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Research article

The impact of family members on aging persons' technology use intentions

Freek Van Baelen [a,*], Melissa De Regge [b,c], Bart Larivière [d], Katrien Verleye [c], Kristof Eeckloo [b,e]

[a] School of Business and Management, University College Ghent, 1, Valentin Vaerwyckweg, 9000, Ghent, Belgium
[b] Strategic Policy Cell, Ghent University Hospital, 10, Corneel Heymanslaan, 9000, Ghent, Belgium
[c] Department of Marketing, Innovation and Organisation, Faculty of Economics and Business Administration, Ghent University, 2, Tweekerkenstraat, 9000, Ghent, Belgium
[d] Department of Marketing, Faculty of Economics and Business, Catholic University of Leuven, 69, Naamsestraat, 3000, Leuven, Belgium
[e] Department of Public Health and Primary Care, Faculty of Medicine and Health Sciences, Ghent University, 10, Corneel Heymanslaan, 9000, Ghent, Belgium

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A B S T R A C T

Technology plays a growing role in allowing aging persons to live independently. However, it is often difficult to motivate aging persons to use these new technologies. Using 182 dyads of aging persons and their primary family caregiver, this study investigates how family members' beliefs about the capabilities of the aging person are associated with the aging person's engagement in using healthcare technology—a phenomenon known as the Pygmalion effect. A quantitative statistical method response-surface analysis (RSA) was performed. RSA is often employed to understand complex, nonlinear interactions within a data set. It was investigated how the level of fit (when both the aging person and his or her family caregiver hold similar beliefs about the technological capabilities of the aging person) and the direction of misfit (whether the abilities of the aging person are greater or worse than the family caregiver thinks) shape the aging person's intention to use healthcare technologies. The individual perception of capabilities is an important driver of the intention to use technology. In line with the Pygmalion effect, the effects of family members on aging persons drives their adoption of healthcare technology. The greatest intentions to use technology are observed when there is a fit in beliefs. In contrast, misfit leads to lower usage intentions. The direction of misfit further reveals that aging person's beliefs about their capabilities are more decisive than their family caregiver's beliefs in promoting their technology usage intentions. In addition, age, experience with technology, attitudes, social norms, and technological savviness in the family also have an impact on aging persons' intentions to use technology. This study extends the theoretical basis of the Pygmalion effect by including fit, misfit, and direction of (mis)fit.

* Corresponding author.
E-mail addresses: freek.vanbaelen@hogent.be (F. Van Baelen), melissa.deregge@uzgent.be (M. De Regge), bart.lariviere@kuleuven.be (B. Larivière), katrien.verleye@ugent.be (K. Verleye), kristof.eeckloo@uzgent.be (K. Eeckloo).

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1. Introduction

Western countries are experiencing an increase in both the size and proportion of aging persons in their populations [1,2]. This amplifies the need for support, social care, and health care for aging persons [3,4]. A growing trend shows aging persons to live independently in their own homes for as long as possible [4,5]. They may have developed strong attachment to their homes, particularly if they have lived there for many years [6,7]. Living at home is beneficial for both the individual (helping to maintain independence, the familiar setting, personal routines, and greater wellbeing) and for society as a whole (in the form of cost savings) [8–11]. On top of that, it may also warrant existing connections with family and friends, enabling aging persons to stay socially active. Technology plays an increasingly important role in enabling aging persons to live independently in their preferred environment [12]. Research has shown that smart home technologies and related services can facilitate aging persons in their daily tasks and improve their overall quality of life [13]. However, lower levels of technological experience and skepticism about technological advances often hinder the implementation. Another obstacle is the fact that technology has often not been developed or adapted for an older audience [14,15]. At the same time, people from older generations are frequently digitally aware due to their need to stay in contact with family and to stay informed [16,17].

Previous research highlights the importance of social influence, derived from different actors in the social network, in technology employment [17–20]. It is also specifically associated with the adoption of healthcare technology [21,22]. Hogue and Sorwar argue that this is applicable for aging persons in particular [23]. Since family members are often crucial actors in the social network of aging people, this research centers on the influence they exert on aging persons' adoption of healthcare technologies.

This study aims to examine how the fit or misfit of beliefs between aging persons and their family members regarding technological capability affects aging persons' intentions to use healthcare technology. While prior research has highlighted the importance of social influence and family support in adopting technology, no studies addressed on how the fit (or misfit) in perceptions between aging persons and their family members affect the process.

2. Literature review

A number of researchers have called in recent years for investigations into how family members influence aging persons [18,24]. To date, an abundance of experimental evidence shows that many kinds of interpersonal relations are affected by subjective expectations (e.g. Ref. [25]). In educational psychology, Rosenthal and Jacobsen [26] used the name "Pygmalion effect" for the phenomenon whereby one person's expectations influence another's behavioral intentions and performance. This effect has been extensively demonstrated in teacher–student relations through empirical studies, qualitative reviews, and meta-analyses, showing that teachers' high expectations towards a student are internalized by the students, increasing their motivation to perform well [27–29]. Researchers have also identified the Pygmalion effect in manager–worker and leader–follower relations [27,30]. Interestingly, the Pygmalion effect has also been observed in relations between caregivers and their patients. In a study of the treatment of alcohol abuse, for instance, researchers have shown that clients who were labeled "motivated" by their therapists were less likely to drop out of treatment than those who were labeled "unmotivated" [31]. In one study where nurses were led to believe that some nursing home patients would progress more quickly than others with their rehabilitation, these patients actually exhibited fewer depressive tendencies and were admitted to hospital less frequently than the average-expectancy patients [32]. In a more recent study, the Pygmalion effect was found to be helpful in alleviating negative emotions among patients with suspected COVID-19 and in promoting patients' self-confidence and courage in facing the disease [33]. Nurses can make use of the Pygmalion effect by providing psychological support in order to increase patients' self-worth, motivation and confidence.

This evidence suggests that the Pygmalion effect arises in many types of interpersonal relationship [34], including those between caregivers and their patients [33]. Because family members often act as informal caregivers for aging persons [35], the Pygmalion effect deserves further investigation when considering how family members can alter aging persons' intention to adopt healthcare technologies.

Several researchers have pointed out that the Pygmalion effect should be studied together with self-efficacy [25,36]. In the context of this study, self-efficacy refers to the beliefs of aging persons regarding their own capabilities of using technologies [37,38]. As self-efficacy is centered on one's own perceptions of being capable of doing something, such as using a healthcare technology, and as the Pygmalion effect centers on the effects of others, such as the family caregiver, and their effects on one's own intentions, it seems warranted to include both concepts. Indeed, in a study on teacher–student relationships, Szumski and Karwowski [25] demonstrated that mathematics students' academic self-conception (i.e., self-efficacy) partially mediated the Pygmalion effect. To respond to criticism that the Pygmalion effect has been studied mostly in isolation [29,34], this research considers not only how family members' beliefs about aging persons affect their intention to adopt healthcare technologies, but also how the behavioral intentions of aging persons are affected by older persons' own beliefs about their self-efficacy.

Furthermore, there is evidence that the behavioral intentions of individuals also depend on the extent to which those in their social network have realistic or unrealistic expectations about their potential performance. For example, Karakowsky et al. [39] looked at the effects of supervisors' high and low expectations of their subordinates' performance. They found the Pygmalion effect to be strongest when the expectations of the supervisors fit with those of the subordinates. When supervisors have higher or lower expectations than the subordinates (when they overestimate or underestimate them), the supervisor's effect on the subordinates' behaviors decreased. Likewise, Dai et al. [28] demonstrated that a misfit between athletes' expectations of their own performance and the expectations of their social network may have negative implications for the athletes' behavior (they may quit), but only in cases of overestimation. This evidence suggests that a misfit between the expectations of family members and the aging person may weaken the Pygmalion effect.

3. Method

3.1. Conceptual framework and propositions

The goal of this research is twofold (see Fig. 1). First, it aims to investigate the occurrence of the Pygmalion effect in relationships between family members and their older relatives by exploring how family members' beliefs about the aging persons' ability to adopt a new technology actually affect the aging persons' intentions to adopt healthcare technologies. Specifically, this study seeks to answer the following research question (RQ1): "How do family members' beliefs about aging relatives' self-efficacy influence the intentions of aging persons to adopt healthcare technologies?" We predict that stronger beliefs on the part of the family members regarding the aging persons' self-efficacy have a more positive effect on the aging persons' intention to use the healthcare technology.

Secondly, this research aims to investigate the effects on the aging person's intent to use healthcare technology of the fit or misfit (overestimation or underestimation) between the aging persons' own beliefs regarding their capabilities and those of their family. Here the fit or misfit reflects the extent to which the family member' beliefs about the aging person's capability of adopting a new technology corresponds (fits) or does not correspond (misfits) with the aging person's own beliefs about his or her own capability to do so (here, self-efficacy). To address this, we pose the following research question (RQ2): "How does the fit or misfit between family members' beliefs and aging individuals' beliefs regarding technological capabilities affect the aging individuals' intention to adopt healthcare technologies?". Our assumption is that fit increases the strength of the Pygmalion effect, whereas misfit decreases it.

In addition to the Pygmalion effect, this study also takes account of family members' experience with technology (tech savviness) and the prior experience and attitude of the aging person towards technology [17]. Experience with technology plays a specific role in aging persons' intentions to use healthcare technologies [40]. This leads us to explore the following question (RQ3): "How do family members' technology experience and the aging person's prior technology experience and attitudes influence the aging person's intention to adopt healthcare technologies?"

Furthermore, traditional technology acceptance and adoption frameworks posit social norms as another important driver of the intent to use technology [41]. Social norms are the unwritten rules or expectations that govern how people behave in social situations. These norms can affect people's attitudes and beliefs about technology, which can in turn influence their intentions to use it [42]. Thus, where self-efficacy concerns a person's beliefs about his or her own knowledge or skills and the Pygmalion effect concerns the beliefs of others, social norms refer to the expectations to use (or not use) technology that are exerted by social pressure. This gives rise to the following research question (RQ4): "How do social norms influence aging individuals' intentions to adopt healthcare technologies?"

Finally, the age [43] and gender [44] of the aging persons have been included as control variables in the model (Fig. 1). While these variables are not the main focus of the study, we examine the following question (RQ5): *"How do age and gender of the aging person moderate the relationships between family members' beliefs, social norms, and aging persons' intentions to adopt healthcare technologies?".*

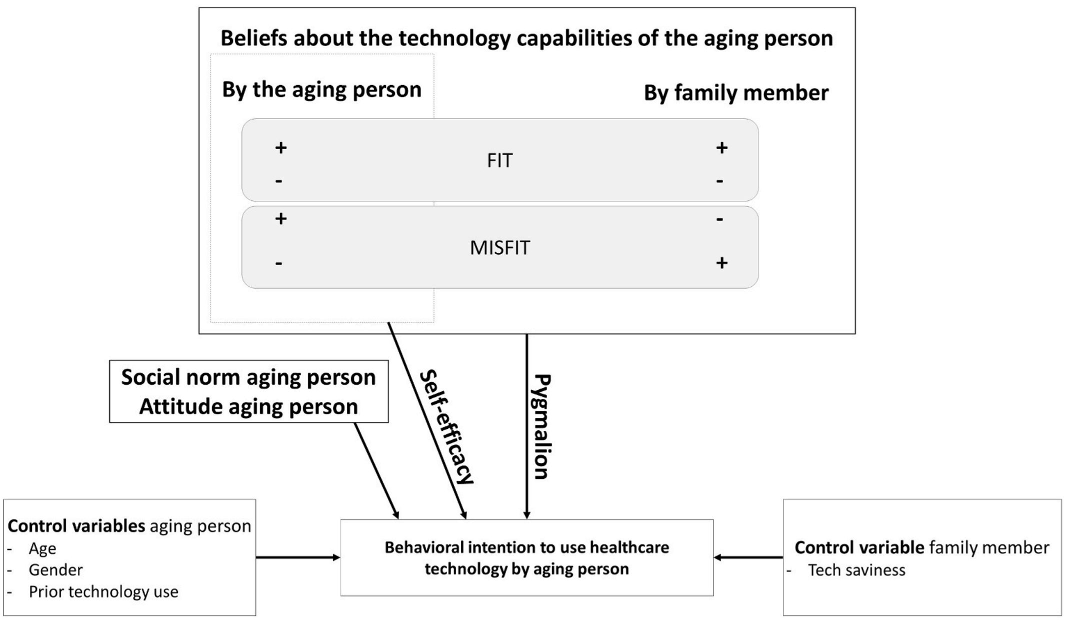

Fig. 1. Conceptual framework.

3.2. Research design

This study employs a quantitative research design using 182 dyads, each a matched pair of an aging person and a family member. RSA is used to investigate the fit or misfit between the beliefs of the aging persons and that of their family members. This technique generates a "response surface", which is a mathematical representation of how changes in predictive variables affect the response variable. By using polynomial regression models, RSA captures curvilinear patterns and interaction effects that are typically undetectable through simple linear models. This makes RSA very useful for examining the interplay between two variables, since both its fit and misfit effects can be calculated simultaneously.

3.3. Ethics and consent

Approval for the study was granted by the Ethics Committee of Ghent University Hospital (2017/0045) on 18 January 2017. All participants were given an informational letter outlining the aim of the study and each signed a written informed consent form.

3.4. Procedure and participants

To test the conceptual model, a paired-sample study design was used. Surveys were conducted among 204 aging persons aged seventy years and older. In addition, the primary family caregiver of each aging person completed a similar survey which included items on the family members themselves, as well as their expectations and beliefs about the aging person.

Data collection was carried out in Flanders (Belgium) among aging persons who could benefit from adopting health care technology and who were living in a nursing home, in a residential care facility, or in their own home. This sample was selected for its convenience: in terms of accessibility and proximity to the research team. Participants were recruited through home nursing care and residential care facilities. People who were not able to give their informed consent and people with cognitive or psychological disorders (as assessed by the research team) were excluded.

The surveys were administered face-to-face with the aging individual. A short introduction on healthcare technology was provided. Respondents who were unfamiliar with healthcare technology were presented with an example of healthcare technology that can assist aging people (such as Cubigo®). The researcher read out the questions if necessary and recorded the answers provided by the respondent. The survey for the primary family care giver was provided to the aging person, who gave it to the family member. After completion, the family member returned the questionnaire either through the postal service or by returning the survey to the aging person's care facility.

The questionnaire was completed by 304 aging people and 213 family members. After a data quality check, the final sample included 182 pairs of aging persons and family members. The data on the aging persons was complete, since the interviews had been administered face-to-face. The questionnaires for the family members were however not administered face-to-face, which resulted in some surveys being incomplete; these entries were not included in the final sample.

3.5. Measures

Both questionnaires measured constructs that were based on translated validated scales. In addition to sociodemographic variables, the survey for the aging person contained measures regarding self-efficacy, attitude, and use of health care technology. The family member questionnaire measured technological savviness and expectations of the aging persons' technological self-efficacy. Responses were registered on a Likert scale ranging from 1 (strongly disagree) to 10 (strongly agree). As suggested by Castle and Engberg [45], a ten-point scale was used instead of the more usual five- or seven-point scale to make it easier for older participants to respond accurately, as scoring on 10-points is more familiar to most respondents.

Intention to use. The intention to use health care technology was measured among the aging persons using three items from Venkatesh et al. [41]. Internal reliability was high ($\alpha = .96$). A sample item is "Assuming I have access to the technology, I intend to use it".

Attitude towards technology. Two items from Venkatesh et al. [41] were used to assess attitude towards technology among the aging persons. Internal reliability was high ($\alpha = .94$). A sample item is "Using healthcare technology is pleasant".

Social norms. Social norms among the aging persons were measured using the three-item scale from Venkatesh et al. [41]. Internal reliability was high ($\alpha = .85$). A sample item is "People who are important to me, such as friends and family, think that I should use healthcare technology".

Self-efficacy. Self-efficacy was assessed among the aging persons and family members using three items adopted from Cimperman et al. [46]. Aging persons were asked to evaluate their own self-efficacy, whereas the family member was asked to evaluate their beliefs about the self-efficacy of the aging person. Internal reliability was high ($\alpha = .88$ among the aging persons and $\alpha = .87$ among the family members). A sample item from the survey for the aging persons is "I know too little about new technologies to use them correctly". In the survey for family members this item was formulated as "He/She knows too little about new technologies to use them correctly".

Technological savviness. The technological savviness of family members was measured using four items. Internal reliability was high ($\alpha = .97$). A sample item is "I am good at using technology".

3.6. Statistical analysis

IBM SPSS Statistics (version 27) was used for sample analysis and descriptive data statistics. Cronbach's alpha reliability scores were calculated to test the internal consistency of the scales. A paired *t*-test was used to measure equality in answers between the aging persons and their family member.

The relationships of our conceptual framework (See Fig. 1) were investigated by means of an RSA [47] using MPlus software (version 8.3). Specifically, the following equation was used:

$$Intent_i = \beta_0 + \beta_1 \, Age_i + \beta_2 \, Gender_i + \beta_3 \, PriorTechUsage_i + \beta_4 \, TechSavvyFam_i$$

$$+ \beta_5 \, Attitude_i + \beta_6 \, SocialNorm_i$$

$$+ \beta_7 \, Efficacy\_aging\_person_i + \beta_8 \, Beliefs\_family_i + \beta_9 \, Efficacy\_aging\_person_i^2$$

$$+ \beta_{10} \, Efficacy\_aging\_person_i \times Beliefs\_family_i + \beta_{11} \, Beliefs\_family_i^2 + \varepsilon_i \quad (1)$$

in which $Intent_i$ represents the behavioral intent for aging person *i,* and ε_i represents the error term. β_1 to β_4 denote the parameter estimates for the four control variables, β_5 *and* β_6 denote the parameter estimates for the aging person's attitude and the aging person's social norms, and β_7 to β_8 denote the parameter estimates for the effect of both the aging person's efficacy perceptions ($Efficacy\_aging\_person_i$) and the family member's beliefs about the aging person's efficacy ($Beliefs\_family_i$). These later two parameter estimates and the additional polynomial parameter estimates (β_9 to β_{11}) are used to calculate the fit (a_1 and a_2) and misfit (a_3 and a_4) parameters [47]:

$$a_{1\_Fit} = \beta_7 + \beta_8 \quad (2)$$

$$a_{2\_Fit} = \beta_9 + \beta_{10} + \beta_{11} \quad (3)$$

$$a_{3\_Misfit} = \beta_7 - \beta_8 \quad (4)$$

$$a_{4\_Misfit} = \beta_9 - \beta_{10} + \beta_{11} \quad (5)$$

Here a_{1_Fit} and a_{2_Fit} respectively provide information about the level and curvature of fit between the two efficacy variables, whereas a_{3_Misfit} and a_{4_Misfit} respectively provide information about the direction and extent of the misfit (overestimation or underestimation) between the two efficacy variables.

The analysis focuses on three parameters: fit parameters, misfit parameters, and convergence and robustness tests. The fit and misfit parameters are analyzed because they give insight into the complex interactions between the beliefs of the family members and the aging persons and thus allow the research questions to be answered. Convergence and robustness tests are essential for validating the robustness and reliability of the model's findings (in this regard they are comparable to the model fit parameters in other statistical methods). It is important to ensure that the algorithm has converged properly to a stable solution. Without proper convergence, the parameter estimates would be unreliable.

Fit Parameters. A positive and significant a_{1_Fit} means that higher values for the outcome variable (here, behavioral intent) are observed when both the efficacy of the aging person and the family member's perception of the efficacy of the aging person are high rather than low. In addition, if a_{2_Fit} is positive (negative) and significant, we find evidence for a nonlinear fit effect, in which the outcome variable—here, behavioral intent—will increase (decrease) more sharply as both efficacy variables have higher values. In other words, the fit parameters test the interplay between both efficacy variables and show what happens if both the aging person and her or his family member believe that the aging person's efficacy is high (rather than low).

Misfit Parameters. Unlike conventional moderation analyses, a_{3_Misfit} and a_{4_Misfit} provide information about the extent (i.e., a_{4_Misfit}) and direction (i.e., a_{3_Misfit}) of the misfit between the two efficacy variables. Specifically, a negative a_{4_Misfit} parameter denotes that the aging person's behavioral intent will decrease more rapidly as the extent of misfit increases (that is, as the distance between the reported efficacy variables increases), whereas a positive value of a_{4_Misfit} yields the opposite relationship. Finally, a_{3_Misfit} provides insight into the effect of the direction of misfit on the aging person's behavioral intent, thereby taking the two possible misfit situations into consideration. Specifically, a positive a_{3_Misfit} value means that the negative effect of the misfit on the aging person's behavioral intent is incrementally more severe when the family's perception of the aging person's efficacy exceeds that of the aging person's, and vice verse for a negative a_{3_Misfit} value. In other words, the misfit parameters test the interplay between both of the efficacy variables and in particular they examine what happens when the efficacy of the aging person is greater than the family's perception of the aging person's efficacy, as well as vice versa; these are both possible situations, as can be seen in Table 1, which provides insight into the proportion of fit and misfit in our data set, by following the suggestion of Fleenor et al. [48] and Shanock et al. [47] to first show the

Table 1
Fit and misfit between aging persons' and their family members' beliefs regarding the aging person's efficacy.

	Sample size	Mean (SD) efficacy aging person	Mean (SD) efficacy beliefs by family	Paired *t*-test
Fit	53.3 % (n = 97)	3.35 (2.29)	3.47 (2.14)	0.060
Misfit: efficacy aging person > efficacy of family beliefs	20.9 % (n = 38)	6.41 (2.71)	2.68 (1.90)	≤0.001
Misfit: Efficacy aging person < efficacy of family beliefs	25.8 % (n = 47)	2.80 (2.02)	6.21 (2.24)	≤0.001

proportion of fit versus misfit in the population.

Convergence and Robustness Tests. Equation (1) was calculated with Bayesian inference using Markov chain Monte Carlo (MCMC) techniques. In line with Gelman and Rubin [49], we ran three independent MCMC chains with different starting points and 100,000 iterations each, of which the first half is considered the "burn-in" phase and the second half is used to determine the posterior distribution for the parameters. To assess the convergence of the MCMC algorithm, we inspected the Gelman–Rubin convergence statistic R, the autocorrelation plots, and the trace plots of the residual variance for the parameter estimates [50]. Specifically, given the last 50,000 iterations (used to estimate the parameters), the values of the Gelman–Rubin convergence statistic R ranged from 1.042 to 1.833. (Note that Yuan and MacKinnon [51] have suggested that a value of R close to 1 [the highest cut-off being 1.2] is an indication of reasonable convergence.) Hence, this investigation provided evidence that the MCMC algorithm converged.

4. Results

Table 1 indicates that fit occurred in about half of the sample, meaning that for 53 % of our aging person–family dyads, the perception of the aging person's efficacy was the same for the aging persons themselves and their family members. Interestingly, for about the other half of our sample we observed misfits between the aging persons and their family members: in 21 % of the cases, the aging person's perception was higher than that of his or her family members, whereas in 26 % it was lower.

Table 2 presents the results of our analysis. The parameter calculations in Panel A reveal that, overall, both aging persons' efficacy ($\beta_7 = 0.433$) and their families' beliefs about their efficacy ($\beta_8 = 0.173$) exert a positive, significant effect on the aging person's behavioral intent. Interestingly, the former effect is found to be 2.5 times (i.e., 0.433/0.173) more pronounced. An additional post-hoc test [52] confirms that this difference is statistically significant at 0.027.

In addition, Panel B of Table 2 reports the fit (a_{1_Fit}, a_{2_Fit}) and misfit (a_{3_Misfit}, a_{4_Misfit}) coefficients based on the main effects of the polynomial regression model (see Equation (1)). Specifically, we observe a significant positive effect for the level of fit ($a_{1\_Fit} = 0.446$) and for the direction of misfit ($a_{3\_Misfit} = 0.261$) on the aging person's behavioral intent. Hence, the fit effect is found to be 2.3 times (i.e., 0.606/0.261) more pronounced than the misfit effect (significant at 0.036; [52]). In other words, the greatest levels of the aging person's behavioral intent are observed when both the efficacy of the aging person and the perceived efficacy of the family members are high (i.e., fit via $a_{1\_Fit} = 0.446$). Interestingly, when the aging person's efficacy is higher than the family's beliefs ($a_{3\_Misfit} = 0.261$), this also results in a greater behavioral intent (than the situation in which the family's beliefs about efficacy are stronger than those of the aging person; cf. $a_{4\_Misfit} = -0.104$)—although this is less than the case in which both aging persons and their family members report high efficacy for the aging person.

Finally, Table 2 also reveals that greater age ($\beta_1 = -0.083$) leads to lower intentions. Furthermore, an aging person's prior experience with technology ($\beta_3 = 1.037$), his or her attitudes towards technology ($\beta_5 = 0.360$), and social norms ($\beta_6 = 0.443$) all enhance behavioral intent. The family member's technological savviness also exerts a positive effect on the aging person's behavioral intent ($\beta_5 = 0.193$).

Table 2
Model findings.

A: Parameter Estimates	
	Behavioral intent of aging person
Control variables	
Age *aging person* (β_1)	−0.083*
Gender (female) *aging person* (β_2)	−0.393
Prior technology usage *aging person*(β_3)	1.037*
Technological savviness *family* (β_4)	0.193*
Independent variables	
Attitude *aging person* (β_5)	0.360*
Social norm *aging person* (β_6)	0.443*
Independent variables: Pygmalion effect	
Efficacy *aging person* (β_7)	0.433*
Efficacy beliefs *family* (β_8)	0.173*
Efficacy *aging person* squared (β_9)	−0.065*
Efficacy *aging person* × efficacy beliefs *family* (β_{10})	−0.021
Efficacy beliefs *family* squared (β_{11})	0.018
R-square	*58.0 %*
B: Response surface analysis coefficients	
Interplay between efficacy of the *aging person* and efficacy beliefs of the *family*	
Level of fit ($a_{1\_Fit} = \beta_7 + \beta_8$)	0.606*
Fit curvature ($a_{2\_Fit} = \beta_9 + \beta_{10} + \beta_{11}$)	−0.069*
Direction of misfit ($a_{3\_Misfit} = \beta_7 - \beta_8$)	0.261*
Extent of misfit ($a_{4\_Misfit} = \beta_9 - \beta_{10} + \beta_{11}$)	−0.104*

Notes.* Bayesian estimation, significant at 0.05.

5. Discussion

In this study, we examined the Pygmalion effect within family dynamics in order to understand how family members' beliefs about an aging person's capability affects the aging person's intent to adopt healthcare technology. Specifically, we tested whether stronger beliefs from family members about the aging person's self-efficacy enhance the aging person's intention to use such technology. Additionally, we investigated the effects of fit and misfit between family members' beliefs and the aging person's self-beliefs. Fit between these beliefs was hypothesized to strengthen the Pygmalion effect, whereas misfit (whether overestimation or underestimation) was expected to weaken it.

Beyond the Pygmalion effect, we incorporated factors known to affect technology adoption: family members' tech-savviness, the aging person's prior experience and attitudes towards technology, as well as social norms. All of which exert social pressure around technology use. Age and gender were included as control variables in order to account for their potential effect on adoption intentions.

This study has shown that the social context in which aging persons come in contact with technology has a profound impact on their behavioral intentions. Type 1 diabetics, for example, need to track their blood glucose levels several times a day. There are numerous applications that provide this facility, the user friendliness of which has improved dramatically in recent years with the introduction of glucose sensors and mobile apps that automatically interact with them, that sound alarms when glucose levels are too low or high, and that share data with health care professionals [53]. However, this increased user friendliness will only result in higher adoption rates if the users themselves believe they will be able to use the technology effectively. Among older diabetics, the adoption of these new technologies is probably hindered more by patient beliefs about their ability to work with these technologies than by the actual user friendliness of these systems. Aging persons who doubt their ability to work with new technologies will most likely turn to their direct social network (family and friends) for support.

Our findings shed light on the effects that aging persons' belief in their personal technological capabilities have on their adoption of healthcare technology. Such expectations are of two type: first is self-efficacy, which refers to the beliefs a person has about their own ability to use technology. Research has convincingly shown that higher self-efficacy leads to better performance [54,55]. Secondly, there are the beliefs held by others about a person's capabilities—i.e., the social influence aspect [55]. Our findings provide a comprehensive answer to the first research question, which explored how family members' beliefs about aging relatives' self-efficacy influence the intentions of aging individuals to adopt healthcare technologies. The results indicate that family members' stronger beliefs in the aging persons' self-efficacy are positively associated with the aging individuals' intentions to adopt such technologies. Our results indicate that the strength of these beliefs, in combination with strong self-belief (i.e., a fit between these two sets of belief), is the main driver of behavior. As such, our findings also provide insights into the second research question: "How does the fit or misfit between family members' beliefs and aging individuals' beliefs regarding technological capabilities affect the aging individuals' intention to adopt healthcare technologies?". The greatest intentions to use technology are observed when there is a fit in beliefs. In contrast, misfit leads to lower usage intentions. In the case of misfit, intention is higher when it is the aging person who has higher beliefs in their capabilities.

When an aging person and his or her family assess the aging person's capabilities differently—such as in the worst case, when the aging person perceives his or her own capability to be lower than do the family members—the question arises of how to transform this into a situation where there is a high level of agreement. Ultimately, this comes down to two strategies: (1) increasing one's own beliefs in one's capability (such as via training) and (2) closing the gap in beliefs (for example, by involving family members in this training). By implementing both strategies, a situation of high-level fit can be achieved.

There seems to be a role for the developers of technology in both strategies. For example, by investing in training, the aging person's belief in their own capabilities can be strengthened. Involving the family in this training can also ensure that the beliefs concerning the aging person's capabilities held by both parties can grow towards each other. Training can be provided in the form of tutorials, training videos, user guides, showcases, and mock ups. In many cases it is possible to include family members or healthcare professionals, thus providing opportunities for beliefs about the aging person's technological capabilities to converge.

Healthcare professionals can also play a role in creating a high-level fit situation: often it is them who suggest technology that can improve the aging person's quality of life. By involving the family in discussions about such technologies, and by supporting the family and the aging person in their belief in the aging person's ability (e.g., by giving examples of other aging persons who successfully employ the technology), healthcare professionals can also facilitate a situation of high fit.

This study expands on existing theory by offering a more nuanced understanding of how the Pygmalion effect operates within a broader context. A common critique of Pygmalion research is that it often examines the effect in isolation [29,34], disregarding the possible interplay between the Pygmalion effect and other effects. This study contributes to this view by showing the interaction that the Pygmalion effect has with other variables (namely, fit or misfit between family members' and aging persons' beliefs and the direction of this fit or misfit). The analysis contributes to the view that the Pygmalion effect is not something that occurs in isolation, but is instead the result of a complex set of circumstances.

In line with other research, we have seen that age, experience with technology, attitudes, and social norms also affect intentions to use technology (RQ3 and RQ4) [56,57], whereas gender was not found to have a significant effect in our study. Not surprisingly, experience with technology and attitudes towards it have a very strong impact on the intention to use the technology [58]. Experience and attitudes create more positive expectations and less uncertainty about technology, thus contributing to the intention to use. This also explains the negative relationship between age and intention to use. On average, the older a person is, the less experience he or she has in using technology in general. Age also has a negative effect on the speed with which new technologies can be learned. All of this means that the rapid arrival of new technologies is more likely to be challenging for aging persons [20].

Interestingly, this study indicates that the level of technological savviness in the family also has an impact on intention to use. We assume that this can be explained by several interlinked processes. First, it is plausible that the threshold for using new technology is lower because a tech-savvy family member is more likely to be able to help if problems arise. Second, being around a tech-savvy family member can help familiarize the aging person with technology. Third, the advice of a tech-savvy family member regarding the use of a new technology is likely to be accepted more readily. The influence of family members and professional caregivers in shaping the attitudes and intentions of aging persons depends largely on the effect that they have on the aging person. This study has confirmed the effects of social norms on the intention to use, as has previously been demonstrated in research [59]. Social norms refer to the sociocultural contexts in which people experience expectations from their social environment regarding, for example, the use of technology. While this insight has little practical implications it has implications for the generalizability of the results of this study. It is after all difficult to imagine how one could shape social norms to increase the influence of family members and professional caregivers without resorting to highly unethical behavior.

6. Limitations and future research

This study, conducted in Western Europe, has certain cultural and methodological limitations that should be addressed in future research. Different cultures may exhibit varying social norms [60–62], meaning that the influence of family members and informal caregivers on aging persons' technology adoption could differ significantly in other cultural contexts. Future studies should investigate these dynamics across diverse cultural settings to assess the generalizability of the Pygmalion effect and the effects of social expectation on the adoption of healthcare technology.

The main limitations of this study are the direct result of the data collection method used. First, the dyadic approach—interviewing pairs of aging persons and their primary family caregivers—was both a strength and a limitation. Family caregivers used a paper-and-pencil survey, while aging persons participated in face-to-face interviews. Although effective for gathering relational data, this method introduced constraints, particularly on questionnaire length, to keep participation feasible. Consequently, some nuanced variables were omitted in order to maintain practicality, which suggests the need for follow-up studies that could explore these factors with more extensive questionnaires or alternative data collection methods. Second, the questionnaire measured intention to use technology, and not actual technology usage. This means that even when respondents said they are very likely to adopt a technology, there is no guarantee that they would actually use it.

Since this study was focused on aging persons, it would be interesting to see future research looking at the effects of family member characteristics and relationships: for example, grandchildren might be among the more tech-savvy family members who are more likely to support aging persons in their technology adoption [24,63].

Finally, professional caregivers were not included as respondents in this study. As the trend toward home care grows, it is increasingly important to examine the effects of professional caregivers alongside family members in supporting aging persons' technology adoption. Future studies could investigate how professional caregivers interact with aging persons and their family members in this process, offering a more comprehensive view of support networks in technology adoption.

7. Conclusions

This study demonstrated the existence of the Pygmalion effect in the relationship between aging persons and their family members with regard to the adoption of healthcare technology. When a family member has stronger beliefs about an aging persons' ability to use healthcare technology, the aging person's intention to use that technology increases. However, lower expectations on the part of the family member result in weaker intentions to use. Furthermore, the fit or misfit between the beliefs of family members and of aging persons is key. A fit between beliefs more strongly affects the intention to use a technology than a misfit, while a fit at greater levels of beliefs regarding ability is better than a fit at less levels of belief. However, an individual's own beliefs about his or her ability to use technology remains the primary driver of the intent to use the technology.

These findings contribute theoretically by expanding our understanding of the Pygmalion effect beyond isolated settings. By including fit, misfit, and their direction, we have illustrated that the Pygmalion effect interacts with relational dynamics. This study has highlighted that the Pygmalion effect does not occur in isolation, but is rather the product of complex interpersonal expectations and individual self-perception. Additionally, age, prior experience with technology, attitudes, social norms, and technological savviness of family members also significantly affect intentions to adopt technology, providing a more comprehensive framework for understanding the drivers of healthcare technology adoption among older adults.

CRediT authorship contribution statement

Freek Van Baelen: Writing – review & editing, Writing – original draft, Visualization, Project administration, Methodology, Data curation, Conceptualization. **Melissa De Regge:** Writing – review & editing, Writing – original draft, Supervision, Resources, Project administration, Conceptualization. **Bart Larivière:** Writing – review & editing, Writing – original draft, Methodology, Formal analysis, Data curation. **Katrien Verleye:** Writing – original draft, Supervision, Conceptualization. **Kristof Eeckloo:** Supervision, Project administration, Funding acquisition.

Data availability statement

Data will be made available on request. For requesting data, please write to the corresponding author.

Declaration of competing interest

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

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.heliyon.2025.e42252.

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