



Research article

In-depth analysis to develop a social marketing model to promote women's participation in waste segregation behaviour: A qualitative study

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ABSTRACT

Waste separation is one of the key factors in managing solid waste and creating a healthy environment. Waste separation at source has always been associated with challenges. Therefore, this study was conducted to determine the perceptions of housewives and related parties regarding the factors that influence waste separation behaviour and to identify approaches to improve behaviour based on the social marketing framework. This study was conducted as a qualitative content analysis in Amol City in 2022. The data was collected through semi-structured individual interviews. A total of 25 housewives were selected as main participants and 5 stakeholders through purposive selection. The results of the study included lack of awareness of recyclable materials (product), personal, family and environmental barriers (price), lack of doorstep collection of dry waste (place), and lack of use of appropriate technology (promotion). The lack of financial resources, inappropriate political measures and the coronavirus pandemic were also the causes of this challenge. Most participants cited environmental and educational deficits as the main reason for not separating waste. It is possible to improve waste sorting behaviour at source through appropriate behavioural interventions at the individual, social and environmental levels. Researchers can use the results of this study to design, implement and evaluate waste segregation intervention programmes for housewives.

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1. This qualitative study provides a rich description of the phenomena studied through the examination of a small but diverse sample, due to the unique experiences of individuals with interpersonal issues, concepts and culture.
2. We investigated and deeply understood from the audience's point of view and recognised the factors influencing waste separation behaviour among housewives and stakeholders based on the social marketing approach. The previous studies were only based on the viewpoint or opinion of one group and did not conduct the studies from the viewpoint of both groups.
3. After identifying the influencing factors, needs, problems and views of housewives and civil servants, it is possible to plan and improve waste separation behaviour.
4. The results of the study can be a suitable guide for the formulation and implementation of strategies and programmes to improve waste separation behaviour in communities.

1. Introduction

The World Health Organisation is committed to sustainable development in all its activities to protect future generations from increasing health risks. One of the most effective activities in this area is solid waste management (SWM), which is an important responsibility of local governments worldwide and has a direct impact on public health, the environment and people's livelihoods. SWM contributes to the development of new energy sources and to overcoming the challenges of climate change. However, rapid urbanisation and population growth are putting strong pressure on waste management systems, especially in low-income countries, which are most affected by the lack of access to basic services such as waste collection and disposal [1,2]. By 2050, it is expected that 3.40 billion tonnes of waste will be generated worldwide every year, a sharp increase on the current 2.01 billion tonnes. The East Asia and Pacific region accounts for the largest share of global waste generation at 23 per cent, while the Middle East and North Africa region produces the least in absolute terms at 6 per cent [3]. Improper disposal of municipal solid waste can hurt health through water, soil, and air pollution [4–6]. Almost a quarter of global diseases can be prevented by reducing environmental hazards [5]. The goal of preserving the climate is still of great importance to everyone, which is why it is necessary to reduce or even eliminate the activities that cause these pollutants [7].

The most important and best solid waste management measure is waste recycling, which helps to save environmental and economic resources [8]. Integrated waste management systems promote economic growth and social progress [2]. Reducing the amount of waste is beneficial for both the environment and communities [9]. Contact with a sustainable environment improves people's physical and mental health and the well-being of society [10]. Waste recycling requires waste separation at the source [2]. Factors such as awareness, education, social norms, perceived benefits, structural barriers, motivation, attitude, subjective norms, self-efficacy, perceived behavioural control, behavioural intentions, normative feedback, and environmental factors have an impact on waste sorting behaviour [11–19]. Surveys show that waste separation is very important for the preservation and improvement of the environment [20–22]. In most countries around the world, waste management systems have evolved [9]. However, this is still a challenge in developing countries and recycling rates are very low [23–27]. Waste management is an important infrastructure for the development of society, but so far it has not been recognised in many developing countries [28]. Waste separation at landfill sites requires more time and labour [29]. Separation and recycling reduce greenhouse gas emissions and economic growth [30,31]. It is possible to reduce environmental problems by reducing household waste [32].

Because solid waste management mainly takes place in the home environment, married women as household managers can effectively contribute to improving waste management by separating household waste [33]. Public participation in this process is essential in order to develop comprehensive solutions for dealing with waste problems [34]. In Iranian cities, most women are responsible for sorting waste. However, only 17.7 % of Iranian women stated that they separate their waste [13].

The Amol Waste Organisation has been active for 13 years. The organisation's activities include door-to-door personal training and the distribution of educational brochures to the trained families. 12 waste stations in the city take dry waste from people and give them other goods in return. According to the waste organisation's statistics, the proportion of waste separation in the city of Amol in 2022 was around 1%, well below the global and national average. It is therefore necessary to determine the causes and influencing factors. It is useful to conduct a qualitative study to discover the challenges of waste management. Previous qualitative studies investigated the views of households or beneficiaries in the area of waste separation and did not investigate the views of both groups [13,22,35–38]. Analysing the perspective of a group does not shed light on all aspects of a problem. To gain a deeper understanding of waste sorting behaviour, all influencing factors should be investigated. To fill this gap, we investigated the views of relevant individuals and stakeholders to gain a more comprehensive view of waste sorting behaviour. Studies on waste separation should design their interventions according to the principles of behaviour change after they have conducted sufficient formative research [39,40]. Qualitative studies are used to understand human situations in different contexts and under different perceptual conditions [41]. A qualitative study provides a comprehensive description of the phenomena investigated [42]. The use of a qualitative study based on social marketing is very useful to understand the audience's perspective and to identify the issues, barriers and factors that influence behaviour [13,35,37,43].

Theories and models guide the work of educators and can be used at different stages of planning, implementing and evaluating a programme [44]. One of the effective approaches is social marketing. Social marketing refers to the application of commercial marketing techniques to analyse, plan, implement and evaluate programmes that aim to influence the voluntary behaviour of target groups in order to improve their personal well-being and society [44,45]. Social marketing does this by analysing the target group and identifying its needs before developing measures with the help of the marketing mix (4Ps), namely product, price, place and promotion [44]. The use of strategies based on community-based social marketing is effective in removing barriers and promoting waste

segregation behaviour [46]. Also, social marketing can be a means to improve participation in waste segregation [9,47].

The level of waste separation in Amol is far below international and national standards. To determine the reasons for this, the problem must be analysed at the source of waste separation, i.e. in households. In Iranian households, women play an essential role in maintaining and promoting waste separation within the family. However, for them to play this role, problems and obstacles need to be identified. The first step of the social marketing approach is to get to know the audience, the obstacles and the competitors through a qualitative study. Our aim is therefore to explore the audience's perspective and to know the factors that influence the behaviour of housewives and stakeholders about waste separation based on the social marketing approach. In-depth knowledge, understanding and gaining the beliefs of women and stakeholders in this area can be a suitable guide for the formulation and implementation of measures by researchers and policymakers to improve waste separation behaviour in society.

2. Methods

2.1. Study area

Amol is one of the most populous cities in the province of Mazandaran in northern Iran. According to statistics from the Amol Health Centre, the population of Amol in 2022 was 400,193 people. Most of the inhabitants of Amol belong to the Tabari ethnic group and speak the local language Mazandarani. However, the official language of the city is Farsi. The city is one of the oldest cities in Iran and the centre of industry and export in the province of Mazandaran. It is also the rice capital of Iran. This city has a humid climate. The groundwater level is high there. This makes waste disposal in this city a challenge.

2.2. Study design and subjects

This qualitative study was conducted using a content analysis approach from April to May 2022 in the city of Amol. We aimed to identify the causes (challenges) of low waste segregation at source. There were 20 clinics in the city, 16 clinics were located within the city and 4 clinics were on the outskirts of the city. We selected 4 clinics within the city and 1 clinic on the outskirts using random numbers. Through purposive sampling, 25 housewives and 5 stakeholders were invited to participate in the study. All participants were interviewed in person. Details of the participants are shown in Tables 1 and 2. The participation criteria included one year of residence in the city, no continuous waste separation behaviour in the last six months, interest in participating in the study and the ability to express opinions and experiences.

2.3. Interview method

Semi-structured interviews were conducted to collect data. Each interview was introduced with warm-up questions. Then the most important open questions were asked. Questions such as.

Table 1
Demographic variables Status of the participating housewives.

Participant no.	Age	Number of family members	Marital status	Educational level	Occupation
P1	29	2	Married	M.Sc.	Employee
P2	28	2	Married	Ph.D.	not working
P3	54	2	Single	Diploma	freelance job
P4	65	3	Single	Elementary	not working
P5	37	4	Married	Bachelor	Employee
P6	34	3	Married	Bachelor	Employee
P7	35	4	Married	Diploma	not working
P8	41	4	Married	Elementary	not working
P9	55	1	Single	Diploma	not working
P10	35	4	Married	Bachelor	not working
P11	39	5	Married	Diploma	not working
P12	40	4	Married	Elementary	not working
P13	52	2	Married	Under Diploma	not working
P14	48	4	Married	Under Diploma	not working
P15	33	4	Married	Bachelor	freelance job
P16	51	3	Married	Diploma	freelance job
P17	45	4	Married	Elementary	freelance job
P18	40	4	Married	Elementary	not working
P19	48	2	Married	Under Diploma	not working
P20	45	4	Married	Bachelor	not working
P21	45	4	Married	Bachelor	Employee
P22	60	4	Married	Diploma	Employee
P23	28	3	Married	Bachelor	Employee
P24	22	3	Married	Elementary	not working
P25	23	3	Married	Elementary	not working

Table 2
Status of the demographic variables of the stakeholders.

Participant no.	Gender	Age	Level of education	Marital status	Responsibility	Years of service
P 1	Female	36	Bachelor's degree	Married	Municipal employee	8
P 2	Male	44	Bachelor's degree	Married	Waste management specialist	11
P 3	Male	51	Bachelor's degree	Married	Contractor	13
P4	Female	32	Bachelor's degree	Married	Employee	10
P5	Female	39	Diploma	Married	Employee	8

Table 3
Viewpoints of the participants.

Category	Sub-category	Codes	Examples of comments
Product	Advantages of waste segregation	Cleanliness of the environment, physical, mental and spiritual health, help for the economy of the house and the country, prevention of diseases, avoidance of high costs	We enjoy the environment because it stays clean everywhere. It is beneficial for us and society. Because a healthy environment contributes to our physical, mental and emotional health. I use the money from the sale of dry waste to buy household items. We buy equipment for the building. If the waste is not separated, more space is taken up for landfill. This leads to soil loss, destruction and erosion of the soil. Failure to separate waste leads to the destruction of plants and the destruction of the ecosystem. Failure to separate waste is harmful to health because it leads to the accumulation of germs and diseases in humans and animals. It costs a lot of time and money to collect and bury waste. It helps the country's economy because useable materials are recycled and not wasted.
	Types of segregation	Separation of plastics, metals, glass, paper and cardboard as well as food waste	I only separate the leftover fruit and vegetables. I only remove the plastic and the yoghurt pot. I only separate the big things.
Price	Personal obstacles	Many obligations, too little time, laziness, negative attitude	I work and have a small child, I don't have time. As I have lots of commitments and housework, I don't have time to separate the rubbish. It's pointless work, why should I do it?
	Environmental barriers	Lack of space, living in small flats, long distance to the nearest recycling centre and lack of special dry waste bins in the districts and in the city, unreasonable price for recycling material	The municipality should set up a waste station in every neighbourhood, place special containers for dry waste and give people recycling bags. The waste station is not always equipped with appliances. The price of replacement equipment in the waste station is higher than outside.
	Family and norms	Lack of support from family, friends and acquaintances	My family didn't do it, and neither did I. My friend says it's pointless work, so you shouldn't waste your time. My neighbour says that sorting waste is a matter for the municipality.
Place	The right place to receive messages	Educational media, service clinics, virtual space	Virtual training is better, e.g. training with Instagram, Telegram, and WhatsApp. Face-to-face training by a trusted person is good. Training should be conducted by the service clinics and health workers. It is better to conduct both face-to-face and virtual training so that all housewives can use it. This way, learning will be better and teaching materials will also be available.
	The right place for waste separation	Easy access to the facilities and equipping all areas with dry and wet waste bins or waste stations	Dry waste bins and recycling stations should be clearly visible and accessible so that people who are outside the house can separate the waste. Dry waste should be collected from the front door several times a week.
Promotion	Using communication channels for advertising	Appropriate advertising on radio, television and the Internet service clinics, schools and neighbourhoods	Advertising in media such as television and radio as well as cultural work are necessary in society. The media and social networks should also promote waste separation. In schools, this topic should be worked on with the children. In schools, waste separation should be part of the curriculum. I would like to educate and inform myself in this area, but I don't know how to do it
	Effective people in waste segregation	Wives, parents, friends, relatives, famous and well-known people	My wife does it. That encourages us to do the same. My mum and sister separate the rubbish.
	Use of technology	Creating partners	Create an app that they can use to report when they have dry rubbish and come and collect it.
		Supporting services	Awaken people's interest in waste separation. For example, collect rubbish at the front door. Give families special nylons for collecting dry waste.
		The social network of friends	I first heard about this in a group with my friends.

1. What do you think about waste segregation?
2. What factors influence your behaviour in this area?
3. How can you obtain information about waste separation?

To find out more details, leading questions were asked where necessary. Questions like: Would you please elaborate, Please give an example, What do you mean, How, Why?

Questions such as the following were used to interview the stakeholders.

1. What information do you have about the status of waste sorting in households in the city of Amol?
2. In your opinion, what are the challenges and problems in implementing programmes to promote waste separation in households?

The survey questions can be found in [Appendix 1](#). The time and place of the interviews were determined based on the participants' preferences. Therefore, the interviews were conducted in in-service clinics. The interviews lasted 20–45 min. To avoid the loss of some data and to complete the content, all interviews were digitally recorded with the consent of the participants. The interviews with the stakeholders were conducted at their workplaces according to their preferences.

2.4. Data analysis

A qualitative content analysis approach was used to analyse the data. The analysis was carried out manually by the research team. The recorded content was transcribed verbatim after being carefully listened to several times. The interviews were then read and re-read several times. The content obtained was analysed using the coding system and converted into units of meaning. After being summarised, they were converted into codes. After the first coding, the extraction of concepts was started and a total of 123 initial codes were extracted. The codes were then categorised into sub-categories based on their similarity. The sub-categories were categorised based on their relationship to each other and to the components of social marketing (4Ps). These categories eventually formed the main theme of waste segregation based on the social marketing approach. Data collection and analysis continued until data saturation, when no new themes or ideas emerged.

2.5. Reliability of the data

To increase the validity and acceptability of the data, the written text of the interviews was reviewed with each participant and, if necessary, necessary changes were made [35]. Subsequently, the extracted codes were shared with the participants. In addition, communication and interaction with the participants took place to get to know them properly. Another researcher was brought in to re-extract the codes and compare them with the extracted codes. Purposive sampling with maximum diversity was used to achieve the broadest possible range of participants and perspectives. This diversity helped to obtain real data. This diversity included the diversity of service clinics, residential areas (deprived, semi-privileged and privileged areas), access to public facilities and demographic variables (age, occupation, education level and number of children). Therefore, the samples were carefully selected and continued until data saturation. All steps were reviewed and supervised by one of the researchers.

2.6. Ethical considerations

The ethics committee of Hamedan University of Medical Sciences approved the conduct of the study on ethical grounds (code number/ethics, IR.UMSHA.REC.1401.417). Before the interview was conducted, the purpose of the study and the reason for using the audio recorder were explained to the participants. It was also emphasised that all information obtained from the interviews was confidential and would only be used for this study. Participants had the right to withdraw from the study at any time if they did not wish to co-operate. Participants signed the written consent form after receiving the necessary explanations.

3. Results

After analysing the data, four main categories were identified as challenges to implementing waste sorting at source: lack of awareness of recyclable materials (product), individual, family and environmental barriers (price), lack of doorstep collection of dry waste (place), and lack of use of appropriate technologies (promotion). The individual categories and sub-categories ([Table 3](#)) are as follows.

3.1. Product

Our product was the waste separation behaviour of housewives. Therefore, we investigated the types of waste separation behaviour and its benefits from the perspective of the target group. Then we identified and categorised the main benefits of the product (waste separation) together with the needs of the target group to increase the value and attractiveness of the behaviour and finally improve the acceptance of the proposed product among the target group. From the analysis of the housewives' opinions on the products, two subgroups were formed, including the advantages of waste segregation and the type of waste segregation.

3.1.1. Advantages of waste segregation

Participants cited a wide range of environmental, personal, economic, and social benefits of separating waste. The majority emphasised keeping the environment (including soil, water and air) healthy, preventing disease in humans and animals, physical and mental health and supporting the domestic economy and the country's economy. "It helps the country's economy because useable materials are recycled and not wasted." (P14).

3.1.2. Type of waste segregation

The study of participants' views on waste separation and their willingness to do so revealed that most of them prefer to separate large waste, and most of them stated that they usually separate cardboard and plastic. Some people only separated the leftover bread and rice to feed the animals. "We give the leftover bread and rice to our friends in the village to use for the animals" (P9). Many people did not know that materials such as glass, iron, and aluminium can be recycled. "I would like to know about renewable and non-renewable waste. I don't know much about this field. I would like to know more" (P5).

3.2. Price

What the customer pays to receive the desired product is called the price. The price can be money, but also the waste of time and energy, the development of fears and worries or the loss of pleasure and comfort. In this section, the behavioural barriers or costs perceived by the participants should be identified. Before performing a behaviour, people compare the perceived obstacles and costs with the perceived benefits and advantages of the behaviour and choose behaviours with greater benefits [44]. The main reasons for not separating waste include lack of awareness of the benefits of waste separation, lack of awareness of recyclable materials, lack of familiarity with the waste station, lack of bins for dry waste, distance to dry waste collection points, and lack of time due to work. In addition, there was no space in a house or flat to store dry waste. The results of this section were divided into three categories: personal barriers, environmental barriers, and family and norms.

3.2.1. Personal barriers

Most participants expressed a lack of time due to work, impatience, laziness, lack of knowledge and uselessness. "It's difficult because I don't have enough time and sorting waste takes time." (P6). "It's very tiring, you should take each piece of rubbish apart piece by piece" (P17). Some felt that these behaviours should start in childhood to become institutionalised in people. "We are not used to this. The family should be a role model for the children. It should start in the family" (P2). "I don't have enough information in this area. I don't know what materials are recycled" (P19).

3.2.2. Environmental barriers

This refers to the environmental factors that limit waste separation among housewives. Most participants cited lack of space, living in small flats, long distances to the nearest waste station, and lack of dedicated bins for dry waste in neighbourhoods and the city as environmental factors affecting the non-separation of waste. "I don't have a rubbish bin. My house is small and it's an apartment. We don't have enough space to dispose of dry rubbish" (P7). Some people also mentioned the inadequate price of the waste station and the lack of suitable goods to exchange. "The price of the waste station is lower than outside. Some people have not received money for their dry waste from the waste station for a year" (P14). "The waste station is far away for many of us. It is difficult for me to get there because I don't have a car" (P1).

3.2.3. Family and norms

Several people cited a lack of support from family, friends and acquaintances as the reason for not separating waste. They felt that this would become a habit if it had started in childhood and at home. Now and at this age, it is difficult to do it despite the existing problems. "Waste separation education should start in childhood and at home so that it is institutionalised in people and becomes a part of their daily life" (P2).

3.3. Place

It refers to the places where the social marketing product, including the idea or behaviour, reaches the audience [44]. This study refers to the place where housewives prefer to receive messages and training on waste sorting or the place where they want to carry out waste sorting. Most participants indicated that service clinics, social media and virtual media are good venues to receive messages and raise awareness. Most housewives preferred face-to-face training combined with virtual training as they believed that this combined method is accessible to most housewives and has a positive impact on behaviour. "It is better to offer both face-to-face and virtual training so that all housewives can use it. This way, the learning success improves and teaching materials are also available" (P7). Most respondents stated that the municipality should collect the dry waste from their homes and place special dry waste bins in the city so that passers-by and people who are outside the house can easily access them. "Dry rubbish bins and recycling stations should be visible and accessible to people. When we are on the street, there is no place to dispose of dry rubbish, we have to throw it in the wet bins" (P23).

3.4. Promotion

It refers to a range of advertising, public relations, media support, personal communication and similar activities that focus on creating and maintaining the audience's desire to welcome the desired product or service to the customer [44]. Promotion refers to the use of different methods to raise awareness and motivate housewives to separate waste. The extracted codes refer to the following three main sub-categories: Use of communication channels for promotion, education, and people influencing waste separation.

3.4.1. Use of communication channels for advertising

Most participants stated that face-to-face meetings, broadcast programmes (television and radio), teachers at school and virtual spaces such as WhatsApp and Instagram were the best communication channels. "Radio programmes should promote this culture so that it becomes anchored in people" (P1). "I like face-to-face training more. I learn better and can ask my questions" (P19). All participants considered the lack of adequate training on waste separation to be the main reason for not separating waste. "Nobody taught us about this and talked to us about the importance of this work" (P11). "Education should start from childhood and waste separation should be part of the school curriculum" (P23). "I've never heard of it before. Where can I get information about it?" (P6).

3.4.2. People who are effective in separating housewives' waste

Most of the participants stated that they take their cue from their husbands and parents and that their opinions are important to them. Some other family members such as brothers, sisters, relatives and peer friends, school and service clinics were mentioned. Some said that they do not get much motivation from other people "because I know I am doing the right thing, I don't care about others" (P15).

Most participants cited peer modelling as an effective and useful factor in waste separation. "One of my friends did it. I saw that it's a good thing, so I do it too" (P9). "If we do it, others will learn from us and do it too" (P5).

3.4.3. Use of technology

One of the appropriate ways to improve environmental behaviour is to use virtual networks such as WhatsApp, Telegram and Instagram and to develop an application for mobile phones. This topic was raised by the stakeholders. The housewives also wanted this. "They should use technology so that people can use it easily and notify them when they have dry waste so that they can come and collect it" (P23).

3.5. The results of the stakeholder perspective analysis

After analysing the stakeholders' perspective, four main categories were identified as challenges in implementing waste separation

Table 4
Viewpoints of the stakeholders'.

Category	Sub-category	Codes	examples of comment
Product	Status of waste separation	Reduction of waste separation among housewives due to Corona	When the coronavirus pandemic broke out, all waste stations were ordered to close. For this reason, waste separation was very low, reaching 1%.
	Advantages of waste segregation	Economic savings for family and society, avoidance of water, soil and air pollution as well as energy waste	It is also affordable for families. Fewer resources and costs are needed for waste collection. There is so much Amol waste that we don't have enough land to bury the waste. If dry waste is removed from the rubbish, the amount of waste is reduced and we don't have a problem with pollution.
Price	Personal obstacles	Lack of time	Many people say that they don't have time to separate waste due to their busy schedules.
	Environmental barriers	Lack of suitable space at home - living in a flat - far away from the waste station - lack of separate waste bins in the city	We need to reopen the waste stations that were closed due to the coronavirus.
Place	The right place to receive messages	Web-based training	WhatsApp and Instagram can be used to educate people and raise awareness. We use Instagram in our organisation.
	The right place for waste separation	Improving people's access to existing facilities Access	Many people live in flats and say that they don't have enough space for waste separation. One of the biggest obstacles is the disposal of dry waste. We will develop an application that solves this problem.
Promotion	Media and effective people in waste separation for housewives	Use of the radio and well-known personalities in the city, support from families and friends	The most influential media that can help are television and radio, but they have high advertising costs. Celebrities in the city can also help in this area. Family and friends are definitely influential in this area.
	Competitors and partners	The presence of waste collectors and waste buyers	The municipality should install separate waste bins in the city, but this is not possible due to the presence of waste collectors, who take the dry waste with them.
	Supporting services	Social network of friends	In my opinion, the friends are now more connected and influence each other.

at source: lack of knowledge about proper separation (product), budget and labour (price), houses and recycling stations (Place) and lack of use of appropriate technologies (promotion). The results are shown in Table 4.

Product: Stakeholders were aware of people's lack of awareness and the public's views on waste separation. They explained that sometimes people separate some of the dry waste but throw it in the bin with the wet waste. "We need to do more work in this area. We need to educate people and encourage them to do this work properly. We need to reopen the waste stations that were closed because of corona."

Price: The analysis of the participants' perspective showed that they were aware of the personal, environmental and normative obstacles faced by households. They were aware of the existence of competitors and partners. They announced that it is not possible to place dry rubbish bins in the city due to the presence of refuse collectors. There is no labour and no budget for daily or weekly collection of dry waste from the doorstep.

Place: The participants stated that they carried out their training at home, in recycling centres and in some schools. According to them, it is currently not possible to train other organisations and get them to cooperate. Due to a lack of resources and labour, it is not possible to collect dry waste at the door of all homes.

Promotion: Stakeholders were aware of the effect of advertising on changing people's behaviour. However, due to a lack of resources, they were unable to advertise on radio and television. They felt the best way to educate people was to use home visits and existing communication channels such as WhatsApp and Instagram to educate and sensitise people. They considered the influence of social networks to be important and had a channel on Instagram for advertising. "The use of the mobile app is good. If the funding is available, we want to use it soon".

4. Discussion

The current qualitative study has identified various challenges in the area of waste separation in the city. Furthermore, no study was conducted on the challenges in the city. Therefore, limitations and problems have not been identified and the waste organisation continues its usual programmes with all the existing shortcomings. The results show that waste separation is influenced by individual, family, technical, and environmental factors. Beneficiaries also pointed to the lack of financial and human resources, inadequate measures and restrictions caused by the spread of the coronavirus. In addition to these cases, the lack of cooperation between the organisations involved is one of the reasons for their failure. It seems that the waste organisation should change their strategies and implementation plans. Two other qualitative studies have also shown the impact of Community policy on waste separation behaviour [35,37]. Poor planning leads to poor performance [48]. On the other hand, people's waste sorting behaviour is caused by the combined effect of external environmental factors and people's internal factors [49]. Controlling many of the factors that cause these barriers requires the cooperation of different individuals and organisations involved. Therefore, it is possible to eliminate or reduce many of these factors by raising awareness, motivating people and promoting cooperation between social institutions and communities.

In social marketing, the product is the behaviour or offer to be adopted by the target group. The product can be a tangible product, a service or an intangible idea such as environmental protection. This product should fulfil people's needs and be both attractive and interesting. It is important to link the potential benefits and subsequent advantages to the product and thus make it attractive to the target group [44]. To do this, the obstacles must be recognised and removed. In general, the housewives who participated in the present study were aware of the importance of waste separation, but they did not have complete information about recyclable materials. Thus, none of them could name all recyclable materials, and each of them named only two to three items and stated that they did not know the other recyclable materials. Personal barriers included lack of awareness of recyclable materials, lack of awareness of the waste station, lack of motivation, and lack of responsibility, which can be overcome through awareness raising, family support and group discussions. In a qualitative study, the low level of citizen participation was cited as one of the reasons for the low level of waste separation. According to the results of this study, the reason for this is the lack of a sense of responsibility and the lack of trust in officials due to the irregular collection of dry waste at the front door [35]. Awareness of the benefits of recycling was one of the decisive factors in favour of waste separation [37]. Another study found the positive role of knowledge on waste sorting behaviour [50].

A qualitative study conducted in India showed that people are well-informed about waste separation. The reason for this was the education of community members and even children in schools. The results of this study showed that women do more waste separation than men [22]. The study by Cheng et al. showed that knowledge has a positive effect on waste separation behaviour and that women participate more in waste separation [51]. The results of two studies have shown that women are more likely to separate their waste [52,53]. The study by Aguilar et al. showed that environmental education has a positive effect on people's attitudes and improves their waste-sorting behaviour [54]. The study by Ahmadi showed that attitudes and environmental responsibility have a positive effect on waste separation at source, i.e. in the household [33]. The study by Heidari et al. suggests that higher awareness and motivation are factors that influence waste separation among housewives [13]. In the study of Hoson waste separation was improved by educating and raising people's awareness [55]. As the results of studies in different countries have shown, environmental behaviour, including waste separation, can be improved by educating and raising people's awareness [40].

The role of family and friends in setting an example was very important. The participants who had witnessed their parents separating waste from childhood cited it as a duty and daily chore and did so not only at home, but also at work and in their free time. By raising awareness and motivating parents, we should encourage them to separate waste so that people are confronted with this behaviour from an early age, get used to it and it becomes ingrained in them. The participants who had seen their friends separating waste became interested and started this behaviour. The influence of friends and social environment on environmental behaviour, including waste separation, has also been confirmed in other studies [32,56,57].

However, the study by Cheng et al. showed that subjective norms have a negative influence on waste separation behaviour [51].

The results of the study by Heidari et al. showed the influence of social norms on waste separation behaviour [13]. In the study by Mugambe et al., community support was a decisive factor for waste separation behaviour [37]. A qualitative study from India showed that subjective norms are the strongest predictors of waste separation behaviour [22]. The results of a study have shown that social capital has a positive effect on waste separation behaviour [52].

Most participants were concerned about the lack of environmental facilities. Rubbish (dry and wet) is not collected on time from the doorstep. There is also no specific day and time. There are no waste stations near the houses. The prices of the waste stations are not reasonable for goods. There are no dry waste bins in the city. The presence of these obstacles has discouraged people from separating waste, which should be solved in cooperation with the waste organisation and the city administration. Situational factors such as convenience tools can encourage residents to separate waste [51]. The study by Amanidaz et al. found that the provision of facilities increased waste separation [58]. In Zhang's study, environmental factors were predictors of people's waste separation behaviour [12]. In the study by Babazadeh et al., the lack of regular collection of dry waste caused mistrust among citizens and reduced their participation in waste separation [35]. The results of the study by Heydari et al. showed that structural barriers influence waste separation behaviour [13]. Easy access to a system for the disposal of separated waste is very important for the implementation of waste separation [9,59,60]. The results of the qualitative study by Herati et al. with stakeholders showed that the distribution of separate bins in homes, schools and offices influences on waste separation behaviour [38]. In the study by Mugambe et al., the availability of infrastructure was one of the effective factors for waste separation [37]. The provision of environmental facilities by local authorities will therefore increase people's willingness to separate waste.

The price refers to tangible and intangible things that the target audience has to give up to accept the new idea (the new product). The price can be money, which is tangible, but often it is also intangible costs such as time, effort or giving up an old way of life. Formative research should identify what the target group sees as the price of adopting the new behaviour. This research should include an assessment of any barriers faced by the target groups [44]. In this study, participants expressed that they were spending more time and effort. Some were sceptical about recycling and doubted that these materials would be reused and returned to the natural cycle. The benefits of waste separation should be made clear to people so that they understand what they will get in return for adopting the behaviour. Incentives for individuals should be considered. In Xu's study, economic motivation was an influential factor in promoting waste sorting behaviour [61]. The study by Haghghatjoo et al. showed that the use of strategies based on community-based social marketing is very useful and effective in removing barriers and promoting sorting behaviour [46]. In the study by Mugambe et al., financial rewards were a decisive factor for waste separation [37].

In social marketing, the term "place" refers to the location where the target groups are confronted with behaviour-related messages. The messages should be targeted to a specific place to be effective. Along with the messages, the product (the idea or behaviour) should be made available in that specific place [44]. Most of the respondents considered training at home, in service clinics, at work and in virtual networks to be appropriate. Most housewives favoured face-to-face training in combination with virtual training, but stated that they had not yet received any training. It appears that the municipality and the waste organisation Amol have acted alone and have not involved other organisations and institutions in the education issue. There is no doubt that environmental activities require social and organisational activities as well as the involvement of different ecological levels and cannot be carried out in a closed framework. This problem was raised in the stakeholder interviews and the low budget of the waste management organisation for training was cited as a reason for this. In other studies, door-to-door education was effective [55,58,61,62].

Promotion is the mechanism by which the message is conveyed to the target audience. Depending on the topic, various techniques are used, e.g. advertising, public announcements, competitions, media support, counselling sessions and special events such as health and entertainment fairs [44]. The participants believed that advertising and public service announcements on social media such as television and radio can play an important role in this regard. The study by Karimi et al. mentioned the direct role of the media in improving waste-sorting behaviour [50]. The study by Cheng et al. showed that advertising has a positive and significant influence on waste separation behaviour [51]. The results of Harati's study with stakeholders showed that it is necessary to use separate applications for waste separation and collection [38]. Participants indicated that they tended to receive messages from known and trusted individuals. Lakhan's study showed that messages presented by community leaders were more successful in improving behaviour than community-based training [63]. The results of the study by Mugambe et al. show that social networks encourage people to separate their waste [37]. In Van der Werff's study, the use of local media and applications had a positive effect on waste reduction [32]. In Sadeghi's study, teaching in the form of lectures and group discussions improved waste separation [56]. Two review studies have shown that personal interaction, education and the use of technologies such as social networks contribute effectively to waste prevention [40,47]. Two studies used websites that increased recycling rates [64,65].

From the beneficiaries' point of view, the coronavirus pandemic was the main reason for the decline in waste separation in the city. This is because during the coronavirus pandemic, the city's waste centres, which had 26 active centres, were closed to prevent the spread of pollution. At that time, dry waste was only collected by rubbish collectors and scrap buyers. After three years, 12 waste centres were reopened. But they were not well received.

The lack of budget and labour was an important factor. Beneficiaries stated that they did not have enough staff to train departments and organisations. Due to limited staff, training was only conducted in limited areas. Due to the presence of waste collectors, they did not set up bins for dry waste in the city. Due to the high costs, it was not possible to provide mechanised bins for dry waste. A study on waste management techniques and challenges related to COVID-19 found that Asian countries need to allocate more resources to waste management. Furthermore, existing waste management techniques are not sufficient and more new techniques are needed to comply with regulations. It appears that Amol's waste organisation relies only on its staff and limited budget. To influence environmental behaviour, ecological approaches and the involvement of related organisations in this area can be effective. By working together with the environmental organisation, the municipal health centre, the city administration, the educational and environmental associations,

waste separation in the city can be improved. The waste organisation only used Instagram for information. Due to limited filtering in the country, other communication channels should be used to educate people. Domestic virtual channels that everyone can easily access. The results of Eskandari's study showed that the weakness of educational programs is one of the main obstacles to not separating waste [66]. A study on waste pickers has shown that their cooperation can be socially and environmentally beneficial for society [67]. Municipalities can therefore utilise these people with the right measures to improve the waste separation situation in the city.

The summary of the results shows that several reasons have caused the decline in waste segregation in the city. These reasons are the lack of awareness of people due to lack of education, lack of proper facilities in the city, lack of sufficient budget and human resources of waste organisations, lack of proper technology and lack of cooperation with related organisations. Collaborating with related organisations and using the human resources of these organisations can solve the problem of education in the city. However, providing the necessary technology and facilities requires allocating the necessary budget to the waste organisation. This requires proper policy-making at the city level.

4.1. Strengths and limitations

In this study, the most diverse sample possible was drawn to provide a comprehensive understanding of the phenomena. This qualitative study provides a rich description of the phenomena studied by examining a small but diverse sample due to each individual's unique experiences with interpersonal issues, concepts, and culture. We investigated the factors influencing the waste separation behaviour of housewives and stakeholders based on the social marketing approach and understood it from the audience's perspective. The previous studies were only based on the view or opinion of one group and did not conduct studies from the perspective of both groups.

One of the limitations of the research was the time required. Obtaining authorisations and coordinating with the relevant authorities was a lengthy process. The coincidence of the survey with the COVID-19 pandemic was another limitation that made it difficult to reach the people selected. This problem was solved by working with the staff at the service clinics and gaining people's trust. Only one person did not want to participate in the study because of the spread of the coronavirus. This study was conducted in urban areas. Therefore, the results cannot be generalised to rural areas due to the different structures of the villages. Concerning external validity, it should be borne in mind that the sample studied consisted only of housewives, meaning that the results cannot be generalised to society as a whole.

4.2. Future research

In future studies, researchers can plan, implement and evaluate appropriate measures to improve waste separation behaviour by understanding the influencing factors, needs, problems and views of housewives and civil servants. The results of the study can be a suitable guide for the formulation and implementation of measures and programmes to improve waste sorting behaviour in municipalities. Considering that the present study was conducted in urban areas and that the cultural, social and environmental context may be different in villages, it is suggested to apply this study also in rural areas. When implementing measures, it is recommended to use the development of infrastructure related to environmental facilities such as waste stations, special dry waste bins and mobile applications to improve waste separation behaviour. It is also recommended to teach children the importance of waste separation from an early age.

5. Conclusion

This study provided a comprehensive understanding of the beliefs, opinions, barriers and factors related to the waste-sorting behaviour of housewives. An important and practical point in this study is the influence of individual, family, technical, educational and environmental factors on waste separation behaviour. Reasons given for separating waste included protecting the environment, preventing pollution and disease, economic benefits and habituation to this behaviour. Most of the barriers mentioned were environmental barriers, including the lack of waste stations, the lack of dry waste bins in the city, the lack of dry waste collection at the doorstep and the lack of awareness due to a lack of education. As the results showed, it is possible to improve waste sorting behaviour at source through appropriate behavioural interventions at the individual and environmental level and through community involvement. In this way, the social marketing approach and appropriate behavioural theories can be used. This study and similar studies can identify the existing obstacles and problems, determine the solutions, reduce costs and pave the way for the development of effective waste separation measures. Depending on the factors that affect waste segregation, an appropriate model should be used for intervention. Among the theories and models of health education, the Integrative Model of Behavioural Prediction has all these effective factors. Therefore, we suggest that this model be used in the planning and implementation of waste segregation interventions.

Ethics approval and consent to participate

All procedures performed in studies involving human participants were by the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. Ethical approval was obtained from the Ethics Committee of Hamadan University of Medical Sciences with proprietary ID, IR.UMSHA.REC.1401.417. Informed consent was obtained from all individual participants included in the study.

Consent for publication

Written and informed consent for publication was obtained from all participants together with consent to participate.

Data availability statement

The data that has been used is confidential.

CRedit authorship contribution statement

Babak Moeni: Writing – original draft, Supervision, Methodology, Funding acquisition, Conceptualization. **Majid Barati:** Writing – original draft, Supervision, Methodology, Conceptualization. **Mohammad Khazaei:** Writing – original draft, Investigation, Conceptualization. **Leili Tapak:** Writing – original draft, Supervision, Methodology. **Maryam Hashemian:** Writing – review & editing, Writing – original draft, Methodology, Formal analysis, Data curation, Conceptualization.

Declaration of competing interest

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

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Abbreviations

SWM	solid waste management
4Ps	four elements of social marketing include product, price, place, and promotion
P	Participant

Appendix 1

The survey questions.

Interview guide based on the social marketing mix for the survey of housewives

1. What do you think about waste separation?
2. What factors influence your behaviour in this area?
3. How do you receive information about waste separation?
4. What do you think about the benefits of waste separation for you and society?
5. What problems arise if waste is not separated?
6. What materials can be recycled?
7. What do you think your friends, neighbours and people around you think about waste separation?
8. What waste separation options are available where you live? Or is it mandatory?
9. Which factors influence the waste separation behaviour of housewives?
10. How can the waste separation behaviour of housewives be improved?
11. Would you like to learn about waste separation?
12. What kind of education do you prefer?
13. What is your favourite place to learn?

Note that these 10 questions were part of the main questions, and probing questions were asked as needed to get more detail. Questions like:

- Would you please explain more?
- Please give an example?
- What do you mean? How? Why?

Interview guide based on the social marketing mix for interviewing stakeholders

1. What is your protocol and programme in the area of increased waste separation? How is it being implemented?
2. What information do you have on the status of waste segregation among the housewives of Amol city?
3. What is the best way to train housewives?
4. What is the best channel to raise awareness among housewives?
5. Where is the best place to train housewives?
6. What partners or competitors do you have in this field?
7. What do you think are the challenges and problems in implementing programmes to promote waste separation in households?
8. How do you think the behaviour of housewives can be improved with regard to waste separation?
9. Do you think that relatives, neighbours and friends can serve as role models for waste separation?

To find out more details, probing questions were asked where necessary. Questions like:

Would you please explain more?

Please give an example?

What do you mean? How? Why?

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