

Cost-effectiveness of a programme to detect and provide better care for female victims of intimate partner violence

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Objective: Primary care clinicians often fail to detect women who are victims of intimate partner violence. Our aim was to investigate the cost-effectiveness of a programme in primary care to detect and support such women.

Methods: We developed a Markov model to estimate the cost-effectiveness of education and support for primary care clinicians to increase their identification of survivors of intimate partner violence and to refer them to a specialist advocacy agency or a psychologist with specialist skills. The programme was implemented in three general practices in the United Kingdom (with an additional practice acting as a control) and provided cost data and rates of identification and referral. Other cost data and the effectiveness of intimate partner violence advocacy, came from published sources.

Results: The model gave an incremental cost effectiveness ratio of approximately £2,450 per quality adjusted life year (QALY). Although the ratio increased in some of the sensitivity analyses, most were under a conventional willingness to pay threshold (£30,000/QALY).

Conclusions: While there is considerable uncertainty in the underlying parameters, a training programme for primary care teams to increase identification and referral of women experiencing intimate partner violence is likely to be cost-effective.

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Introduction

Intimate partner violence (IPV) has a high prevalence among women attending general practices and a long-term detrimental effect on health.¹ The cost of domestic violence to the UK economy, including costs to the State, to employers and in human suffering is £23 billion.² Primary health care professionals have an important role in identifying women experiencing IPV and responding by acknowledging the abuse, checking for safety and appropriate referral to expert agencies or colleagues.^{3,4} In this paper we estimate the

Incremental Cost-Effectiveness Ratio of a system-level IPV programme in primary health care.⁵ ICER can be interpreted as the cost of a one-point improvement in whichever outcome measure is considered to best represent the effect of the intervention. In this case, the most suitable outcome measure is the quality-adjusted life year (QALY).⁶ If a new intervention is being compared with an existing intervention, the ICER estimated in the following way:

$$ICER = \frac{Cost_{New} - Cost_{Comparator}}{Effectiveness_{New} - Effectiveness_{Comparator}}$$

Our aim was to estimate both the costs and effectiveness of a programme to increase identification of and provide better care for women experiencing IPV; to contrast the costs and outcomes with existing standards of cost-effectiveness; and to present the limitations and uncertainties surrounding these conclusions.

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Methods

Intervention

The feasibility of a general practice based intervention (*Prevention of Domestic Violence*) was tested in four practices (three acting as an intervention and one as a control) in the United Kingdom. The system-based intervention aimed to change the behaviour of clinicians towards women experiencing IPV, and was designed to increase enquiry about IPV, assessments of women who disclose recent violence and referrals to an advocate in a community domestic violence agency or a psychologist with specific training in relation to IPV survivors. An initial educational session for all clinicians within the practice emphasised a pragmatic approach to enquiry and referral and also gave an overview of the wider community response. Referrals from health care professionals were facilitated by a direct referral pathway to a domestic violence advocate and a psychologist. The advocate regularly attended practice meetings to give feedback on referrals and any organisational or management issues. In addition, prompts in the electronic medical record were used to probe for IPV during routine consultations based on a four-item screening tool – termed HARK (an acronym based on the dimensions of abuse, i.e. humiliation, afraid, rape and kick) linked to a range of coded diagnoses such as depression, insomnia, sexually transmitted infections and fatigue. When the clinician used these diagnoses, a template with the HARK questions appeared on the screen. HARK was developed from the Abuse Assessment screen⁷ and it has been validated in general practice in the UK.⁸ The HARK questions and a prompt to refer women to the advocate or psychologist were installed as a template onto the electronic medical record.

The most appropriate method for modelling costs and outcomes in this area is Markov modelling. This has significant conceptual advantages in terms of treatment of time, but requires high standards of reporting to describe what is a complicated task.^{9,10} In this application, women are followed over time as their status with regard to IPV changes. In order to calculate cost-effectiveness of the PreDoVe program, we fitted a model with and without the PreDoVe programme and used the differences between the two simulations to calculate the incremental costs and outcomes associated with the programme. Women were followed for ten years. If the time horizon is changed, the impact is small as the occurrence of new cases and all transition probabilities remain constant over time, and the cost is similar across years. Therefore, the impact of changing horizon is largely proportional for costs and outcomes, therefore not impacting on QALY calculations.

As in all Markov models, we attempted to describe a set of states that a woman experiencing IPV (or not)

can be in at any one time. We assumed that at any point in time all women must be in only one of these states. The model then simulates how a hypothetical cohort of women moves between the states. Figure 1 shows a schematic representation of a woman's pathways through the model. The design of this model was necessarily a balance between the need to replicate the complexity of reality with the limitations of available data. We used a 6-monthly cycle, since six months is the average length of time a woman remains in contact with the agency that provided domestic violence advocacy. The chances of one individual woman moving are determined by transitional probabilities, defined either by data from PreDoVe, published literature, or assumptions.

Data sources

The model was based primarily upon the PreDoVe pilot trial in which data were collected on the number of: (i) women attending the practices; (ii) assessments made by health professionals; (iii) women that disclosed intimate partner violence (iv) referrals to the domestic violence advocate and/or psychologist linked to the practice; (v) women that declined to take up the referral during the period of the pilot. In addition, information from the pilot trial provided good cost data surrounding use of the HARK template in the electronic medical record.

Transition rates between abuse and other states

Figure 1 represents a woman's path through the model, where arrows represent a movement from one state to another every 6 months. Some of these movements between the states involve a number of smaller steps, which are not shown in the figure. For example, a movement from abuse unidentified to the advocate within the 6 month period involves the following possible steps: a woman is assessed, identified as abused or not, accepts or rejects the referral, and, if she accepts referral, attends or does not attend a meeting with the advocate. In our model it is important to capture these smaller steps so that we can accurately cost the number of women that are assessed. In Table 1, these smaller steps are termed instantaneous as the women necessarily move into a different state. The general principle is that, to estimate the transition probability from one state to another (A to B) if there are instantaneous states between the two, we multiply the probability of moving from state A by the probability of each of the instantaneous steps which lead to state B. For example, moving from abuse unidentified to advocacy involves a number of smaller instantaneous steps. In the intervention practice the 6 month transition is 0.014

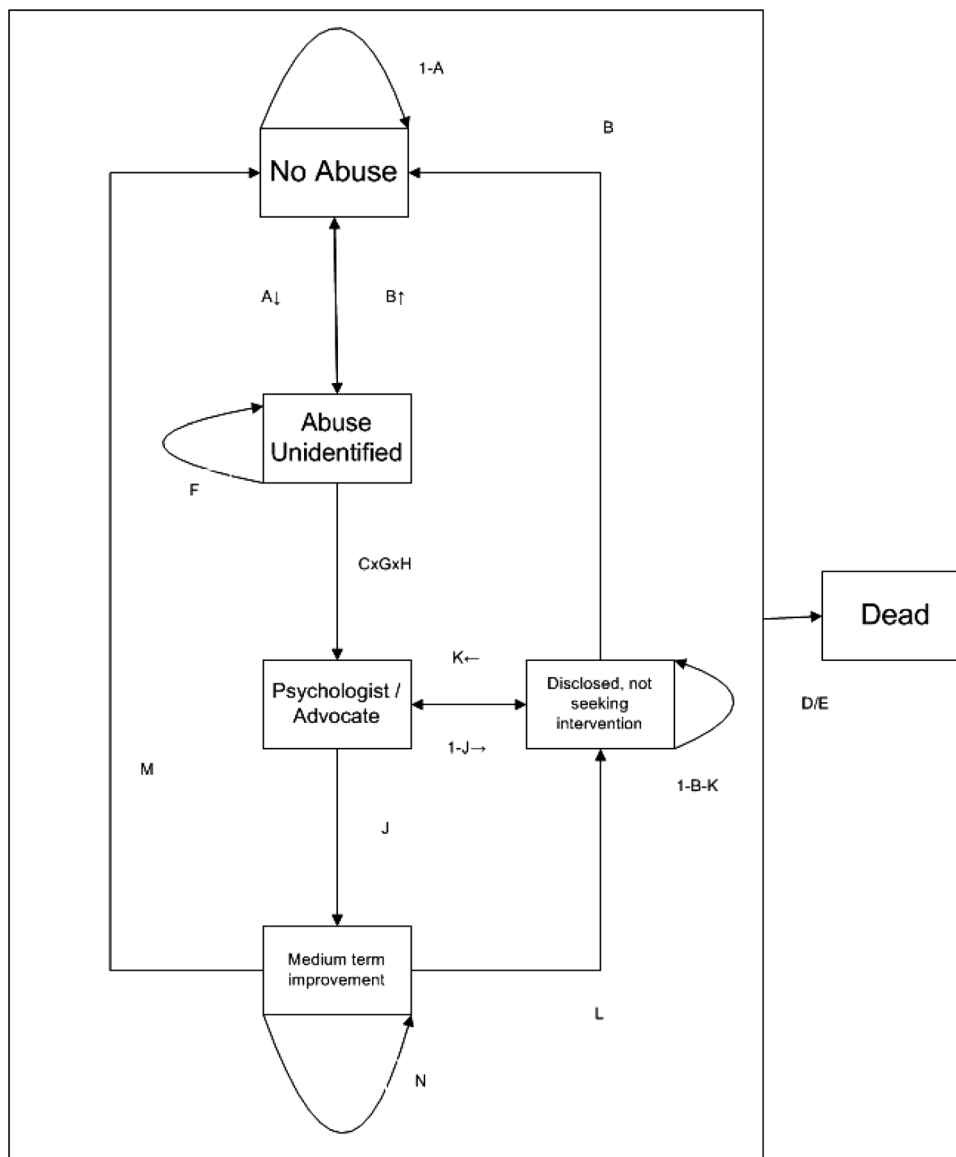


Figure 1 Markov model

(i.e. $0.054 \times 0.42 \times 0.95 \times 0.67 = 0.014$). Figure 1 does not identify assessment which proves negative, although this is accounted for in the final costing.

One important aspect of Figure 1 is that it defines a positive outcome from an intervention to be a movement to medium term improvement. This distinction was made as it recognises that previously abused women are more likely to become abused again than someone who has not been in an abusive relationship. While the model does not preclude the possibility of these women returning to population levels of risk, it highlights the difficult intermediate states between being in an abusive relationship and returning to population risk.

6,950 women attended the PreDoVe intervention practices over a one year period; 435 (6.3%) were

assessed for IPV by health professionals using the HARK template. Existing evidence from similar practices in the same area of London showed 17% of women can expect to be a victim of IPV per annum.⁷ Therefore, we would expect that 1,182 of the women attending the practice had experienced IPV in the past year. Searching the electronic medical records in the participating practices we found that health professionals did not always use the HARK template when they asked about IPV. We have assumed that 25% more women were assessed for abuse than that recorded by HARK: therefore, 7.8% were assessed (or 544 of 6,950 women attending). To calculate the rate of assessment separately for the abused and non-abused women in both the control and intervention practices we assumed that that on average the clinicians' rate of

assessment was 1.5 times higher for abused compared to non-abused women, because they were more likely to ask those women about abusive experiences. We therefore estimated that in the intervention practice 8.8% of abused women were assessed (104 women out of 1,182) and 5.9% of the non-abused (i.e. $0.666 \times 8.8\%$).

As we did not have data on the numbers assessed in the PreDoVe control practice, we based our assessment rate on an earlier study.¹¹ We additionally assumed that 3.33 times more women were assessed for abuse than that recorded. This is a higher inflation factor than that for intervention practices because health care professionals in the control practice had no training in the recording of abuse nor did they have HARK or any other prompts within the electronic medical record to remind them to ask about and record abuse. As in the intervention practices, this was divided into a probability of being assessed for an abused woman, and for a non-abused woman. The expected rate of assessing abused and non-abused women in the control practices was 4.6% and 3.0% respectively. This suggests the intervention increased the rate of assessment by approximately four percentage points.

Using the figures on the number of women assessed with HARK in the intervention practices (435), the one year prevalence of IPV among women attending general practice in east London (17%), the assumption that GPs in the intervention practice are 50% more likely to ask abused women about IPV than non-abused

women, we have calculated the number of assessed women who were abused ($0.17 \times 1.5 \times 435$) = 111. As 43 women disclosed to the GPs, the model assumed that the probability of a women experiencing IPV disclosing if asked was $43/111 = 39\%$. The transitions to advocacy and/or psychology services and follow-up by primary health care professionals shown in Table 1 are also based on PreDoVe data.

We based transition rates relating to improvement as a result of advocacy or psychological interventions on previous research. Domestic violence advocacy can reduce abuse, leading to improvements in psychological health and quality of life.¹² There is also evidence from controlled studies that psychological interventions may improve the mental health of women who have experienced IPV.¹³ The magnitude of the effect in terms of the cessation of abuse or mental health is uncertain, varying between studies. In our model we estimated that advocacy results in 30% of women moving to *medium term improvement* and applied the same rate to the psychological intervention. This rate may appear to be high, but the medium term improvement in our model entails relatively modest improvements in the quality of life and costs of abuse, as shown in Tables 2 and 3. For longer term improvement, we have made a conservative assumption that only 20% of women move to the 'no abuse' state from medium term improvement.

We assumed an annual all cause mortality rate for women of 58 deaths per 100,000 based on women

Table 1 Transition probabilities

	Control	Intervention	Source	Period
No abuse to abuse unidentified* (A)	0.0027		See text	6 monthly
No abuse to no abuse	0.9973		Complementary to A	6 monthly
Abuse to no abuse without intervention (B)	0.005		Assumption	6 monthly
Abuse unidentified to GP assessment (C)	0.023	0.054	PreDove study	Instantaneous
Death rate if being abused (D)	0.00040		Violent deaths ¹⁰ + all cause mortality ¹⁴	6 monthly
Death rate if not abused (E)	0.00029		All cause mortality ¹⁴	6 monthly
Abuse unidentified to abuse unidentified (F)	0.97143	0.94048	Complementary to B + C + D	6 monthly
GP assessment to identified (true positive) (G)	0.21	0.42	PreDoVe study	Instantaneous
GP assessment to abuse unidentified (false negative)	0.79	0.58	Complementary to G	Instantaneous
Identified to accept referral (H)	0.75	0.95	Assumption	Instantaneous
Identified to decline referral*	0.25	0.05	Complementary to H	Instantaneous
Accept referral to advocate	0.67		PreDoVe study	Instantaneous
Accept referral to psychologist	0.29		PreDoVe study	Instantaneous
Accept referral to both	0.04		PreDoVe study	Instantaneous
Advocate to psychologist or visa versa (I)	0.05		PreDoVe study	6 monthly
Advocate/psychologist/both to medium term Improvement (J)	0.3		Assumption	6 monthly
Advocate/Psychologist to Disclosed – not seeking intervention***	0.6496		Complementary to D + I + J	6 monthly
Both to Disclosed – not seeking intervention	0.6996		Complementary to D + J	6 monthly
Disclosed – not seeking intervention to accept referral (K)	0.2		Assumption	6 monthly
Medium term improvement to disclosed – not seeking intervention (L)	0.2		Assumption	6 monthly
Medium term improvement to no abuse (M)	0.2		Assumption	6 monthly
Medium term improvement to medium term Improvement (N)	0.59971		Complementary to E + L + M	6 monthly

Q1 *Identified to decline referral are classified as Disclosed – not seeking intervention

Table 2 Treatment costs in 2005 prices (£ sterling)

	Cost per person	Source
Cost of Advocacy	164	PreDoVe
Cost of Psychologist	305	PreDoVe
Cost of Advocate and Psychologist Administration costs	469	PreDoVe
Administration costs	5	PreDoVe
Use of HARK by doctor or nurse	24	Griffiths <i>et al.</i> ¹²

aged 15–44 years in 2000,¹⁴ which converted to a 6 monthly all cause mortality rate of 0.00029. In the United Kingdom, IPV resulted in 102 deaths in the year 2001–2.¹⁵ Based on an estimated annual 529,000 cases of IPV against women² we assumed 19 deaths per 100,000 women per year, which converted to a 6 monthly death rate of 0.000095. The overall morality rate for women experiencing IPV was then estimated by summing the 6 monthly death rates from domestic violence and all cause mortality (i.e. 0.000095 + 0.00029 = 0.00385).

Prevalence of abuse and other states

As a starting point for our modelling, the point prevalence of women in each state assuming no intervention was estimated: all women were initially assumed to start in the non-abuse state; the model was run over many cycles using the control transition probabilities to predict a point prevalence for each state at each cycle. After a certain number of cycles the number of women in each state became stable (reached a steady state) and those numbers gave our point prevalences for women in each state when there is no intervention. Furthermore, if the model accurately reflects actual

states and transition probabilities, these prevalences should correspond to the known point prevalences for each state. It was therefore possible to cross-check the model's predictions with known data on prevalence. As a result, some of the transitions were altered and the process repeated. This calibration approach allows better estimates of transition probabilities for which no data are available. The final point prevalences from this exercise were used as a starting point for modelling using the intervention group and control group transition probabilities. This use of the same starting point for both models ensured that the effect of any biases in the base line (control) estimates of transition probabilities would affect both groups equally and would not affect the estimated cost-effectiveness.

Costs and benefits of abuse

Service use data were collected on the health care professional time for assessing and referring women, and for administering the advocacy and psychological services. A unit cost figure was then applied to these estimates, based on the salaries of the advocate and psychologist in the PreDoVe study, to estimate the cost per woman receiving the advocacy and psychological services shown in Table 2. All cost figures were adjusted to 2005 prices.¹⁶ We estimated the administration costs of the intervention as £5,210 per year. Given that 544 abused women were assessed over the year, it was estimated that the administrative costs amounted to approximately £5 per woman assessed for every 6 month period.

The assessment costs of the intervention are proportional to the numbers of abused and non-abused women assessed. In the intervention practices, doctors

Table 3 Average 6 monthly costs and quality of life per women by states (2005 prices)

	Examples of what costs are covered	No abuse	Abuse unidentified	Advocate*	IEV	Medium term improvement
Criminal justice	Violence against a person	0	£436	£873	£873	£436
Civil justice	Injunctions, divorce proceedings children and property	£18	£93	£185	£186	£101
Employment loss of output	Fatalities, serious wounding	£0	£1,628	£1,628	£1,628	£814
Temporary housing	Shelters, hostel accommodation, local authority housing, friends and family	£111	£379	£757	£757	£434
Social services and child care	Children looked after or in need	£0	£432	£432	£432	£0
Medical services	Family medicine consultations, emergency room visits, health visitor (public health nurse) visits	£0	£164	£164	£164	£0
Mental health		£52	£209	£209	£209	£131
Treatment costs	Advocate's visits	£0	£0	£164	£0	£0
Administration costs	Central administration of the intervention	£0	£0	£5	£5	£0
Total 6 monthly costs		£181	£3,340	£4,416	£4,253	£1,916
Utilities		1	0.63	0.63	0.63	0.65

Source: Costs are based on Walby 2004, and adjusted to 2005 prices

*We have shown the costs for the advocacy treatment only. The psychology and advocacy and psychology treatments differ only in terms of the treatment costs

and nurses assessed 5.4% and 3.6% of abused and non-abused women respectively (based on primary care prevalence data from a neighbouring borough);¹¹ in the control practice, doctors and nurses assessed 2.3% and 1.83% respectively. For these assessments we ascribed a unit cost of £24 (Table 2).

We also estimated the wider impacts of IPV based on Walby's 2004 calculation of cost consequences of IPV in the UK. This is a conservative estimate i.e. would lead to an under-estimate of cost-effectiveness of the intervention. It is reported that women take time off work due to psychological and physical injury; this is captured as employment loss in our model.

In Table 3, Walby's 2004 cost estimates are used for women who have disclosed IPV or are receiving advocacy or psychological interventions. Table 1 summarises the assumptions that we made to assign similar costs to other states shown in Table 3. Table 3 also shows the quality of life values that we used for each of the states based on survey data,¹⁷ and we applied an annual discount rate of 3.5%.

Sensitivity analysis

We conducted univariate sensitivity analyses. Probabilities were both increased and decreased by 25%, unless these figures were internally invalid. For transition probabilities for which we have assumed the intervention to be preferable to the control, we constrained the sensitivity analysis to assume the transition probabilities were at worst equal; this was because there was no reason for the intervention to cause harm. In addition, the sensitivity analysis used an upper and lower confidence interval for the impact of abuse on the health. The upper and lower confidence interval for the quality of life in the medium term improvement state were taken from recent figures from Wittenberg and colleagues.¹⁷

Results

Prevalence of abuse and other states

At the start of the model, 25.7% (2571) of women were abused by their partner. 2,245 (87.3%) of these women were in the abuse unidentified state, 64 (2.5%) were seeing a domestic violence advocate or psychologist or both, 264 (10.3%) were women who had disclosed abuse who were not receiving advocacy or seeing a psychologist.

The prevalence of women being abused is therefore rather high in our model, even though we lowered the probability of moving from no abuse to abuse unidentified from an initial 6 monthly estimate of 0.5–0.65% to 0.27%, the proportion we used in our model. Though the prevalence is high relative to the 14–19% 95% confidence

intervals from a survey of patients in a neighbouring borough,¹¹ it is comparable to the 12 month prevalence in another general family practice study.¹⁸

Cost effectiveness

The incremental cost per woman was estimated to be £23.22. This includes the cost of the screening tool, plus the increased costs of downstream management of identified women, plus any savings as a result of reduced violence. The incremental QALY outcome was estimated to be 0.0313 per woman. This ICER was therefore estimated to be £742, which indicates that the intervention is likely to be cost-effective.

Sensitivity analysis

Under almost all sensitivity analysis estimates, the cost per QALY remained below £30,000, which is a frequently assumed threshold for the QALY in the United Kingdom.¹⁹ It was most sensitive to the success rate of interventions 'downstream' from disclosure to a health care professional (in PreDoVe this entailed domestic violence advocacy and a psychological intervention) and to the likelihood that medium-term improvement will continue into living outside of an abusive relationship. On balance, the sensitivity analysis suggests that the system level programme of training in general practice, electronic medical record prompts and a simple referral pathway to specialist domestic violence management is likely to be a good use of societal resources.

Discussion

Our model suggests that this programme is likely to be a cost-effective use of societal resources. The projected benefit of identification and referral following the system based intervention compared to normal care and the relatively modest cost of the intervention makes it competitive with other health care interventions.

We have made a number of simplifying assumptions. We considered the possibility that women may return to their abusive relationship, but we did not capture the possibility that women with past histories of IPV have a greater likelihood of entering into a new abusive relationship. This is a recurrent hypothesis emerging from qualitative studies and cross-sectional surveys, but has not been tested in longitudinal studies.²⁰ We also did not differentiate between women in a relatively new abusive relationship and those in longer standing relationships or long term stalking and harassment after they have left an abusive relationship. The latter group may take longer to change their situation.

Our model draws upon the available evidence for the effectiveness of interventions following disclosure of IPV, but these studies are based upon different

populations and this may affect the accuracy of our results. For instance, the effect of the programme on identification and referral of abused women was based on data from the PreDoVe pilot trial, based in inner-city general practices with multi-ethnic, relatively deprived populations in the UK. The population targeted was patients in primary care and the majority of referrals were women who had not previously disclosed abuse. In contrast, our estimate of effect of advocacy came from a US study focused on a domestic violence shelter (refuge) population who had already self-identified and sought help, not necessarily in the context of health care.¹² Ideally we would have used a pooled estimate of advocacy's effectiveness, but this is not possible because of the heterogeneity of most of the advocacy trials.²¹

Are our findings sufficient to justify commissioning the programme? One could make a case for commissioning based on the magnitude of the health consequences of IPV, the high likelihood of cost-effectiveness and the current absence of any programme in primary care to address the unmet needs of women experiencing IPV. Another option would be to use this model and other prevalence and effectiveness data to develop an expected value of information analysis to determine whether further research is justifiable.²² If it were, then a definitive trial of the programme, measuring outcomes for women and calculating cost-effectiveness would be appropriate. Extending beyond primary care, there is a need for research on the cost-effectiveness of system-level interventions to improve identification and management of women experiencing IPV, complemented by trials of specific advocacy and psychological interventions for women after disclosure in health care settings.

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