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How well do the theory of reasoned action and theory of planned behaviour predict intentions and attendance at screening programmes? A meta-analysis

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Abstract
Meta-analysis was used to quantify how well the Theories of Reasoned Action and Planned Behaviour have predicted intentions to attend screening programmes and actual attendance behaviour. Systematic literature searches identified 33 studies that were included in the review. Across the studies as a whole, attitudes had a large-sized relationship with intention, while subjective norms and perceived behavioural control (PBC) possessed medium-sized relationships with intention. Intention had a medium-sized relationship with attendance, whereas the PBC–attendance relationship was small sized. Due to heterogeneity in results between studies, moderator analyses were conducted. The moderator variables were (a) type of screening test, (b) location of recruitment, (c) screening cost and (d) invitation to screen. All moderators affected theory of planned behaviour relationships. Suggestions for future research emerging from these results include targeting attitudes to promote intention to screen, a greater use of implementation intentions in screening information and examining the credibility of different screening providers.

Keywords: *Screening attendance, theory of reasoned action, theory of planned behaviour, intention, mammography, cervical*

The main aim of screening programmes is to identify people at high risk of a particular condition, to allow interventions to prevent that condition developing or progressing. A major determinant of the effectiveness of all programmes is the

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level of uptake of those programmes. A high level of attendance at screening programmes is a pre-requisite if screening programmes are to have a significant impact on population morbidity and mortality.

Despite the importance of attendance, rates of attendance for screening programmes vary widely and are often low, even when screening is offered free of charge. For example, breast screening is offered free of charge to all women between the ages of 50 and 64 years in England, and achieved nearly 75% coverage in 2003–2004 (Department of Health, 2005) However, coverage was less than 60% in 24 out of 303 primary health care organisations and less than 50% in 8 of these. A good deal of research has been conducted to explore the demographic, economic, motivational and organisational factors predicting variation in attendance at screening programmes (Jepson et al. 2000). The focus of this article is on motivational factors that predict attendance behaviour.

Two models of human behaviour that have been extensively utilised to predict health behaviour (Johnston, French, Bonetti, & Johnston, 2004), such as screening attendance, are the theory of planned behaviour (TPB; Ajzen, 1991) and its predecessor, the theory of reasoned action (TRA; Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975). Both models propose that the most important determinant of any behaviour is a person's intention to perform the behaviour. In the TPB, perceived behavioural control (PBC), i.e., an individual's perceptions of control over behavioural performance in the face of internal and external barriers, is also specified as an additional predictor of behaviour. Intentions are predicted by attitudes, subjective norms and, in the TPB, PBC. Attitudes are an individual's positive or negative evaluation of performing the behaviour. Subjective norms reflect an individual's perceptions of social approval for performing the behaviour.

Meta-analytic reviews have supported the capacity of both the TPB (Armitage & Conner, 2001; Godin & Kok, 1996) and the TRA (Shepherd, Hartwick, & Warshaw, 1988) to predict intentions and behaviour across a wide range of contexts. Godin and Kok (1996) reviewed the literature applying the TPB to health behaviours, including a supplementary analysis of the TPB applied to attendance at screening programmes. They found that intentions to attend screening correlated strongly with attitudes ($r_+ = 0.51$), but more moderately with subjective norms ($r_+ = 0.33$) and PBC ($r_+ = 0.46$) in eight studies. Across six studies, they reported sample-weighted average correlations of $r_+ = 0.35$ between intention and behaviour and $r_+ = 0.29$ between PBC and behaviour. These results are similar to those reported by meta-analyses of the TPB with all behaviours, based on many more studies (Armitage & Conner, 2001). In contrast, other models of health-related behaviour, such as Protection Motivation Theory and the Health Belief Model, tend to account for less variance in intentions and behaviour (see Conner & Norman, 2005 for a review of each theory).

However, there are three critical limitations with Godin and Kok's review. First, the results are based on papers available up to 1994. Therefore, the review does not cover the last decade of research, which has seen a dramatic increase in

the quantity and quality of studies employing the TPB to study attendance at screening programmes. Second, due to the small number of papers included, the review of Godin and Kok did not have sufficient power to investigate potentially important moderator variables, e.g., whether relationships differ between systems of organising screening programmes. Third, not all papers included in the review examined attendance at a screening programme: one examined doctors' decisions to perform a clinical exam on HIV-positive patients (Godin, Boyer, Duval, Fortin, & Nadeau, 1992), one tested the use of oral rehydration therapy (Hounsa, Godin, Alihonou, Valois, & Girard, 1993) and one investigated dental hygiene behaviours (McCaul, O'Neill, & Glasgow, 1988).

The first and main objective of this study is to provide a comprehensive and up-to-date quantitative review of applications of the TRA/TPB in the domain of screening attendance. Specifically, the present study examines the strength of five relationships within the TRA/TPB—attitude–intention, subjective norm–intention, PBC–intention, intention–behaviour, PBC–behaviour—in the context of individuals attending a health screening programme. The second objective is to investigate the extent to which several moderator variables affect the size of the relationships just listed: (a) the type of screening test carried out (e.g., mammogram, cervical smear), (b) the location of recruitment for the study (e.g., general practice (GP), hospital), (c) the cost of screening, screening was either paid for as part of a privately organised system of healthcare (as in the United States) or was free as part of a national healthcare system (e.g., in the UK) and (d) whether or not participants received an invitation to screen.

Method

Literature review and inclusion/exclusion criteria

Several methods were used to identify relevant studies: (a) computerised searches of social scientific and medical databases (BIDS ISI, PubMed, Psychinfo and Web of Science) from January 1981 to the time of writing (July 2006), (b) studies cited in each article retrieved and (c) the authors of published articles were contacted and requests were made for studies in press. Searches were conducted by combining the following keywords 'screening', 'mammograph*', 'cervical', 'health check/screening' and 'attend*' with 'theory of reasoned action' and 'theory of planned behavio*' (to allow for US/UK differences in spelling of behaviour). These searches yielded 156 independent papers, which were considered against the following inclusion criteria:

(1) Studies had to report data on predicting attendance at screening programmes or predicting intention to attend screening. Hence, we included studies that looked at screening for cancer (breast, cervical and colon) as well as at health checks, genetic screening, prenatal screening, diabetes screening and screening for tuberculosis. However, we did not include studies of behaviours such as breast self-examination, which did not involve attending a screening test. Attendance was measured objectively

from medical records in every study except Poss (2000) where participants were followed up 2 days after completing measures of TPB variables.

(2) As a minimum, studies had to include both TRA constructs as predictors of intention. This lead to the exclusion of (a) review papers, (b) papers that measured TRA/TPB variables but did not report the relationships between variables (e.g., Fernbach, 2002) and (c) papers that tested only the attitude–intention relationship (e.g., McCaffery, Wardle, & Waller, 2003). Papers that reported only the intention–behaviour relation were also excluded.

(3) A bivariate statistical relationship between cognitions and intention (or behaviour) had to be retrievable. Where reports did not include relevant statistics (e.g., Barling & Moore, 1996), the authors of the study were contacted and requests were made for bivariate associations.

Using these inclusion criteria, the following were included: 33 tests of the association between attitudes and intentions, 31 tests of the association between subjective norm and intention and 25 tests of the relationship between PBC and intention. There were 19 tests of the relationship between intentions and behaviour and 18 tests of the PBC–behaviour relationship. Table I presents the bivariate correlations of intention with attitude, subjective norm and PBC and Table II presents the bivariate correlations between attendance and intention and those between attendance and PBC.

Meta-analytic strategy

The effect size estimate employed here was an average of the sample correlation coefficients, r_+ weighted by sample size. In this manner, correlations based on larger samples receive greater weight than those based on smaller samples (Hedges & Olkin, 1985). We calculated 'Fail-Safe N' (FSN; Rosenthal, 1984) values for each relationship, which provide an estimate of the number of unpublished studies comparable in size but containing null results that would be required to invalidate the conclusion that a relationship is statistically significant.

Homogeneity analyses were conducted using the chi-square statistic (Hunter Schmidt and Jackson 1982) to determine whether variation in the correlations between studies was greater than chance. If the chi-square statistic is non-significant, then the correlations are homogeneous and the average weighted effect size, r_+, can be said to represent the best estimate of population effect size. If the overall chi-square statistic was significant, pairwise Z tests were conducted between all pairs of tests to determine which screening tests in particular yielded significant different effect size estimates.

Computation of the weighted average correlations and homogeneity analyses were all conducted using Schwarzer's (1988) Meta computer program. All analyses are described in line with Cohen's (1992) recommendations, where a correlation of $r = 0.50$ is a large-sized effect, $r = 0.30$ is a medium-sized effect and $r = 0.10$ is a small-sized effect.

Table I. Studies included in the meta-analysis, with correlation coefficients between motivational variables (attitude, subjective norm, and perceived behavioural control) and intention.

Authors	Sample	Country	Behaviour	*N*	A	SN	PBC
Armitage, Norman and Conner (2002)	Men/women (31–42)	UK	Health check	201	0.46	0.26	0.33
Barling and Moore (1996)	Women (18–63)	Australia	Cervical smear	72	0.49	0.57	
Bish, Sutton and Golombok (2000)	Women[a]	UK	Cervical smear	142	0.67	0.54	0.13
Braithwaite et al. (2002)							
Breast cancer	Women (18–60)	UK	Genetic test	124	0.71	0.48	
Colon cancer	Men/women (18–60)	UK	Genetic test	168	0.67	0.55	
Conner, Sheeran Norman and Armitage (2000)	Men/women (31–42)	UK	Health check	201	0.60	0.67	0.33
DeVellis, Blalock and Sandler (1990)							
High-risk sample	Men/women (40–75)	United States	Colorectal screen	96	0.36	0.18	0.35
Low-risk sample	Men/women (40–75)	United States	Colorectal screen	144	0.42	0.36	0.43
Drossaert, Boer and Seydel (2003)	Women (50–69)	Netherlands	Mammogram	2657	0.60	0.20	0.49
Frost, Myers and Newman (2001)	Men/women (18–25)	UK	Genetic test	449	0.53	0.54	
Godin et al. (2001)	Women (40–69)	Canada	Mammogram	354	0.10	0.31	0.59
	Women (40–69)	Canada	CBE	344	0.35	0.05	0.54
Hill, Gardner and Rassaby (1985)	Women (18–70)	Australia	Cervical smear	123	0.47	0.29	
Jennings-Dozier (1999)							
African–American sample	Women (18–83)	United States	Cervical smear	108	0.58		0.30
Latina sample	Women (18–83)	United States	Cervical smear	96	0.40		0.35
Michels, Taplin, Carter and Kugler (1995)	Women (41–89)	United States	Mammogram	309	0.23	0.36	
Michie, Dormandy, French and Marteau (2004) (routine testing)	Women (under 37)	UK	Prenatal screening	446	0.83	0.70	0.17
(Separate testing)	Women (under 37)	UK	Prenatal screening	597	0.76	0.68	0.17
Montaño and Taplin (1996)	Women (40 and over)	United States	Mammogram	665	0.47	0.43	0.39
Montaño, Thompson, Taylor and Mahloch (1997)	Women (50–69)	United States	Mammogram	361	0.39	0.41	
Norman and Conner (1996)	Men/women (31–42)	UK	Health check	262	0.64	0.56	0.48
Orbell and Hagger (2006a)	Men/women (40 and over)	UK	Diabetes	210	0.54	0.66	0.77
Orbell and Hagger (2006b)	Women (20–64)	UK	Cervical	660	0.35	0.35	0.67
Orbell, Perugini and Rakow (2004)	Women (50–69)	UK	Colorectal	220	0.47	0.71	0.78
Poss (2000)	Men/women (18 and over)	United States	TB screening	206	0.50	0.65	
Rutter (2000)	Women (50–64)	UK	Mammogram	1108	0.45	0.36	0.40
Sheeran, Conner and Norman (2001)	Men/women (30–41)	UK	Health check	389	0.61	0.61	0.53
Sheeran and Orbell (2000)	Women (20–67)	UK	Cervical smear	114	0.38	0.44	0.69
Steadman and Rutter (2004)	Women (50–64)	UK	Mammogram	785	0.21	0.34	0.43
Steadman, Rutter and Field (2002)							
(Individual condition)	Women (50–64)	UK	Mammogram	228	0.49	0.27	0.29
(Modal condition)	Women (50–64)	UK	Mammogram	270	0.44	0.28	0.45
Tolma, Reininger, Ureda and Evans (2003)	Women (40–65)	Cyprus	Mammogram	293	0.33	0.39	0.33
Walsh (2005)	Women (25–60)	Ireland	Cervical smear	156	0.41	0.50	0.67

Notes: CBE = Clinical breast exam; TB = Tuberculosis. [a]No mention of sample age range in article.

Table II. Studies included in the meta-analysis, including correlation coefficients between intentions and behaviour and perceived behavioural control and behaviour.

Authors	Sample	Country	Behaviour	*N*	I	PBC
Armitage et al. (2002)	Men/women (31–42)	UK	Health check	201	0.22	0.19
Bish, Sutton and Golombok (2000)	Women	UK	Cervical smear	142	0.17	0.09
Conner et al. (2000)	Men/women (31–42)	UK	Health check	201	0.34	0.26
DeVellis et al. (1990)						
High-risk sample	Men/women (40–75)	United States	Colorectal screen	96	0.33	0.34
Low-risk sample	Men/women (40–75)	United States	Colorectal screen	144	0.50	0.19
Drossaert et al. (2003)	Women (50–69)	Netherlands	Mammogram	2039	0.32[a]	0.23[a]
Michie et al. (2004)	Women (under 37)	UK	Prenatal screening	446	0.86	0.14
(Routine testing)						
(Separate testing)	Women (under 37)	UK	Prenatal screening	597	0.69	0.13
Montano and Taplin (1991)	Women (40 or older)	United States	Mammogram	665	0.50	0.37
Norman and Conner (1996)	Men/women (31–42)	UK	Health check	268	0.16	0.13
Orbell and Hagger (2006b)	Women (20–64)	UK	Cervical	660	0.19	0.12
Poss (2000)	Men/women (18 or older)	United States	TB screening	206	0.84	
Rutter (2000)	Women (50–64)	UK	Mammogram	600	0.32[a]	0.16[a]
Sheeran, Conner and Norman (2000)	Men/women (30–41)	UK	Health check	389	0.20[a]	0.19[a]
Sheeran and Orbell (2001)						
(Control group)	Women (20–67)	UK	Cervical smear	55	0.57	0.41
Steadman and Rutter (2004)	Women (50–64)	UK	Mammogram	785	0.34	0.15
Steadman, Rutter and Field (2002)						
(Individual condition)	Women (50–64)	UK	Mammogram	228	0.49	0.04
(Modal condition)	Women (50–64)	UK	Mammogram	270	0.44	0.03
Walsh (2005)	Women (25–60)	Ireland	Cervical smear	156	0.18	0.25

Notes: [a]Average of measures taken at two timepoints.

Multiple samples and multiple measures

Where studies reported separate statistical tests for more than one sample, then the correlation from each sample was used as the unit of analysis (e.g., Braithwaite, Sutton, & Steggles, 2002). Where studies had measured attendance on multiple occasions (e.g., Drossaert, Boer, & Seydel, 2003), we employed the conservative strategy of using the weighted average of the sample correlations and the smallest N in the analysis to determine the overall effect size for the study.

Results

For the prediction of intention, all relationships were large- or medium sized, with the strongest relationship observed between attitudes and intentions and the weakest between subjective norms and intentions (Table III). For predicting screening attendance, intention had a medium-sized relationship, whereas PBC had a small-sized relationship (Table III). All the FSN values were large and since it is unlikely so many unpublished studies exist, we can conclude that each population relationship is genuinely different from zero.

Moderator analyses

Tests for heterogeneity for each of the correlations reported were significant (see Table III), suggesting greater variability in effect size estimates between studies than would be expected on the basis of random sampling error alone. This encourages a search for moderator variables, which can explain this variation. We conducted four moderator analyses, specifically were TPB relationships affected by (a) the type of screening the participant was invited to, (b) the location of recruitment, (c) cost of screening and (d) whether participants received an invitation to screen or not.

(a) Type of screening test. The TRA/TPB has been applied to mammography ($k = 10$), cervical smear ($k = 8$), health check ($k = 4$), genetic ($k = 3$), colorectal ($k = 3$) and prenatal ($k = 2$) screening attendance. Only Poss' (2000) study of

Table III. Summary of TRA/TPB relationships estimated by meta-analysis.

Relation	n	K	CI	χ^2	r_+	FSN
Attitude–intention	12,558	33	0.49–0.53	737.96***	0.51	305
Subjective norm–intention	12,354	31	0.39–0.42	560.31***	0.41	221
PBC–intention	10,746	25	0.45–0.48	415.74***	0.46	205
Intention–behaviour	8148	19	0.40–0.44	483.58***	0.42	141
PBC–behaviour	7942	18	0.17–0.21	58.13***	0.19	50

Notes: n, number of participants; k, number of tests of the relationship; CI, 95% confidence interval; χ^2, chi-square test of homogeneity; r_+, sample-weighted average correlation; FSN, Rosenthal's (1984) Fail-Safe N. ***$p < 0.001$.

tuberculosis inoculation and Orbell and Hagger's (2006a) study of diabetes testing did not fit into one of these categories. Data were analysed separately according to test context for the five TRA/TPB relationships tested above. We first tested whether the effect sizes were heterogeneous for each relation (e.g., attitude–intention) between the different types of test (Table IV).

There was a significant chi-square value associated with the attitude–intention relationships reported for the six different tests ($\chi^2(5) = 345.32$, $p < 0.001$). The effect reported for prenatal screening ($r_+ = 0.79$) was significantly larger than all the other attitude–intention relationships reported. The effect sizes associated with genetic tests and health checks were significantly larger than the three remaining tests. Finally, there were no differences between the effect sizes reported in mammography, cervical smear and colorectal screening studies.

The size of the subjective norm–intention relationship was different according to the test context considered ($\chi^2(5) = 350.77$, $p < 0.001$). Prenatal subjective norms were a significantly better predictor of screening intentions than for any other test ($r_+ = 0.69$). There were no differences between the size of the relationships reported for genetic tests, health checks and colorectal screening although these relationships were all significantly larger than those reported for mammography and cervical smear. The effect size reported for cervical smear was significantly higher than that reported for mammography.

The size of the relationship between PBC and intention differed depending on test type ($\chi^2(4) = 168.51$, $p < 0.001$). Effect sizes for cervical smear and colorectal screening were significantly greater than the effects reported for other tests, which did not differ from each other. Effect sizes for health check and mammography were identical and both were significantly greater than the effect reported in prenatal contexts.

Intention differed in its effectiveness as a predictor of behaviour depending on the test studied ($\chi^2(4) = 494.56$, $p < 0.001$). Prenatal intentions were a significantly better predictor of attendance ($r_+ = 0.78$) compared to all

Table IV. Estimated effect sizes for type of screening test for attitude-intention, subjective norm-intention and intention-behaviour relationships.

	Attitude–intention			Subjective norm–intention			PBC–intention			Intention–behaviour		
Moderator	*n*	*k*	r_+	*n*	*k*	r_+	*n*	*k*	r_+	*n*	*k*	r_+
Cervical	1471	8	0.43_c	1267	6	0.43_c	1276	6	0.58_a	1013	4	0.21_c
Colorectal	460	3	0.43_c	460	3	0.52_b	460	3	0.62_a	240	2	0.44_b
Genetic test	741	3	0.60_b	741	3	0.53_b	–	–	–	–	–	–
Health check	1053	4	0.59_b	1053	4	0.55_b	1053	4	0.45_b	1059	4	0.22_c
Mammography	7030	10	0.46_c	7030	10	0.30_d	6360	8	0.45_b	4587	6	0.37_b
Prenatal	1043	2	0.79_a	1043	2	0.69_a	1043	2	0.17_c	1043	2	0.78_a

Notes: Correlations within columns not sharing the same subscript are significantly different from one other ($p < 0.05$). *n*, number of participants; *k*, number of tests of the relationship; *r*, sample-weighted average correlation.

other intentions. Colorectal and mammography intentions were both better predictors of attendance than health check and cervical smear intentions. There were no other differences. PBC did not differ in its prediction of attendance depending on the type of screening ($\chi^2 = 6.86$, NS).

(b) Location of recruitment. Further analyses examined whether the size of TPB relationships varied as a result of where participants were recruited. In some studies, participants were contacted by their GP surgery. Alternatively, participants were recruited as part of a national screening programme or when they attended hospital for another procedure. Finally, in some studies, participants were recruited from other settings such as universities, churches or community centres. All studies could be categorised as GP ($k = 8$), hospital ($k = 9$), health authority ($k = 6$) or other ($k = 10$) based on information provided in the method section of the primary studies (Table V).

Attitudes had the strongest relationship with intentions in GP studies ($r_+ = 0.60$), followed by hospitals ($r_+ = 0.53$) and health authorities ($r_+ = 0.50$), with other studies having the weakest relationship ($r_+ = 0.40$). The largest subjective norm–intention relationship was also found in GP settings ($r_+ = 0.54$). The next largest relationship was hospitals ($r_+ = 0.49$), which was significantly larger than other studies ($r_+ = 0.41$) and those recruited through health authorities ($r_+ = 0.27$). Other studies had the greatest PBC–intention consistency ($r_+ = 0.60$). There was no difference between health authorities ($r_+ = 0.46$) or GP practices ($r_+ = 0.44$) in the size of their PBC–intention relation, although both these relationships were stronger than those reported in hospital studies ($r_+ = 0.39$). Intention predicted attendance best when participants were recruited via hospitals ($r_+ = 0.57$). This relationship was significantly larger than the effects reported for health authorities ($r_+ = 0.34$) or GP practices ($r_+ = 0.23$), which also significantly differed from each other. There were no differences in the results for PBC as a predictor of attendance.

(c) Screening cost. In the majority of studies included in the review, particularly those conducted in Europe, participants did not have to pay for screening. By contrast, in the United States, screening is not provided free of charge by a national healthcare system and individuals must have health insurance to qualify for tests.

All the studies included in the review could be classed as measuring the impact of the TPB in free ($k = 25$) or paid contexts ($k = 8$) based on information provided in the method section of the primary studies (Table VI). In free contexts, attitude had a large-sized relationship with intention ($r_+ = 0.53$), which was significantly greater than the medium-to-large-sized relationship reported in paid contexts ($r_+ = 0.42$). There was no difference in the subjective norm–intention relationship found in paid ($r_+ = 0.43$) and free ($r_+ = 0.40$) contexts. The PBC–intention relationship was medium-to-large sized in free contexts ($r_+ = 0.47$), which was significantly greater than the medium-sized relationship found in paid contexts ($r_+ = 0.38$).

Table V. Estimated effect sizes for location of recruitment for attitude–intention, subjective norm–intention, PBC–intention and intention–behaviour relations.

	Attitude–intention			Subjective norm–intention			PBC–intention			Intention–behaviour		
Moderator	*n*	*k*	r_+	*n*	*k*	r_+	*n*	*k*	r_+	*n*	*k*	r_+
General practices	1601	8	0.60_a	1601	8	0.54_a	1309	6	0.44_b	1256	6	0.23_c
Hospitals	3571	9	0.53_b	3571	9	0.49_b	2901	7	0.39_c	2608	6	0.57_a
Health authorities	5204	6	0.50_c	5204	6	0.27_d	5204	6	0.46_b	4078	6	0.34_b
Other settings	2622	10	0.40_d	2418	8	0.41_c	1772	6	0.60_a			

Notes: Correlations within columns not sharing the same subscript are significantly different from one other ($p < 0.05$). *n*, number of participants; *k*, number of tests of the relationship; *r*, sample-weighted average correlation.

Table VI. Comparison between TRA/TPB relationships reported where screening is paid for *vs.* where screening is free.

	Free					Paid for					
Relation	N	k	CI	χ^2	r_+	n	k	CI	χ^2	r_+	Z
Attitude–intention	10,573	25	0.51 to 0.54	715.72***	0.53	1985	8	0.38 to 0.45	28.75***	0.42	5.89***
Subjective norm–intention	10,573	25	0.39 to 0.42	524.98***	0.40	1781	6	0.39 to 0.46	30.43***	0.43	1.41
PBC–intention	9637	20	0.45 to 0.48	414.32***	0.47	1109	5	0.33 to 0.43	2.40	0.38	3.47***
Intention–behaviour	7037	15	0.38 to 0.41	366.59***	0.40	1111	4	0.53 to 0.61	82.50***	0.58	7.39***
PBC–behaviour	7037	15	0.15 to 0.19	28.92***	0.17	905	3	0.28 to 0.40	5.17	0.34	5.16***

Notes: n, number of participants; k, number of tests of the relationship; CI, 95% confidence interval; χ^2, chi-square test of homogeneity; r_+, sample-weighted average correlation.
***$p < 0.001$.

Both intention and PBC were better predictors of attendance in paid rather than free contexts. For intention, the large-sized relationship with attendance in paid contexts ($r_+ = 0.58$) was significantly greater than the medium-to-large-sized relationship found in free contexts ($r_+ = 0.40$). The PBC–attendance relationship was significantly greater in paid contexts ($r_+ = 0.34$) relative to free contexts ($r_+ = 0.17$).

(d) Invitation to screen. Studies differed in whether participants were sent an invitation to attend screening ($k = 20$) or were not sent an invitation ($k = 13$). Receiving an invitation may act as a helpful cue to action, so we were interested to see if this factor moderated TPB relationships (see Table VII). We report the results for the three predictors of intention because, in all but one study (Poss, 2000) that measured behaviour, all participants were sent an invitation. Attitudes were significantly stronger predictors of intentions in the invitation studies ($r_+ = 0.55$) compared to the no-invitation studies ($r_+ = 0.39$). For subjective norms, there was a stronger relationship with intentions in the no-invitation studies ($r_+ = 0.44$) compared to the invitation studies ($r_+ = 0.39$), and this pattern was repeated for the PBC–intention relationship, with greater PBC–intention consistency in the no-invitation studies ($r_+ = 0.57$) compared to the invitation studies ($r_+ = 0.44$).

There was considerable heterogeneity in the results for the invitation studies. This variation could be due to differences in when participants received the questionnaire. Examination of the method sections of the papers indicated that questionnaires were either sent before the invitation ($k = 10$), at the same time as the invitation ($k = 3$) or after the invitation ($k = 6$). We performed additional analyses comparing the TPB relationships by timing of questionnaire in relation to screening invitation (see Table VIII).

When participants completed questionnaires after, or at the same time as, receiving an invitation there was a stronger attitude–intention relationship (after $r_+ = 0.60$, same time $r_+ = 0.61$) compared to participants who answered questionnaires before their invitation ($r_+ = 0.51$). Receiving the invitation at the same time as completing the questionnaire produced a large subjective–norm intention relationship ($r_+ = 0.51$), with medium-sized effects for questionnaires before ($r_+ = 0.42$) and after ($r_+ = 0.37$). PBC was a significantly better predictor of intentions when measured after receiving an invitation ($r_+ = 0.45$), as opposed to completing the questionnaire before receiving the invitation ($r_+ = 0.40$). Completing questionnaires after receiving an invitation lead to greater intention–behaviour consistency (after $r_+ = 0.47$ *vs.* before $r_+ = 0.31$) and PBC–behaviour consistency (after $r_+ = 0.22$ *vs.* before $r_+ = 0.15$).

Discussion

The present article describes a meta-analysis of research that has applied the TRA/TPB to predict screening intentions and screening attendance. Overall, attitudes had a large-sized relationship with intention, and both subjective norms

Table VII. Comparison between TPB relationships reported in invitation *vs.* no-invitation studies.

	Invitation					No-invitation					
Relation	n	K	CI	χ^2	r_+	N	K	CI	χ^2	r_+	Z
Attitude–intention	9413	20	0.53–0.56	605.54***	0.55	3145	13	0.36–0.42	91.39***	0.39	10.03***
Subjective norm–intention	9413	20	0.38–0.41	384.28***	0.39	2941	11	0.41–0.47	174.00***	0.44	2.85**
PBC–intention	9121	18	0.42–0.45	274.37***	0.44	1625	7	0.53–0.61	144.42***	0.57	6.50***

Notes: n, number of participants; k, number of tests of the relationship; CI, 95% confidence interval; χ^2 = chi-square test of homogeneity; r_+, sample-weighted average correlation. **$p < 0.01$; ***$p < 0.001$.

Table VIII. Estimated effect sizes depending on timing of questionnaire completion.

	Before invitation			Same time as invitation			After invitation		
Moderator	*n*	*k*	r_+	*n*	*k*	r_+	*n*	*k*	r_+
Attitude–intention	3041	10	0.51_b	448	3	0.61_a	5139	6	0.60_a
Subjective norm–intention	3041	10	0.42_b	448	3	0.51_a	5139	6	0.37_c
PBC–intention	3041	10	0.40_b				5139	6	0.45_a
Intention–behaviour	2539	10	0.31_b				4462	6	0.47_a
PBC–behaviour	2539	10	0.15_b				4462	6	0.22_a

Notes: Correlations within columns not sharing the same subscript are significantly different from one other ($p < 0.05$). *n*, number of participants; *k*, number of tests of the relationship; *r*, sample-weighted average correlation.

and PBC had medium-sized relationships with intention. In addition, intention had a medium-sized relationship with attendance, whereas PBC had a small-sized relationship with attendance. These relationships are consistent with those reported in previous meta-analyses of the TPB/TRA (e.g., Armitage & Conner, 2001; Godin & Kok, 1996). For example, all three meta-analyses reported a large-sized attitude–intention relationship and medium-sized subjective norm–intention, PBC–intention and intention–behaviour relationships. The only difference between the articles was the size of the PBC–behaviour relationship, which was small sized in the present article and medium sized in previous articles.

Type of screening test

The attitude–intention relationship appears strongest for tests that could be seen as having the largest effect on people other than those being screened (prenatal screening and genetic testing). In both these cases, values other than personal health are at stake, i.e., those to do with unborn children and other family members. Given that health can be seen as an unambiguous good, the wider variation in these other values that are considered in these contexts appears to lead to a greater impact of attitudes.

Subjective norms also appear particularly strong predictors of intentions in prenatal and genetic test settings. This may be because there is an ethical dimension to these decisions; prenatal decisions affect the woman, her partner and her baby, while genetic testing may occur because of previous family experience of a condition that is more likely due to genetic similarity. Hence, the impact of normative pressure is strongest for these types of screening.

The medium-sized subjective norm–intention relation for mammography was the smallest for any of the types of screening test. One explanation for this may be that women do not vary much in their perceptions of normative pressure when considering mammography screening. In other words, most women perceive mammography screening as something that most of their important others would

want them to do and hence there is limited variability in their responses, reducing the prediction of intentions.

PBC had large-sized relationships with intentions for colorectal and cervical screening. As colorectal screening was not part of any national screening programme in the studies examined, and is down to the individual to perform, individuals may perceive more barriers relative to other tests and this may explain the strong effect for PBC. Although cervical screening is offered free of charge to women in many countries, there appear to be other barriers to attendance. Fernbach (2002) found that under-screened women perceived barriers to screening, such as remembering to attend, as more difficult to overcome than well-screened women.

PBC appears a weaker predictor of prenatal screening intentions. Michie, Dormandy, French and Marteau (2004) comment in their study that PBC may have been a poor predictor of intentions because the women completed the questionnaire while in a hospital context and may have been unaware of barriers that may prevent them attending screening at a later date. In other words, their PBC may have been a less accurate reflection of the actual control they had over attendance.

Intentions were better predictors of prenatal screening attendance compared to other screening tests. One explanation for this difference is that attending prenatal screening is a one-off behaviour performed when a woman is pregnant. In contrast, mammography screening occurs as part of a screening cycle every few years, and frequently performed behaviours are often associated with weaker intention–behaviour relations compared to infrequently performed behaviours (Ouellette & Wood, 1998).

PBC was a relatively unimportant predictor of attendance behaviour, regardless of test. Screening attendance may be an example of a behaviour where perceptions of control do not reflect actual control and as a result are ineffective predictors of behaviour (cf. Ajzen, 1988). It is also likely that PBC may be very high and, because of limited variability in PBC responses, prediction of behaviour may be low.

Location of recruitment

Prediction of intentions by attitudes and subjective norms was strongest in studies that recruited via GP practices. The large attitude–intention relationship for GP settings suggests that individuals may value visits to their GP more than visits to more remote, less familiar, settings such as hospitals. The large subjective norm–intention relation for GP settings may be a reflection of participants having family who attend the same practice and/or having a good relationship with the GPs at their local practice.

PBC–intention relationships were highest in studies where participants were recruited in a setting where screening does not take place, (e.g., university, community centre). Ajzen (1991) argues that as control over behaviour becomes harder, then PBC becomes a stronger predictor of intentions and behaviour.

When recruitment occurs in settings where screening does not take place, this may increase the difficulty of attendance and increase the strength of the PBC–intention relation. In contrast, when participants are recruited through hospitals, there are likely to be fewer control issues and the strength of the PBC–intention relation is reduced. This is consistent with our finding that the PBC–intention relation for hospitals was the smallest effect for any of the locations.

Prediction of attendance is also affected by location of recruitment: The large-sized intention–behaviour relationship reported for hospital studies was significantly greater than small-to-medium-sized relations found in health authorities and GP settings. One explanation of this finding is that participants may not treat invitations to screen in GP settings as seriously as invitations from hospitals. Participants asked about their intentions to attend a health check at the local GP might respond that they intend to attend screening but fail to do so because this screening is viewed as unimportant or unnecessary. This may be very different to participants' response to invitations from hospitals, which may be treated with greater respect particularly if the individual has personal (or family) experience of attending hospital for treatment for serious conditions.

Screening cost

Attitudes and PBC were significantly better predictors of intentions in free *versus* paid contexts, whereas intentions and PBC were significantly better predictors of attendance in paid *versus* free contexts. The subjective norm–intention relationship was not affected by screening cost. Thus, there is better prediction of intention (the motivational part of the TPB) in free contexts but better prediction of behaviour (the volitional part of the TPB) in contexts where screening is not free.

Attitude and PBC may be more predictive of intentions in free contexts compared to paid contexts because screening is not limited to those who can afford it in free contexts. So, other factors such as how easy it is to access screening (in terms of proximity of testing centre), time constraints and the value of screening, have a greater impact on decisions to attend screening. On the other hand, there may be lower attitude–intention relations in paid contexts because individuals are well disposed to screening but do not intend to screen as they cannot afford to attend.

Intentions and PBC were better predictors of attendance in paid contexts than in free contexts. These differences may reflect greater variation in PBC and intention where there is not a free national healthcare system, due to the perception that paying for screening is a significant barrier and hence many people will not intend to attend. It is now well established that people who do not intend to attend for screening are quite successful at not doing so (Orbell & Sheeran, 1998).

In paid contexts, people may possess more accurate perceptions of control which, according to Ajzen (1988), should lead to better prediction of behaviour. For example, people will be aware of their ability to pay, which is likely to be

an important control factor, thus producing more accurate PBC. In free contexts, cost is not an important control factor and it may be that people are less aware of other control factors that impact their ability to attend screening.

Invitation to screen

Attitudes were significantly better predictors of intentions in invitation *versus* no-invitation contexts, whereas subjective norms and PBC were better predictors of intention in the no-invitation studies. It is possible that attitudes were a better predictor of intentions in the invitation studies because participants feel more informed about the screening procedure prior to completing a questionnaire and hence have more stable attitudes. The contrast between the large PBC–intention relations found for no-invitation studies and the medium relationship for the invitation studies is noteworthy. One explanation is that participants in some of the no-invitation studies were being asked about their perceptions of control over screening attendance for a test that was not yet available. For example, Orbell and Hagger (2006a) asked participants about their perceptions of control over attending diabetes screening if it was offered to them in the next few years. So, PBC responses in some of the no-invitation studies were hypothetical. None of the invitation studies examined tests that were not yet available.

We also examined the impact of the timing of the invitation to see if this affected TPB relationships. For every relationship, except the subjective norm–intention relationship, completing TPB measures after receiving an invitation to screen led to stronger relationships, relative to completing measures before receiving an invitation. These findings support Ajzen's (1991) claim that the TPB provides best prediction when constructs are measured near to behaviour because there is less chance that beliefs will change between measurement and behavioural performance. Participants who complete questionnaires after they have received an invitation are likely to be nearer to attendance compared to participants who completed measures before receiving an invitation.

Limitations

The present meta-analysis is limited by the studies selected for inclusion; we decided to focus on the published literature, which means we may have missed relevant papers from the 'grey literature'. Glass, McGraw and Smith (1981) found that published papers tend to report stronger effect sizes compared to unpublished papers, so one minor limitation of this review is that it may overestimate the size of TRA/TPB relationships found in screening contexts. Second, it is possible to be critical of some of the moderator analyses conducted, due to few studies being available for some comparisons. We feel that these analyses are useful, however, in generating hypotheses for future research, rather than as providing definitive conclusions. In addition, comparing screening programmes is problematic because programmes target populations that differ on key characteristics such as age and gender.

Implications

Attitudes appear to be the best predictor of intentions to attend for screening. Consequently, to increase attendance, screening organisations would be best advised to send people information designed to generate positive attitudes, rather than alter subjective norms or PBC. An alternative aim of screening programmes is to promote informed choices. The large-sized attitude–intention relationship suggests that many individuals are making informed choices regarding screening attendance, based on the definition of 'informed choice' as consistency between attitudes towards screening attendance and actual attendance, as well as high levels of knowledge about screening (Marteau, Dormandy, & Michie, 2001). Research by Dormandy, Hankins and Marteau (2006) suggests that individuals are ambivalent about screening attendance and possess both negative and positive attitudes regarding screening. Given the importance of attitudes as a predictor of screening intentions, it is important for future research to assess the impact of properties of attitude, such as ambivalence, on attitude–intention consistency (see Cooke & Sheeran, 2004 for a review of this literature).

Receiving an invitation to screen does not necessarily make people think about how they will attend. One way to reduce the 'gap' between intentions and screening attendance is to use implementation intentions (Gollwitzer, 1993), where the individual outlines when, where and how they will perform a behaviour. Sheeran and Orbell (2000) found that cervical screening attendance was significantly higher for women who formed implementation intentions (see also Walsh, 2005). Asking people to form implementation intentions is another way to increase attendance at screening programmes.

More research is required to explain why there are differences in predicting attendance in free *versus* paid contexts. It is possible that there are differences between participants attending screening in paid contexts *versus* free contexts. The studies conducted outside of the United States tend to concern the whole of a defined age group who are eligible for that screening test, whereas the studies in the United States tend to employ more restricted samples, (e.g., siblings of patients, partners of servicemen). Variation in sampling may explain the differences in the relationships found. To rigorously test the impact on TPB relationships of free *versus* paid systems of screening, a quasi-experimental test is required, where a country or region shifts from one system of organizing screening to the other.

We should investigate how individuals react to invitations to screen. Results for test context and location of recruitment suggest that invitations may be viewed differently depending on where they come from and the nature of the test. For example, an invitation to a health check may be treated as an activity that one should do, but may not, with the consequences of non-attendance viewed as limited. In contrast, receiving an invitation from a hospital to attend for colorectal cancer screening will likely be treated as something one must do, particularly if there is a family history of cancer.

This study found that the TRA/TPB was an effective framework for predicting screening intentions and attendance. The next step is to perform experimental research that builds on these findings to improve screening attendance. Interventions designed to make attitudes more positive may increase attendance because more positive attitudes should create more positive intentions and more positive intentions increase the likelihood of attendance. Implementation intentions should also increase screening attendance, so research is needed to test this proposition. We also hypothesise that invitations to screen from GP practices are seen as less serious compared to invitations to screen at hospital. Research is needed to test these hypotheses and thereby increase our understanding of screening attendance.

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