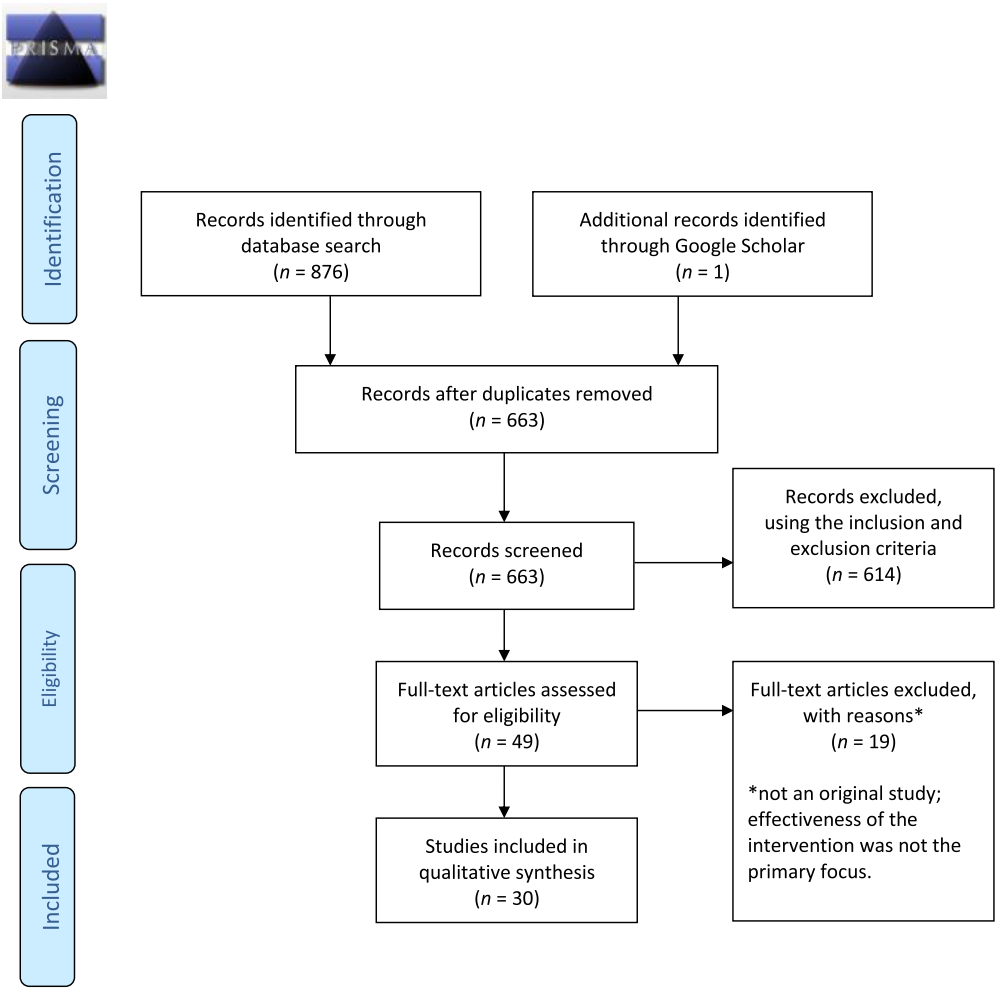

Fig. 2. PRISMA Flow Diagram for the scoping review: Behaviour change in pregnant women.

found in 64% of scoping reviews (Tricco et al., 2016) and is considered to be in line with common practice in scoping reviews. Inclusion and exclusion criteria were applied and the reasons for inclusion/exclusion were documented and duplicates removed. The PRISMA flow diagram was used to report the four phases of the scoping review process. Fig. 2 shows the flow diagram of the scoping review in October 2018. Study characteristics were extracted from the articles included ($n = 30$) and entered into a table (Table 1). Data extraction involved two authors (LZ, KS); one author (LZ) extracted the data into a table, the second author (KS) checked the abstracted data afterwards. The following data points were extracted and synthesised from each article: author(s), year of publication, study setting, study design, intervention(s) and outcome(s). BCPs were assigned to the following categories: education, health coaching, cognitive behavioural therapy, motivational interviewing and public awareness campaigns. The effectiveness or success of the individual BCPs is listed in Table 1, in the column headed "maternity-related outcomes". The empowerment dimensions identified in the studies are listed in Table 2. The various tasks of midwives in BCPs were reviewed, listed and summarised in Table 1. Midwifery involvement in BCPs are described in detail in the results section.

Data analysis

The data extracted from the 30 studies were reviewed to identify different behaviour change approaches. The eight empowerment dimensions of health promotion and preventive healthcare defined by Kliche and Kröger (2008) were applied to the selected studies. These are: 1) *skills and competencies,* which refer to personal knowledge and skills for obtaining and understanding health information, social skills or self-directed learning; 2) *innovation,* which covers motivation for change in situations of uncertainty; 3) *goal-setting and goal attainment,* which is relevant in terms of motivation and prioritising skills; 4) *self-efficacy*, the confidence of individuals in their ability to succeed; 5) *healthcare utilisation,* which stands for the person's orientation in the healthcare system and includes health awareness; 6) *reflexive thought*, the capability to undertake critical consideration of their own lives, behaviours and attitudes; 7) *social support and social capital,* which refers to the help and support provided by the woman's community; and finally 8) *shared decision-making,* the ability to participate in decision-making processes and to develop an informed opinion.

The analysis in this scoping review is descriptive. It investigates the different BCP interventions while asking whether they apply key aspects of the Behaviour Change Wheel and support the autonomy and empowerment of women.

Results

Synthesis of results

The 30 studies included were published between 1989 and 2018 (see Table 1). Of these, 22 were conducted in high-income coun-

Table 2
Empowerment dimensions from the healthcare setting, based on Kliche and Kröger (2008), used in behaviour change programmes.

	Skills and competencies	Innovation	Goal-setting and goal attainment	Self-efficacy	Reflexive thought	Social support and social capital	Shared decision-making	Healthcare utilisation
Al Khamis et al., 2017	X	X	X					
Arefi et al., 2015	X	X						
Baker, 2011	X	X						
Boyd and Windsor, 2003	X	X					X	
Bryce et al., 2009	X	X						
Carter et al., 1989	X	X						
Crawford-Williams et al., 2016	X	X						
Currie et al., 2015	X	X	X	X	X	X		
El-Mohandes et al., 2011	X	X						
Gaston and Prapavessis, 2014	X	X	X	X				
Gesell et al., 2015	X	X	X	X	X	X		
Hayman et al., 2017	X	X	X			X		
Herring et al., 2017	X	X		X				
Hill et al., 2016	X	X						
Hughes et al., 2017	X	X		X				
Kaufman et al., 2017	X	X		X				
Kendall et al., 2017	X	X						
Khan et al., 2013	X	X						
Lau et al., 2014	X	X						
Naughton et al., 2015	X	X				X		
Olson et al., 2018	X	X	X		X			
Osterman et al., 2014	X	X		X				
Poston et al., 2013	X	X	X					
Rasouli et al., 2017	X	X		X				
Secker-Walker et al., 1998	X	X	X					
Shivalli et al., 2015	X	X						
Villadsen et al., 2016	X	X						
Wilkinson and McIntyre, 2012	X	X	X	X	X			
Wilkinson et al., 2010	X	X	X		X			
Windsor et al., 2014	X	X						

tries (Baker, 2011; Boyd and Windsor, 2003; Bryce et al., 2009; Carter et al., 1989; Crawford-Williams et al., 2016; Currie et al., 2015; El-Mohandes et al., 2011; Gaston and Prapavessis, 2014; Gesell et al., 2015; Hayman et al., 2017; Herring et al., 2017; Hill et al., 2016; Hughes et al., 2017; Kendall et al., 2017; Naughton et al., 2015; Olson et al., 2018; Osterman et al., 2014; Poston et al., 2013; Secker-Walker et al., 1998; Wilkinson and McIntyre, 2012; Wilkinson et al., 2010; Windsor et al., 2014). The most frequent study design was a randomised control trial, applied in 17 studies (Al Kahmis et al., 2017; Boyd and Windsor, 2003; Carter et al., 1989; Crawford-Williams et al., 2016; Currie et al., 2015; El-Mohandes et al., 2011; Gaston and Prapavessis, 2014; Gesell et al., 2015; Hayman et al., 2017; Herring et al., 2017; Hughes et al., 2017; Olson et al., 2018; Osterman et al., 2014; Poston et al., 2013; Rasouli et al., 2017; Secker-Walker et al., 1998; Wilkinson and McIntyre, 2012), followed by five quasi-experimental studies (Arefi et al., 2015; Hill et al., 2016; Shivalli et al., 2015; Wilkinson et al., 2010; Windsor et al., 2014), three controlled studies with (Kendall et al., 2017; Khan et al., 2013) or without (Naughton et al., 2015) a control group, one observational study without a control group (Baker, 2011), one action research study without a control group (Bryce et al., 2009), one mixed-method study (Lau et al., 2014), one effectiveness study without a control group (Villadsen et al., 2016), and one post-hoc evaluation (Kaufman et al., 2017). The most frequent study setting was the United States ($n = 11$), followed by Australia ($n = 5$).

The most frequently reported interventions were educational interventions, which were used in 16 studies (Al Kahmis et al., 2017; Arefi et al., 2015; Boyd and Windsor, 2003; Carter et al., 1989; Crawford-Williams et al., 2016; Gesell et al., 2015; Kendall et al., 2017; Khan et al., 2013; Lau et al., 2014; Olson et al., 2018; Secker-Walker et al., 1998; Shivalli et al., 2015; Villadsen et al., 2016; Wilkinson and McIntyre, 2012; Wilkinson et al., 2010; Windsor et al., 2014). Next, there were nine health-coaching interventions (Baker, 2011; Bryce et al., 2009; Currie et al., 2015; Gaston and Prapavessis, 2014; Hayman et al., 2017; Herring et al., 2017; Hill et al., 2016; Naughton et al., 2015; Poston et al., 2013), three motivational interviewing formats (Hughes et al., 2017; Osterman et al., 2014; Rasouli et al., 2017), one cognitive behavioural therapy intervention (El-Mohandes et al., 2011), and one national social and behavioural change campaign (Kaufman et al., 2017). Educational interventions were based on information material, lectures or counselling. Specifically, booklets (Al Khamis et al., 2017; Crawford-Willimas et al., 2016; Khan et al., 2013; Villadsen et al., 2016; Wilkinson et al., 2012, 2010), videos (Hughes et al., 2017; Vindsor et al., 2014), visual reinforcement material (containing pictures and encouraging messages, Shivalli et al., 2015), a website (Olson et al., 2018), lectures (Al Khamis et al., 2017; Boyd and Windsor, 2003; Carter et al., 1989; Gesell et al., 2015; Kendall et al., 2017; Wilkinson and McIntyre, 2012), text messages (Hughes et al., 2017; Kaufman et al., 2017; Lau et al., 2014), individual counselling (Khan et al., 2013; Secker-Walker et al., 1989; Shivalli et al., 2015; Windsor et al., 2014) and TV and radio advertising (Kaufman et al., 2017) were used to transfer information. One study did not specify the nature of the educational intervention (Arefi et al., 2015). Health-coaching interventions were based on advice from professionals (Baker, 2011; Currie et al., 2015; Hayman et al., 2017; Hill et al., 2016; Poston et al., 2013); one study utilised additional face-to-face advice (Bryce et al., 2009) and one study applied text message self-help support for health coaching (Nauhton et al., 2015). Motivational interviewing was used as an intervention to decrease alcohol consumption during pregnancy (Osterman et al., 2014), to stress the importance of antenatal classes (Rasouli et al., 2017), and to reduce the risk of maternal cytomegalovirus infections (Hughes et al., 2017).

The most frequent maternity-related health outcome of the programmes was weight management, which was assessed in six studies (Baker, 2011; Gesell et al., 2015; Herring et al., 2017;

Hill et al., 2016; Olson et al., 2018; Poston et al., 2013). Five programmes targeted smoking cessation (Bryce et al., 2009; El-Mohandes et al., 2011; Naughton et al., 2015; Secker-Walker et al., 1998; Windsor et al., 2014), four interventions aimed to increase health literacy in pregnancy (Lau et al., 2014; Villadsen et al., 2016; Wilkinson and McIntyre, 2012; Wilkinson et al., 2010), three studies focused on healthy nutrition practices for pregnant women (Boyd and Windsor, 2003; Kendall et al., 2017; Shivalli et al., 2015), three on exercises for physical activity in pregnancy (Currie et al., 2015; Gaston and Prapavessis, 2014; Hayman et al., 2017), two on reducing alcohol consumption (Crawford-Williams et al., 2016; Osterman et al., 2014), one on improving dental health (Al Khamis et al., 2017), one on reducing caesarean sections (Arefi et al., 2015), one on the prevention of toxoplasmosis (Carter et al., 1989), one on the prevention of cytomegalovirus (Hughes et al., 2017), one on up-to-date neonatal care practices (Khan et al., 2013), and two on childbirth preparation (Kaufman et al., 2017; Rasouli et al., 2017) (see Table 1).

The interventions and programmes generally started between the first and second trimester, except for three studies which included women in the third trimester (Arefi et al., 2015; Osterman et al., 2014; Villadsen et al., 2016). Most of the programmes were conducted with individual participants ($n = 20$) (Al Kahmis et al., 2017; Bryce et al., 2009; Crawford-Williams et al., 2016; Currie et al., 2015; El-Mohandes et al., 2011; Gaston and Prapavessis, 2014; Hayman et al., 2017; Herring et al., 2017; Hughes et al., 2017; Khan et al., 2013; Lau et al., 2014; Naughton et al., 2015; Olson et al., 2018; Osterman et al., 2014; Rasouli et al., 2017; Secker-Walker et al., 1998; Shivalli et al., 2015; Villadsen et al., 2016; Wilkinson et al., 2010; Windsor et al., 2014), three were group-based (Boyd and Winsdor, 2003; Gesell et al., 2015; Kendall et al., 2017), five were split into individual and group units (Baker, 2011; Carter et al., 1989; Hill et al., 2016; Poston et al., 2013; Wilkinson and McIntyre, 2012), one was a regional campaign (Kaufman et al., 2017) and one study did not specify the exact programme characteristics (Arefi et al., 2015).

Midwives were involved in nine out of 30 BCPs: in four studies, midwives had a role in the BCP, e.g. through the distribution of information material or assessments (Bryce et al., 2009; Hill et al., 2016; Lau et al., 2014; Wilkinson and McIntryre, 2012). In five studies, midwives recruited women to participate in the intervention (Baker, 2011; Currie et al., 2015; Naughton et al., 2015; Poston et al., 2013; Wilkinson et al., 2010). Midwives did not lead, or implement any of the antenatal BCPs described in the selected studies.

Strategies for behaviour change during pregnancy

In 14 studies (Al Kahmis et al., 2017; Arefi et al., 2015; Boyd and Windsor, 2003; Carter et al., 1989; Crawford-Williams et al., 2016; Gesell et al., 2015; Hughes et al., 2017; Kendall et al., 2017; Khan et al., 2013; Olson et al., 2018; Shivalli et al., 2015; Villadsen et al., 2016; Wilkinson and McIntyre, 2012; Wilkinson et al., 2010), education for knowledge gain and informational material were the strategies primarily applied to promote behaviour change during pregnancy. One of the "intervention functions" from the *Behaviour Change Wheel* (Michie et al., 2011) is *education*. For example, Al Khamis et al. (2017) used a dental hygiene leaflet and a booklet with dental health information as well as personal dental health education in dental hygiene techniques. Boyd and Windsor's (2003) intervention group received eight lessons (60 min. each) on healthy nutrition during pregnancy as well as for the newborn baby and postpartum.

Interactive education through psychosocial support (e.g. health coaching) was applied in 13 studies (Baker 2011; Bryce et al., 2009; Currie et al., 2015; Gaston and Prapavessis, 2014; Herring et al., 2017; Hill et al., 2016; Lau et al., 2014; Naughton et al., 2015; Osterman et al., 2014; Poston et al., 2013; Rasouli et al., 2017; Secker-Walker et al., 1998; Windsor et al., 2014). For example, in one study (Baker, 2011) home visits were conducted to jointly identify behaviour change goals (diet and physical activity), followed by individual support. The support provided aimed to achieve the health goals and to stimulate changes six to 24 months postpartum. In the intervention group of another study Poston et al. (2013), a health trainer conducted one individual training session followed by an eight-week group exercise, to promote healthy nutrition during pregnancy.

From the perspective of the *Behaviour Change Wheel* (Michie et al., 2011), *these examples employ interventions that can be categorized as "intervention functions" (*i.e., the *middle circle*). The *outer circle,* which includes organisational categories typical of the structure of the healthcare system, is not brought up in any of the studies. The *inner circle*, the *COM-B Model*, was not deliberately drawn on, neither in the education for knowledge gain nor in the informational material interventions but a link to the capabilities determinant can be assumed. Psychosocial support through individual conversations and/or training sessions, however, involved components of capability, opportunity, and motivation in interactive education, example through the delivering of text messages, this was evident in thirteen studies (Baker, 2011; Bryce et al., 2009; Currie et al., 2015; Gaston and Prapavessis, 2014; Herring et al., 2017; Hill et al., 2016; Lau et al., 2014; Naughton et al., 2015; Osterman et al., 2014; Poston et al., 2013; Rasouli et al., 2017; Secker-Walker et al., 1998; Windsor et al., 2014). In these studies, the interaction between the professional and the client that took place as part of the psychosocial interventions are not described in detail; therefore, no in-depth evaluation of the embedded features of the *COM-B Model* is possible.

Empowerment component in behaviour change programmes during pregnancy

All studies included the empowerment dimensions of *skills and competencies* and *innovation*. Seventeen studies (Al Kahmis et al., 2017; Boyd and Windsor, 2003; Currie et al., 2015; Gaston and Prapavessis, 2014; Gesell et al., 2015; Hayman et al., 2017; Herring et al., 2017; Hughes et al., 2017; Kaufman et al., 2017; Naughton et al., 2015; Olson et al., 2018; Osterman et al., 2014; Poston et al., 2013; Rasouli et al., 2017; Secker-Walker et al., 1998; Wilkinson and McIntyre, 2012; Windsor et al., 2014) featured three or more dimensions by which the pregnant women were assisted in their behaviour changes (see Table 2). The dimensions found in the intervention designs varied broadly. The ranking of the frequency with which the dimensions were found in the studies was as follows, from most to least frequent: *skills and competencies, innovation, goal-setting and attainment, self-efficacy, reflexive thought, social support and social capital, and shared decision-making.* The following paragraphs detail the studies according to these dimensions.

Skills and competencies

In all 30 studies, the skills and competencies aspect was present in the BCP during pregnancy. Across all the different behaviour change technique formats, the participating women were provided with support to develop new skills and competencies in the health topics concerned (see Table 1). Four of the programmes had an explicit focus on self-directed learning: Al Khamis et al. (2017), Crawford-Williams et al. (2016), Hayman et al. (2017), Olson et al. (2018).

Innovation

The innovation aspect was found in all studies, thanks to the women's openness to changing their own behaviour despite the uncertainty of the outcome. Innovation is defined by Kliche and Kröger (2008) as the willingness of people to be open to reflect on and change/experiment with their behaviours and environment. The participating women were all willing to experiment with their own behaviour. In thirteen studies (Baker, 2011; Bryce et al., 2009; Crawford-Williams et al., 2016; El-Mohandes et al., 2011; Gesell et al., 2015; Hayman et al., 2017; Kaufman et al., 2017; Naughton et al., 2015; Osterman et al., 2014; Poston et al., 2013; Shivalli et al., 2015; Wilkinson and McIntyre, 2012; Windsor et al., 2014) the women were willing to use the behaviour change programme to experiment with their human environments (partner, family, friends, or work colleagues). For example: In the study by Baker (2011) obese pregnant women had health visits for weight management during pregnancy. The women's environments (families) were recruited to assist in the programme and did cooperate in terms of meal times and healthier food choices for the whole family. This intervention had benefits for the whole family, e.g. the children in the households ate fewer sweets. In another study, Windsor et al. (2014) encouraged the pregnant women to implement a smoke-free home policy. In that study, which is also included in the review by Chamberlain et al. (2017), the participating women were willing to experiment together with the people living with them in order to stop smoking.

Goal-setting and attainment

The empowerment intervention goal-setting and attainment was briefly mentioned without further description in seven studies (Al Kahmis et al., 2017; Gesell et al., 2015; Hayman et al., 2017; Olson et al., 2018; Secker-Walker et al., 1998; Wilkinson and McIntyre, 2012; Windsor et al., 2010). In a further three studies – Currie et al. (2015), Gaston and Prapavessis (2014), Poston et al., 2013 – *goal-setting* was the central feature of behaviour change techniques during pregnancy. These studies included clear descriptions of the procedures of the interventions. One of these three studies (Poston et al., 2013) had an incremental goal-setting approach. Each week pre-specified goals relating to time, diet and activities for the weight management of obese pregnant women were set and reviewed. The other two studies (Currie et al., 2015; Gaston and Prapavessis, 2014) did not focus on incremental goals, but offered women the opportunity of modifying a goal if it was not met during the intervention period. In four studies (Al Kahmis et al., 2017; Currie et al., 2015; Gaston and Prapavessis, 2014; Hayman et al., 2017) goal-setting was combined with autonomous planning in the form of developing a plan for *goal attainment* during pregnancy. In three of these four studies – Al Khamis et al. (2017), Currie et al. (2015), Gaston and Prapavessis (2014) – the participating women were asked to develop a written plan to determine when, where and how they would implement their new practices (e.g. physical activity, brushing their teeth and cleaning them with dental floss). The remaining one of these four studies, Hayman et al. (2017), did not describe the action planning in detail.

Self-efficacy

In nine studies (Currie et al., 2015; Gaston and Prapavessis, 2014; Gesell et al., 2015; Herring et al., 2017; Hughes et al., 2017; Kaufman et al., 2017; Osterman et al., 2014; Rasouli et al., 2017; Wilkinson and McIntyre, 2012) the intervention aimed to increase self-efficacy for a healthier behaviour. Motivational interviewing was used in three studies: Hughes et al. (2017), Osterman et al. (2014), and Rasouli et al. (2017). Two studies, Gesell et al. (2015) and Wilkinson & McIntyre (2012), based their interventions on a theory that had a component of increasing self-efficacy, but did not describe these components in detail. Osterman et al. (2014) tried to raise self-efficacy via structured support to find appropriate goals for the individual drinking behaviour of the pregnant women concerned. This structured support was provided by outside help, positive feedback and neutral information. Herring et al. (2017) arranged weekly to monthly calls by a health coach to support self-efficacy. Currie et al. (2015) used three steps to support self-efficacy: 1) *task self-efficacy,* including the furnishing of information and discussion; 2) *coping self-efficacy,* including goal-setting and action planning; and 3) *recovery self-efficacy,* including following up on action planning with reviews of the goals. Gaston and Prapavessis (2014) asked the pregnant participants to compose a written account of their own experiences of success (*mastery experience*); verbal persuasion and vicarious experience were also incorporated into the intervention in order to increase self-efficacy, followed by information acquisition and individual action planning.

Reflexive thought

Self-monitoring was applied in five studies (Currie et al., 2015; Gesell et al., 2015; Olson et al., 2018; Wilkinson and McIntyre, 2012; Wilkinson et al., 2010) to implement reflexive thought. In two studies (Wilkinson and McIntyre, 2012; Wilkinson et al., 2010) the self-monitoring activity was conducted through tasks in a booklet, in order to create an awareness of health behaviours such as physical activity and nutrition during pregnancy. Gesell et al. (2015) used social learning theory for their skill-based intervention on weight management in pregnancy: self-monitoring is one component of this theory. In the study by Currie et al. (2015) the participating women reflected on physical activities they had previously enjoyed, and these were made subjects for discussion during pregnancy. In one study by Olson et al. (2018), pregnant women self-monitored their weight management, but specific details about how this was done were not included in the description.

Social support and social capital

Building supportive social networks (family and friends) was part of the intervention in four studies (Currie et al., 2015; Gesell et al., 2015; Hayman et al., 2017; Naughton et al., 2015). In two studies, Gesell et al. (2015) and Hayman et al. (2017), the pregnant women were taught social skills through programme modules. Hayman et al. (2017) utilised social cognitive theory in respect of the area of physical activity; Gesell et al. (2015), focusing on the prevention of extensive weight gain in pregnancy, concentrated in each session on building supportive networks through friends and family. In the study findings of Naughton et al. (2015) it is briefly mentioned that interventions that pay attention to social support (e.g. avoiding contact with other smokers) are beneficial for women and help them to stop smoking in pregnancy. No further information was reported (Naughton et al., 2015). Currie et al. (2015) encouraged the participating women to think about family members and friends whom they might involve to help them achieve their physical activity goals in pregnancy (Currie et al., 2015).

Shared decision-making

Boyd and Windsor (2003) gave consideration to the question of how to make decisions in the area of maternal and child nutritional health. During the eight weeks of one-hour antenatal nutrition lessons, one focal area, alongside seven others, was that of decision-making. No specific description of how this empowerment content was realised was reported in the publication.

Discussion

Behaviour-change interventions or programmes during maternity care vary widely. Some interventions are tailored to a single health issue, e.g. giving up smoking or managing weight gain during pregnancy (Herring et al., 2017; Naughton et al., 2015), while others can be applied more broadly (Lau et al., 2014; Villadsen et al., 2016; Wilkinson and McIntyre, 2012; Wilkinson et al., 2010). The behaviour-change interventions showed varying levels of success (see Table 1).

The majority of the studies selected for this review focused on health-related behaviours that can lead to health problems, while the remainder emphasised staying healthy with a health-related outcome. It is pivotal to support people in learning to protect and improve their own health (i.e. acquiring high health literacy). Healthcare professionals and health scientists have a major role to play in bringing about this important change of focus. Health promotion, disease prevention and people-centred care are cornerstones of wellbeing and health equity the enhancement of population equality (WHO, 2015). An emphasis on staying healthy in health research and in day-to-day practice in the field of healthcare leads to beneficial health-related outcomes. In other words, health promotion through the empowerment of pregnant women can have long lasting positive impacts for family health (Azenha et al., 2013).

With respect to the first aim of this scoping review, namely to investigate the effectiveness of behaviour change programmes, the findings reveal that education has been the dominant approach to changing women's health behaviour during pregnancy. However, psychosocial interventions are more effective, according to the Cochrane review by Chamberlain et al. (2017), who conclude that only education activities have no significant effects on giving up smoking. It is thus advisable not only to provide information – as twelve studies did – but also to apply interventions that include opportunities for learning new behaviour-change skills (Nutbeam, 2000). This aspect of selecting interventions based on actions, analysis and mechanisms of behaviour which are required to correct is also supported by the *Behaviour Change Wheel* (Michie et al., 2011), in which education is only one of the intervention functions together with persuasion, incentivisation, coercion, training, enablement, modelling, environmental restructuring and restrictions – functions that could also be used to foster the effectiveness of behaviour-change interventions during maternity care. It must be noted in this context that coercion refers to government policies and legislation that discourage unhealthy behaviours, e.g. high taxation of tobacco products or restrictions on where smoking is allowed in public spaces. Moreover, the *COM-B Model*, in the inner circle of the wheel, could also be considered as an effective promoter of behaviour change, as it takes individual as well as environmental factors into account. Examining *capability, opportunity* and *motivation* can be helpful in analysing barriers to behaviour change (Michie et al., 2011). In the 30 studies, it was only possible to infer how the *COM-B Model* was embedded in the psychosocial interventions because descriptions of the programmes were often not detailed enough. Chamberlain et al. (2017) showed that cognitive interventions were the most effective way of stopping smoking, but it has not yet been possible to generalise this statement independently of individuals' backgrounds, which makes its transfer into practice difficult. BCP need to test programmes with pregnant women from diverse cultural and socio-economic backgrounds.

Of the 30 studies covered by this scoping review, seventeen included empowerment dimensions in addition to knowledge gain and skills. It was often difficult to extract different empowerment components from the studies as some authors did not provide enough details about the interventions. In these seventeen studies three or more empowerment dimensions were identified as supporting behaviour change. No study used all eight empowerment dimensions of Kliche and Kröger (2008). The empowerment dimensions may be helpful in judging and developing components for BCPs in healthcare. The eight dimensions can be transferred into actual practice in order to achieve and maintain the long-term achievement of WHO's "Health 2020" policy, of empowering people in the fields of health behaviour and self-care. The empowerment of women in particular could greatly benefit them in the further course of their lives (Stuckelberger, 2010). Behaviour change through empowerment of pregnant women highlights the fact that women are able to use their own resources to bring about change and cope with challenges along the way. Overall, BCPs for pregnant women that include more than only *skills and competencies* as an empowerment component are promising, and future studies ought to examine the efficacy and mechanisms of success associated with additional empowerment components of antenatal BCPs, in order to further support healthy living. Moreover, conceptual relations between the Behaviour Change Wheel and the empowerment concepts might be explored in detail.

With respect to the research question on the role of midwives in BCPs, up until now, midwives have rarely been involved in BCPs. The World Health Organization Europe (WHO, 2013a) states that a key role in implementing improvements to health is the promotion of "behaviour change throughout the whole of life", these efforts need to be supported by health care professionals like midwives and nurses. Midwives can play a major role in transforming life, because they form an element in the health promotion structures at a turning point in women's lives. Midwives could be important in BCPs: they are caregivers for women during pregnancy and childbirth and in the postnatal phase and can easily build up connections to other health professions. Midwives provide care that is already aligned with many components that promote behaviour change, such as supporting self-efficacy and shared decision–making. Midwives and nurses are trained to improve health and wellbeing as well as in enhancing health equity in a sensitive way (WHO, 2013a). For these reasons, midwives should be more involved in BCPs, in order to develop, manage, implement or support BCPs during maternity care.

Strengths and limitations

The PRISMA flow diagram (Fig. 2) was used to depict the process by which studies were selected for inclusion in this scoping review (Moher et al., 2009, 2015). In the scoping review, the quality of the studies was not assessed. Due to the methodological limitations of a scoping review, lower quality studies were included. The included studies were screened and selected by one author only. This is a common approach in scoping reviews (Tricco et al., 2016). However, we may have overseen some important aspects in the various studies. Despite these limitations, the present review closes the current knowledge gap by providing an overview of existing behaviour change strategies during pregnancy, of empowerment strategies and of how midwives are involved in BCPs.

Conclusion

A key finding of this scoping review on BCPs during pregnancy was that BCPs are based either on education for knowledge gain and informational material or on interactive education through support. The empowerment dimensions *skills and competencies* were used in all studies. To increase the empowerment of women in the healthcare setting, more empowerment dimensions should be applied. Such empowerment could benefit the women concerned throughout the further course of their lives. Midwives might be well-suited to develop, manage, implement or assist in

BCPs, because they play a major role in maternity care and their practice aligns with principles that are shown to improve success of BCPs. Nowadays, midwives as the key healthcare providers in maternity care are rarely involved in BCPs during pregnancy. A starting point for improving health-promoting behaviours among pregnant women seems to be education. As a next step, programmes ought to include additional interventions in support of behaviour change as outlined in the *COM-B Model* of the *Behaviour Change Wheel*, including individual and environmental factors. As a final step, the BCPs should be screened for empowerment dimensions, and supplemented if necessary.

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Declaration of Competing Interest

No conflict of interest.

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