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Supportive interventions for carers of men with prostate cancer: systematic review and narrative synthesis

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ABSTRACT

Purpose The objective of this study was to summarise the literature on current interventions available for carers of men with prostate cancer and analyse the outcomes of these interventions in supporting carers' needs.

Methods A systematic review was conducted, searching databases MEDLINE, PsycINFO, CINAHL, Scopus and Cochrane, using terms related to prostate cancer, carers and interventions. Randomised controlled trials and non-randomised controlled trials of interventions for informal carers with or without patients were included. Data were analysed using descriptive and frequency statistics; interventions and their impact on carers' outcomes were reported on narratively. The SwiM guidelines were applied to guide data synthesis.

Results Overall, 24 articles were included in the review. On average, participants were spouses (92%) and women (97%). Interventions largely were delivered face-to-face (42%) or used a combination of face to face and online modalities (38%). Two-thirds (63%) showed a significant improvement in carer's outcomes including psychological, sexual, physical and relationship/marital. The majority of studies (79%) tailored contents to carers' circumstances, most within a couples counselling format. Over one-third (42%) of studies focused on a range of supportive care needs, most commonly were psychological (58%), sexual (42%) and informational (25%).

Conclusions Interventions for carers of men with prostate cancer were largely face to face, patient-spouse focused and two-thirds had some measurable impact on carer's outcomes. Research continues to underserve other patient-carer roles, including non-spousal carers. Interventions delivered solely for carers are required to meet gaps in care, and determine the impact on carer outcomes. Further research and more targeted interventions are needed.

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ Interventions for carers looking after someone with cancer have variable impacts on carers' outcomes.

WHAT THIS STUDY ADDS

⇒ Most interventions include some level of tailoring to carers' supportive care needs; however, tailoring often occurs in dyad-based interventions such as couples counselling.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ Findings inform the development of future interventions and current clinical practice where carers' supportive care needs to be addressed outside of the marital relationship.

PROSPERO registration

number CRD42021249870

BACKGROUND

In Australia, prostate cancer is the most common cancer type among men.¹ Despite being the second leading cause of cancer mortality among men, 5-year survivorship from prostate cancer is close to 100% for those diagnosed with stages' I–III.¹ With early diagnosis and improved treatment options, prostate cancer is now considered a chronic condition.²

Cancer is also considered a 'family disease', which has a significant impact on the daily lives and long-term health and well-being of close family members and friends.³ Approximately, 70% of people undergoing cancer treatment have a family member who provides ongoing care at home,⁴ these family members and other unpaid carers such as friends are

known as informal carers (hereafter, carers).⁵ Understanding the role and influence of carers is a necessary component in developing resources to assist individuals providing care.⁶

Most carers will report experiencing at least one unmet need throughout and beyond the illness trajectory and carers often require assistance to address needs as they arise.⁷ The type of support required by carers can vary across cancer stages and treatment types,^{8,9} as different side effects are experienced within each treatment regime.^{10,11} Carers can receive support in a myriad of ways, including informal social networks, formal support through government and hospital services, and through technology; linking with cancer organisations and online support groups.^{12,13} There is a range of information, resources and support available to carers across different modalities including face to face and through technology, and in the community and outpatient setting; however, resources are commonly provided based on patients' needs.¹⁴ Caregivers' knowledge of available support is dependent on their availability to attend outpatient appointments.¹⁴ Carers can initiate seeking support; however, accessing information and support is a time-consuming task¹⁵ and carers require adequate health literacy, knowledge and access, to properly navigate and understand health information.¹⁶ In particular during crises, a lack of information and support can result in uncertainty and at times delays in seeking medical assistance.¹² Spouses and partners are family members who most commonly provide care to men with prostate cancer, and the patient-partner dyad can experience more specific unmet needs related to sexual function and marital relationships during and after treatment.¹⁷⁻¹⁹ Early educational programmes can be used to promote couples' marital and sexual well-being prior to surgery.²⁰ Carers require additional support to confidently manage patients' side effects and symptoms²¹ and assistance to maintain their own health and well-being.²²

There is a pressing need to explore how interventions meet the supportive care needs experienced by carers. Within the wider cancer context, there is evidence that interventions are largely dyad based with intervention content focused on patient care.²³ Similarly, within the prostate cancer field, the best way to support carers looking after men with prostate cancer is still unclear; dyadic interventions have limited positive outcomes in female partners.²⁴ Technology-based interventions may play a role in improving carers' outcomes²⁵; however, the full impact of these interventions requires further investigation. This review provides much needed information on how to support carers looking after men with prostate cancer.

Aims

The aim of this review was to summarise the current literature on supportive care interventions for informal

carers of men living with prostate cancer and answer the following questions:

1. What supportive interventions have been evaluated to meet carers' needs?
2. What are the outcomes of these supportive care interventions?

METHODS

This systematic review was registered on PROSPERO, registration number: CRD42021249870.

Search process

A systematic search was conducted in December 2020 and updated in January 2022 using the following databases: MEDLINE, PsycINFO, CINAHL, Embase, Scopus and Cochrane Database of Systematic reviews. References lists of articles included in the review were screened for additional articles meeting the inclusion criteria. Articles found through hand searching were included in the review. To gain a full understanding of the scope of research available, no date limits were applied. References were uploaded and organised in Covidence. Duplicates were removed and remaining resources were double screened by title, abstract (by NW, HJ and AU) and full text (by NW, HJ and AG; figure 1).

Search strategy

Search terms were developed by the whole research team and were reviewed by the research librarian. Search terms were developed for three main topics with subject heading applied to each database. An example of the strategy on the Medline database is outlined in table 1. Search terms for each topic were as follows:

1. Prostate cancer—prostate neoplasm*, prostate, prostatic carcinoma*, urologic carcinoma*, urologic neoplasm*, urologic cancer*, prostate cancer*.
2. Carers—carer*, caregiver*, spouse*, famil*, partner*.
3. Supportive care interventions—program, intervention, counselling, therapy, community service*, social network, cognitive behavioural therapy, CBT, support group, telephone, internet, web, smartphone application, mobile application, app, pilot, randomi?ed control trial, non-randomi?ed controlled trial.

Inclusion criteria

Criteria are presented according to the Population, Intervention, Control, Outcomes (PICO) framework.²⁶ Studies were included in this review if they met the following criteria:

- Population—interventions for partners and informal carers, identified as family members or non-family members who were providing care to men with prostate cancer.
- Intervention—interventions available to informal carers of men with prostate cancer including: face to face, online, telephone and studies using a combination of modalities to deliver intervention content.

PRISMA 2020 flow diagram for new systematic reviews which included searches of databases and registers only

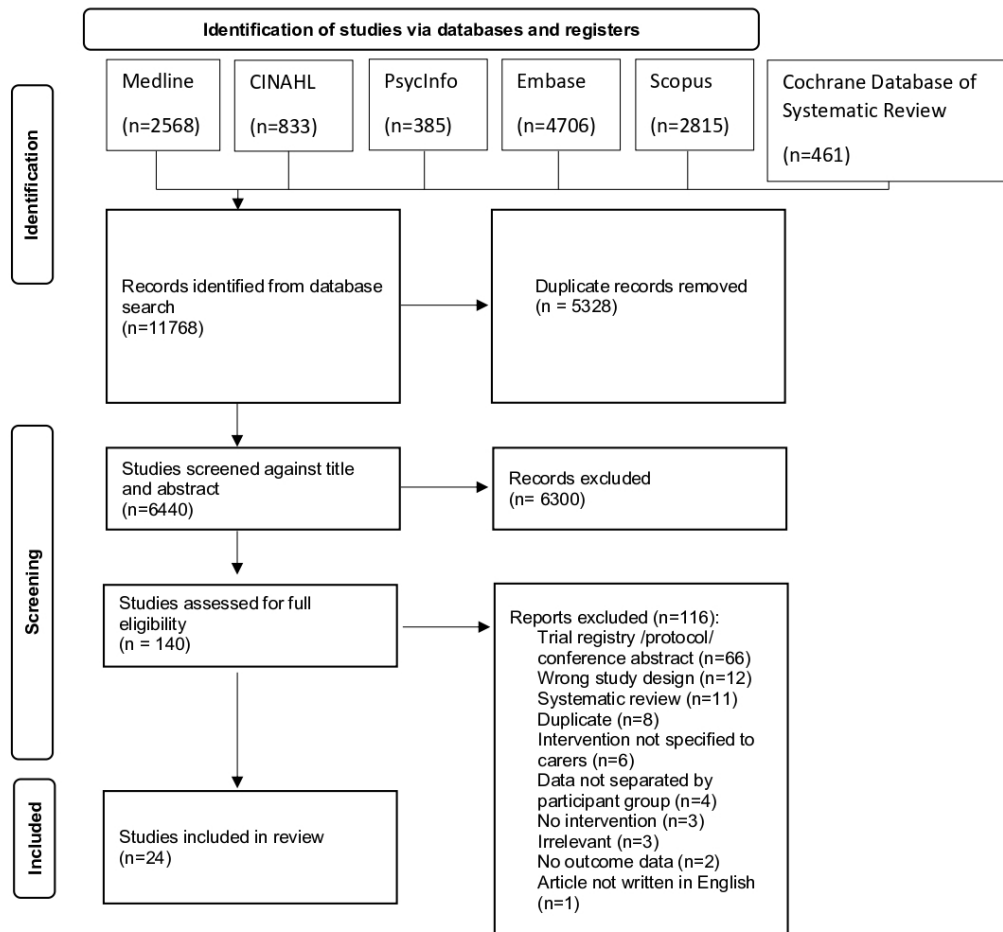


Figure 1. Prisma flowchart

Figure 1 Prisma flowchart.

Database	Search strategy
(including platform for clarity of source, eg, Medline Complete (Via Ebsco)	(Paste in the search strategy from the database, so others can replicate your search exactly.)
Medline Complete (Via Ebsco)	<p>S1 (MH "prostatic neoplasm*") OR (MH "urologic neoplasm*") OR (TI "prostate neoplasm*") OR (TI prostate) OR (TI "prostatic carcinoma*") OR (TI "urologic carcinoma*") OR (TI "urologic neoplasm*") OR (TI "urologic cancer*") OR (TI "prostate cancer*") OR (AB "prostate neoplasm*") OR (AB prostate) OR (AB "prostatic carcinoma*") OR (AB "urologic carcinoma*") OR (AB "urologic neoplasm*") OR (AB "urologic cancer*") OR (AB "prostate cancer*")</p> <p>S2 (MH Caregiver*) OR (MH spous*) OR (MH family) OR (TI Carer*) OR (TI caregiver*) OR (TI spous*) OR (TI famil*) OR (TI partner*) OR (AB Carer*) OR (AB caregiver*) OR (AB spous*) OR (AB famil*) OR (AB partner*)</p> <p>S3 (MH "self-help group*") OR (MH "cell phone") OR (MH "mobile application*") OR (MH "clinical trial") OR (MH "qualitative research") OR (MH pilot*) OR (MH "randomized controlled trial") OR (TI program) OR (TI intervention) OR (TI counseling) OR (TI therapy) OR (TI "community service*") OR (TI "social network") OR (TI "cognitive behavioural therapy") OR (TI CBT) OR (TI "support group") OR (TI telephone) OR (TI internet) OR (TI web) OR (TI "smartphone application") OR (TI "mobile application") OR (TI app) OR (TI pilot) OR (TI "randomi?ed control* trial") OR (TI "non-randomi?ed control* trial") OR (TI "clinical trial") OR (AB program) OR (AB intervention) OR (AB counseling) OR (AB therapy) OR (AB "community service*") OR (AB "social network") OR (AB "cognitive behavioural therapy") OR (AB CBT) OR (AB "support group") OR (AB telephone) OR (AB internet) OR (AB web) OR (AB "smartphone application") OR (AB "mobile application") OR (AB app) OR (AB pilot) OR (AB "randomi?ed control* trial") OR (AB "non-randomi?ed control* trial") OR (AB "clinical trial")</p> <p>S1 AND S2 AND S3 S1 AND S2 AND S3 Limiters - Scholarly (Peer Reviewed) Journals Narrow by Language: - english Search modes - Boolean/Phrase</p>

Systematic review

- ▶ Comparators—all usual care and alternative intervention groups were included in the review.
- ▶ Outcomes—there were no restrictions on outcomes, studies could report on any supportive care outcomes including supportive care needs, psychosocial well-being and physical health.
- ▶ Studies included randomised controlled trials and pilot studies of interventions to address partner and carers needs.

Publications including carer/patient dyads were included if results relating to carers' support needs were reported separately.

Exclusion criteria

Studies were excluded in this review if they met the following criteria:

- ▶ Published in a language other than English.
- ▶ Focus on preventative screening of prostate cancer.
- ▶ Includes several types of cancer in their analysis where the specific needs of carers of men with prostate cancer cannot be distinguished.

Data extraction

For each included study, descriptive data were collected including: mean sample age, gender, ethnicity, race, recruitment and attrition rates, intervention modality, focus area of intervention and key findings. A data collection tool was created to collect data via Qualtrics and used a range of closed and open-ended questions. For example, close-ended questions included the target sample of the study (carers/dyads/other), study design (randomised controlled trial/pilot randomised controlled trial), intervention modality (face to face, online, telephone, hardcopy, other and types of unmet needs addressed in the intervention (information, support, marital etc)). Open-ended questions included age, sample size, recruitment rate, retention rate, description of the intervention and impact on outcomes. Data extraction was completed (NW, AG and HJ) with 20% cross-checked by NW. Ambiguities were discussed until a consensus was reached. Two studies reported on one set of data in a longitudinal approach^{27 28}; we combined the findings of both studies during our analysis.

Data analysis

Data were analysed using descriptive and frequency statistics. Interventions and their impact on carers' needs were reported. A meta-analysis was not conducted due to the heterogeneity of the studies. The Synthesis Without Meta-analysis (SwiM) guidelines are recommended for use when a review is undertaken with no meta-analysis; we have applied these guidelines to our review.²⁹

Studies were analysed in different groups, first by study design, where studies were grouped by randomised controlled trials, pilot studies and non-randomised clinical trials and were reported on in these groups. Second, studies were grouped by intervention

modality such as face to face, online or a combination of both modalities to describe differences in outcomes compared with intervention delivery.

Risk of bias

A risk-of-bias assessment was completed using the Cochrane risk-of-bias tool. Risk of bias was completed by two authors and a research assistant (NW, HJ and Sharina Riva), with 20% cross-checked by Sharina Riva. Eight studies received a low risk of bias, 13 suggested some concerns and 2 had a high risk of bias (figure 2). Risk of bias was not completed for one study as it was a pilot study where the waitlist data were collected from participants 2 months prior to the delivery of the intervention.³⁰ The same participants were then treated as the intervention group.

RESULTS

Study characteristics

Of 6440 articles screened, 24 were included in the review (figure 1), totalling 2015 participants. The majority of studies were published in the USA (12/24, 50%) and two-thirds were randomised controlled trials (16/24, 67%). Nearly all studies focused on spousal carers as participants (22/24, 92%) and just under half were conducted in a face-to-face setting (11/24, 46%). On average, women accounted for 97% of participants (range 40%–100%, SD 14). Most interventions were delivered as a patient–carer dyad as opposed to solely focusing on carers (22/24, 92%). Recruitment rates were on average 35% across studies (range 26%–98%, SD 22). See online supplemental table 1 for full study demographics.

Intervention modality

Overall, 10 of 24 studies (42%) delivered their intervention solely face to face,^{30–39} of these 7 showed a significant impact on carers' outcomes^{30–35 37 39} (see online supplemental table 2). Nine studies delivered interventions using a combination of modalities^{27 40–47} and six had a significant impact on carers' outcomes.^{27 40 41 43 45} Two studies trialled telephone interventions,^{48 49} one of which had a significant impact on carers' outcomes.⁴⁸ Two studies used online interventions,^{50 51} one of which showed a significant impact on outcomes.⁵¹

Intervention description

Interventions focused on a variety of topics, with some using multiple approaches. This included counselling therapies,^{24 27 31–33 36 38–45 48 52} skills training,⁴⁹ information booklets or online modules,^{40 46–48 50 51} information sessions^{30 35} and exercise.^{34 37 41} The majority of interventions (19/24, 74%) were presented as weekly modules^{27 31–37 39–42 44–46 48 49 51 52} that were most frequently 6 (n=6/24, 25%)^{33 35 40 42 49 52} or 8 weeks in duration (n=5/24, 17%).^{27 36 39 45 48} Intervention content was tailored to family members

Study	Risk of bias domains					Overall
	D1	D2	D3	D4	D5	
Badger, et al. 2011 [48]	+	+	+	+	+	+
Borji, et al. 2017 [31]	-	X	+	+	+	X
Campbell, et al. 2007 [49]	-	+	+	+	+	+
Canada, et al. 2005 [32]	+	-	+	+	+	-
Carlson, et al. 2017 [52]	+	-	+	+	+	-
Chambers, et al. 2015 & 2019 [27, 28]	+	+	+	+	+	+
Chien, et al. 2020 [40]	+	+	+	+	+	+
Couper, et al. 2015 [33]	+	+	+	+	+	+
Karlsen, et al. 2021 [41]	+	+	+	+	+	+
Karlsen, et al. 2017 [42]	X	X	X	X	+	X
Levesque, et al. 2015 [47]	-	+	+	+	+	-
Lyons, et al. 2016 [34]	-	+	+	+	+	-
Malcarne, et al. 2019 [39]	-	+	+	+	+	-
Manne, et al. 2004 [35]	-	+	+	+	+	-
Manne, et al. 2019 [43]	-	+	+	+	+	-
Manne, et al. 2011 [36]	-	+	+	+	+	-
McCaughan, et al. 2018 [44]	+	+	+	+	+	+
Northouse, et al. 2007 [45]	-	+	+	+	+	-
Robertson, et al. 2016 [38]	+	+	+	+	+	+
Song, et al. 2021 [50]	-	+	+	+	+	-
Walker, et al. 2013 [46]	-	+	+	+	+	-
Wittmann, et al. 2022 [51]	-	+	+	+	+	-
Winters-Stone, et al. 2016 [37]	+	+	+	-	+	-

Domains:
D1: Bias arising from the randomization process.
D2: Bias due to deviations from intended intervention.
D3: Bias due to missing outcome data.
D4: Bias in measurement of the outcome.
D5: Bias in selection of the reported result.

Judgement
X High
- Some concerns
+ Low

Figure 2 Risk of bias.

supportive care needs in the majority of studies (19/24, 79%).^{30-33 36-43 45 48-52}

Randomised controlled trials (16/24)

Two-thirds of the studies were randomised control trials (16/24, 67%). Of these, seven studies used a combination of modalities including face to face, telephone, online, hardcopy material and other multimedia formats, with intervention periods ranging from 2 to 24 weeks.^{27 39-41 43-46} Face-to-face interventions were trialled across five studies with intervention periods ranging from 5 to 26 weeks.^{31 33-35 37} Two studies used telephone interventions with intervention periods ranging from 6 to 8 weeks,^{48 49} and one used an online intervention with a 28-week period.⁵¹

Pilot studies (8/24)

Half of the pilot studies assessed face-to-face interventions (4/8, 50%); and only two studies measured duration ranging from 4 to 8 weeks.^{32 36} Two studies used a combination of approaches including face to face, hardcopy material and multimedia formats, of these one was a 6-week course⁴² and one provided material to participants at baseline which was then accessed on an 'as needs' basis by participants.⁴⁷ One study assessed an online intervention which was accessed on an 'as needs' basis by participants⁵⁰ and one study held group sessions over a 6-week period; however, the mode of delivery of the groups was not specified.⁵²

Impact of interventions on carer outcomes

A total of 15 studies (63%) reported a significant impact on carer outcomes. Of these, 13 were RCTs,^{27 31 33–35 37 39–41 43 45 48 51} n=5 had a low risk of bias^{27 33 40 41 48} and n=6 were scored as ‘some concerns’ due to lack of clear reporting during randomisation.^{34 35 39 43 45} Two were pilot studies that have significant impacts on carers’ outcomes, one raised concerns about interventions concealment³² and one was not assessed for bias.³⁰ Six studies had no impact on carers’ outcomes; one RCT⁴⁴ and five pilot studies,^{38 42 47 50 52} of these only two had a low risk of bias.^{38 44} See online supplemental table 2 for a full description.

Of the 15 studies that had an improvement in outcomes, 12 (80%) tailored their content to family members’ supportive needs.^{30–33 37 39–41 43 45 48 51} Six studies (25%) found that their intervention had no impact on family members’ outcomes,^{38 42 44 47 50 52} of these six, five (83%) presented intervention content tailored to family members’ supportive care needs.^{38 42–44 50 52}

Significant findings

During at least one time point in each study, the RCTs showed significant improvements in a range of outcomes including depression,^{31 48} anxiety,³¹ fatigue, social well-being, social support from family, spiritual well-being,⁴⁸ relationship satisfaction,^{27 43} positive and negative affect,⁴⁰ distress,³⁹ cohesion, avoidance and conflict resolution,³³ affectionate behaviours,³⁴ sexual functioning,^{27 51} higher sexual satisfaction, intimacy and fewer sexual unmet needs,²⁷ dyadic adjustment, problem-solving,³⁹ subsections of coping,³⁵ subsections of post-traumatic growth,^{35 43} higher quality of life communication, active communication and self-efficacy, and lower negative appraisal, uncertainty, symptom distress, problems with husband’s incontinence and hopelessness,⁴⁵ lean mass, upper and lower body strength and chair standing time³⁷ and general physical function.⁴¹ Pilot studies showed significant improvements in female sexual functioning^{30 32} medical impact, sexual interest and problems.³⁰

Two RCTs measured effect sizes and found moderate effect sizes for depression, fatigue, vigour⁴⁹ dyadic adjustment and intimacy in relationships.⁴⁶ One pilot study found moderator effects for baseline cancer specific distress, relationship satisfaction and intimacy.³⁶

Intervention focus categorised into common supportive care needs

In 10 studies (42%), the primary area of focus of each study often spanned multiple supportive care needs^{27 36–38 40 43–46 49} (see online supplemental table 2). The most common outcomes were psychological (14/24, 58%),^{31 35–40 43–45 48–50 52} sexual (10/24, 42%)^{27 30 32 34 38 40–42 46 51} and informational (6/24, 25%).^{40 44–47 49} One quarter of studies included additional measures including symptom management,

quality of life, health related quality of life and a broader unmet supportive care needs measurement.

Eight RCTs had a low risk of bias^{27 33 40 41 44 48 49} and eight raised some concerns.^{31 34 35 39 43 45 46 51} Of these, lack of clear reporting of the randomisation process raised some concerns in n=7,^{34 35 39 43 45 46 51} and a high risk of bias occurred in one study n=1 as there was no record of an analysis plan and the appropriateness of results could not be assessed.³¹ Across pilot studies, n=1 had a low risk of bias³⁸ and n=6 raised some concerns.^{32 36 42 47 50 52} Of these, n=3 did not clearly report on randomisation procedure.^{36 47 50} In two studies, there was little information given about concealment of assigned intervention prior to randomisation, due to the nature of interventions, for example, counselling, there was potential for bias to occur in as a result of knowledge of the intervention.^{32 52} One study had a high risk of bias across multiple domains.⁴²

DISCUSSION

In this review, we found that the majority of interventions available to carers of men with prostate cancer were provided in face-to-face format, delivered a counselling intervention and focused on spouses. Half of the included studies showed a significant impact on a variety of carers’ outcomes. Of these studies, three-quarters provided some elements of tailoring content to carers’ own circumstances. Studies largely focused on psychological, sexual and informational aspects of caregiving.

There is debate around the ideal delivery modality of interventions for carers of people with cancer. In this review, earlier studies used a combination of approaches including face to face, written material, CD-ROMs and early technology such as the telephone; later studies primarily using face-to-face approaches with few using online only interventions. However, our findings contrast the cultural shift in the delivery of interventions to digital health platforms.⁵³ Our results indicate that a higher number of face-to-face interventions provided positive outcomes for carers. It is possible that face-to-face settings correspond with the type of supportive care needs identified in this review such as psychological and sexual needs. These types of needs may often be addressed through counselling interventions requiring needs assessment of individuals’ and couples traditionally conducted in a face-to-face setting. However, previous research has identified that technology-based interventions show promising results⁵⁴ for education, cognitive therapies, communication and support. Further research is required into the use of innovative solutions such as video conferencing and telehealth in supporting counselling-based services for people affected by prostate cancer to support traditional face-to-face services. In addition to existing face-to-face interventions, greater understanding and use of innovative resources will allow for the delivery of interventions to carers

where none existed before, for example, in rural and regional areas.

Despite our findings of the success of face-to-face interventions, it is important to recognise the context of the COVID-19 pandemic and lockdowns worldwide where family members have been unable to attend outpatient settings with patients. The long-term ramifications on carers' support needs and well-being are yet known. The adaptation of resources, including face to face and digital options, may allow for carers in diverse circumstances to seek support. There is a need for flexibility in the delivery of services. Recruitment rates of the included studies were low (average 35%), indicating that carers are unlikely to volunteer or initiate participation in programmes, as well as highlighting challenges in recruiting patient-carer dyads into research projects. These findings are similar across other studies.^{55 56} Reasons for hesitancy to seek support include lack of time for themselves, not acknowledging their own needs or having limited time to participate in additional tasks.¹³ There is a need therefore to embed new services into existing healthcare structures with automatic referrals to ensure uptake of programmes.⁵⁷ Support for and referral into interventions have the potential to promote health and well-being during the illness and caring period, and more can be done to intervene early prior to unmet needs developing. A hybrid model of care may be required following the pandemic period; however, what this looks like in the long term and how sustainable it is requires further investigation.

The impact of interventions addressing couples' needs has been explored previously and found that couples' based interventions are as successful as stand-alone patient and carer interventions.⁵⁸ Despite positive impacts of couples based interventions, a more recent review has identified that couple-based interventions are inadequate in addressing and producing successful outcomes for both patients and partners simultaneously.²⁴ There is a need to tailored content to address the needs of family members⁵⁹; however, in this review we found that nearly equal amounts of studies with tailored content to family members' needs both had a significant improvement in outcomes (n=10) or had no improvement in outcomes (n=7). One reason for this may be the level of tailoring provided to carers. Interventions were largely dyad based and at times were tailored to couples' needs rather than individuals' needs. While many dyads affected by prostate cancer experience unmet needs as a couple, there may be individual supportive care needs that carers experience, such as, dealing with emotions related to cancer,⁶⁰ and at times planning for life after death.⁶¹ There is a need to ensure that future interventions incorporate less common unmet needs experienced by cancer carers to meet the needs of the carer.⁶² Additionally, while it was not represented in this review, the male/female spouse dyad represents only one patient-carer relationship

who experience prostate cancer. Previous research indicates that up to 19% of carers of people with prostate cancer may also be children, or other relatives or friends⁶³ where sexual and marital unmet needs may not be relevant for the carer. Similarly in this study, we found that couples were predominately heterosexual with women, representing 97% of the sample. This limits the ability to assess whether success of interventions is related to carers' gender. It is known that women both living with cancer⁶⁴ and who are carers^{65 66} experience higher levels of distress compare to people who do not identify as woman. Given that dyad interventions comprise primarily heterosexual spousal,⁶⁷ there is a pressing need to codesign and evaluate interventions for same-sex couples, or those who have a different relationship with the person living with prostate cancer to ensure that interventions are inclusive and encompassing to the needs of the caring population. The use of tailoring across flexible technology-based platforms requires further exploration to assess whether one programme can address both dyadic and individual needs for carers from diverse situations.

Consideration should be taken when designing and implementing studies about the language used as many carers do not identify with the term 'carer'.⁶⁸ In day-to-day practice, conversations between clinicians and patients/carers should include defining whether the patient has a carer or support person, and the term they prefer to use when being addressed.⁶⁹

From this review, we identified that interventions were largely focused on psychological, sexual and informational outcomes. However, carers of people with prostate cancer also experience other gaps in care, including the need for peer support,⁷⁰ and practical advice related to everyday care needs.^{18 70} This highlights gaps in prostate cancer research and the need for interventions for carers own needs during the disease trajectory. Interventions had an impact on a diverse range of outcomes including psychological, social, marital and physical well-being, suggesting that interventions have the potential to meet the complex needs that carers experience. However, more research is needed to explore whether the focus of interventions can be broadened to meet a variety of needs experienced by carers and whether any resulting impact on outcomes can be seen. The majority of studies (60%) demonstrated that interventions had a significant impact on carers' outcomes; however, this was across a multitude of psychological, physical and interpersonal measurements. Greater understanding of how interventions can improve carers' well-being in the short-term and long term is needed.⁴⁸

Limitations

One limitation of this work is the lack of information provided about the stage of mens' illness or the treatment they were undertaking, due to the heterogeneity of information reported this information was

unable to be extracted. Carers can experience different supportive care needs in relation to the stage of diagnosis and treatment type. Further work should clearly report on the patients stage of illness in order to ascertain the impact on the carer at that time.

Findings of this review are limited as the majority of studies (63%) had 'some concerns' or high risk of bias.

In the majority of cases, this was due to inadequate reporting of randomisation and concealment, this is similar across risk of bias findings in other similar systematic reviews.⁷¹ However, as only five of the studies included had a low risk of bias and significant impact on outcomes, findings should be interpreted with caution. Future research is needed to strengthen findings, and clearer reporting is required to accurately determine risk of bias.

CONCLUSIONS

Our review highlighted that interventions for carers of people with cancer were largely face to face, were counselling based and patient-spouse focused. Most interventions addressed psychological, sexual and informational unmet needs. Opportunities exist for flexible technology-based interventions to test tailored programmes addressing complex unmet needs meeting dyad and individual carer needs. Findings from these interventions may provide additional information about the success of interventions in improving outcomes of carers of people with prostate cancer.

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Contributors All authors contributed to the study concept and design. HJ performed the literature search. NW and HJ screened resources. Data was extracted by NW, AU and HJ and cross-checked by NW. Data synthesis was performed by NW. The first draft of the manuscript was written by NW and HJ. All authors critically revised and approved of the final manuscript. NW is the guarantor who accepts full responsibility for the finished work and/or the conduct of the study, had access to the data, and controlled the decision to publish.

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Supplementary Table 1. Demographics of studies included in the review											
Authors	Year	Country	Study design	Participant focus	Sample size	% female	Mean Age	Ethnicity and race	Follow up period	Recruitment rate (%)	Retention rate (%)
Badger et al., [48]	2011	USA	RCT	Spousal partners and other family members	70	93	61	White (81%)	8 weeks 16 weeks	39	T1 ^a 100%, 8 weeks: 93% 16 weeks: 90%
Borji et al., [31]	2017	Iran	RCT	Spousal partners and other family members	80	40	IG ^b 39 CG ^c 40	NR ^d	4 weeks 8 weeks	NR	NR
Campbell et al., [49]	2007	USA	RCT	Spousal partners	40	100	59	NR	6 weeks	18	6 weeks: 75%
Chambers et al., [27, 28]	2015; 2019	Australia	RCT	Spousal partners	189	100	60	NR	3 months 6 months 12 months 2 years 3 years 4 years 5 years	47	3 months: 85% 6 months: 84% 12 months: 84% 2 years: 82% 3 years: 89% 4 years: 82% 5 years: 81%
Chien et al., [40]	2020	Taiwan	RCT	Spousal partners	103	Not reported	64	NR	6 weeks (T1) 10 weeks (T2 ^e) 18 weeks (T3 ^f) 24 weeks (T4 ^g)	20	Control 100% IG1 92% IG2 100% 10 weeks: Control 100% IG1 92% IG2 100% 18 weeks: Control 98%

											IG1 88% CG2 100% 24 weeks: Control 98% IG1 88% IG2 100%
Couper et al., [33]	2015	Australia	RCT	Spousal partners	62	100	IG 60 CG 62	NR	10 weeks (T1) 9 months (T2)	30	9 months: 87%
Karlsen et al., [41]	2021	Denmark	RCT	Spousal partner	35	100	60	NR	2 months (T1) 8 months (T2) 12 months (T3)	52	8 months: 85% 12 months: 80%
Lyons et al., [34]	2016	USA	RCT	Spousal partners	64	100	68	• White (92%)	3 months 6 months	22	3 months: 100% 6 months: 100%
Malcarne et al., [39]	2019	USA	RCT	Spousal partners	164	Not reported	62	• White (82%) • African-American (5.5%) • Latino (5.5%) • Asian (5%) • Other (2%)	2-3 months (T2) 6 months (T3)	98	Intervention group only 2 months: 82% 6 months: 84%
Manne et al., [35]	2004	USA	RCT	Spousal partners	68	100	60	• White (84%) • African-American (12.5%) • Hispanic (1.8%) • Other (1.8%)	10 weeks (T1)	56	Intervention group only Post intervention: 88%

Manne et al., [43]	2019	USA	RCT	Spousal partners	237	99	57	<ul style="list-style-type: none"> • Non hispanic (97%) • White (74%) 	5 weeks 3 months 6 months.	15	NR
McCaughan et al., [44]	2018	UK	RCT	Spousal partners	17	100	IG 64 CG 60	<ul style="list-style-type: none"> • Caucasian (100%) 	Baseline (T1), Immediately post intervention (T2), 1 month follow- up post intervention (T3)	20	Post-intervention (T2): IG 92.3% CG 87.5% 1 month (T3): IG 84.6% CG 62.6%
Northouse et al., [45]	2007	USA	RCT	Spousal partners	263	Not reported	59	<ul style="list-style-type: none"> • Caucasian (84%) 	Baseline 4 month 8 months 12 months	69	4 months: 90% (83%) completed all 3 follow-up assessments.
Walker et al., [46]	2013	Canada	RCT	Spousal partners	27	100	NR	NR	Baseline 6 months	30.3% at one site, no figures reported for the second site.	NR
Winters-Stone et al., [37]	2016	USA	RCT	Spousal partners	64	100	IG 67 CG 70	<ul style="list-style-type: none"> • Non-Hispanic (94%) • Caucasian (94%) 	Baseline, 3mths (T2), 6mths (T3)	22	Baseline (T1) IG: 100% CG: 100% 3 months IG: 100% CG: 91% 6 months

											IG: 100% CG: 84%
Wittman et al., [51]	2022	USA	RCT	Spousal partners	142	IG 95 CG 96	IG 60 CG 59	<ul style="list-style-type: none"> • IG 85% white • CG 74% white • 11% African American across both groups 	3 and 6 months after treatment	44	3 months: 70% 6 months: 71%
Canada et al., [32]	2005	USA	Pilot	Spousal partners	51	100	Man alone group 61 Couple group 62	<ul style="list-style-type: none"> • White (88%) • Hispanic (8%) • African-American (4%) 	3 months 6 months	NR	Post treatment 82% 3 months 75% 6 months: 73%
Carlson et al., [52]	2017	Canada	Pilot	Spousal partners	77	100	62	NR	Post-intervention 3 months post-intervention 6 months post-intervention	11	Post-intervention IG:84% CG:78% 3 months IG:71%, CG:75% 6 months IG: 80%, CG:75%
Hampton et al., [30]	2013	Canada	Pilot	Spousal partners	38	100	IG 58 CG 60	• White (93%)	2 months	Unknown	76%
Karlsen et al., [42]	2017	Denmark	Pilot	Spousal partners	7	100	not recorded	NR	8 months 12 months	14	71%
Levesque et al., [47]	2015	Australia	RCT,Pilot	Spousal partners	42	NR	60	NR	2 months	23	95%

Manne et al., [36]	2011	USA	RCT,Pilot	Spousal partners	71	97	56	• White (83%)	Baseline 2 months	21	IG: 95% CG: 81%
Robertson et al., [38]	2016	United Kingdom	RCT,Pilot	Spousal partners	42	98	64	• White (100%)	Baseline 4 months after baseline (T1) 6 months after the end of intervention (T2)	38	74%
Song et al., [50]	2021	USA	RCT,Pilot	Spousal partners	62	100	IG 62 CG 62	• White (71%) • Black (24%)	4-6 months Semi structured post exit interview after T2	42	IG: 90% CG: 81%

Supplementary Table 2. Impact of interventions on carers' outcomes					
Authors	Primary Outcomes	Intervention description	Intervention modality	Intervention format	Impact of intervention on carers outcomes
Badger et al., 2011 [48]	<ul style="list-style-type: none"> • Depression • Positive affect • Negative affect • Perceived stress • Fatigue • Social wellbeing • Social support from family • Spirituality 	IG1 ^a - Telephone interpersonal counselling (TIP-C ^e). Carers received four phone calls to address problem related to physical and emotional wellbeing. IG2 ^b Health education attention condition (HEAC ^f) participants received National Cancer Institute prostate information booklets. Carers received 4 calls to review information.	Telephone	8 week course	IG1 group had improved depression symptoms over time (p<0.05). IG2 had significantly improved depression (p<0.05), fatigue (p<0.01), social wellbeing (p<0.01), social support from family (p<0.05) and spiritual wellbeing (p<0.01).
Borji et al., 2017 [31]	<ul style="list-style-type: none"> • Depression • Anxiety • Stress 	1.5 hour twice weekly sessions x8 (followed by two summary session) based on cognitive behaviour therapy for managing stress.	Face-to-face	5 (4 weeks of twice weekly sessions, then two further session of summary)	Significant decrease in depression and anxiety symptoms between groups at 4 and 8 weeks (both p=0.001)
Campbell et al., 2007 [49]	<ul style="list-style-type: none"> • Self efficacy • Quality of life • Caregiver strain 	1 hour sessions 6 Coping skills training - included information about prostate cancer and side effects, teaching problem solving skills and teaching cognitive coping skills	Telephone	6 week course	No significant effects for caregiver negative mood, strain or self efficacy. Moderate effect size for depression (0.46), fatigue (0.39), vigour (0.40), small effect size for strain (0.27) and self efficacy (0.30) between groups.

Chambers et al., 2015; 2019 [27, 28]	<ul style="list-style-type: none"> • Utilisation of erectile dysfunction treatments • Sexual function and satisfaction • Sexual supportive care needs • Sexual self-confidence • Masculine self-esteem • Marital satisfaction • Program evaluation 	<p>IG1 - participants received telephone calls from nurse consultants and sessions followed principals of cognitive behavioural sex and couples therapy.</p> <p>IG2 received peer support telephone intervention for others living with prostate cancer based on the sharing of common personal experiences. CG – usual care.</p>	Telephone, Audio-visual DVD	6 weeks (post-surgery recruitment) or 8 weeks (pre-surgery recruitment)	<p>No significant effects of intervention on the primary outcomes of sexual function, sexuality needs, sexual self-confidence, masculine self-esteem, marital satisfaction or intimacy were found for either men or women. For helpfulness of telephone calls, the mean rating for the nurse intervention at the 6-month assessment was 8.33 for females; the mean rating for the peer intervention was 7.47 for females. IG2 had improved sexual function and satisfaction at 2 years (p=0.002) and at 3 years (p=0.003) compared to usual care.</p> <p>Compared to IG1, IG2 had improved sexual function and satisfaction at 2 years (p=0.023) and at 3 years (p=0.035). IG1 had higher marital satisfaction compared to IG2 (p=0.006) at 4 years.</p>
Chien et al., 2020 [40]	<ul style="list-style-type: none"> • Disease appraisals • Emotion status • Relationship satisfaction • Health-related quality of life • Satisfaction with intervention 	<p>IG1: The intervention included a psychosocial information package (PIP[®]) manual and telephone support for 6 weeks. Six-session psychosocial information manuals were provided. A trained nurse called the participants to guide their reading and to explain the manual content.</p> <p>IG2: The intervention included a weekly multimedia psychosocial intervention (MPI[®]) via the mobile messaging application</p>	Online Telephone Hardcopy Multimedia films	6 week course	<p>At T1^c the PIP had high positive affect than control group (p=0.027). At T2^d the MPI and PIP groups experienced significant improvements in negative affect compared with the control group (p=0.044). The PIP group had higher QOL^s at T2 than control group (p=0.023).</p>

		<p>(MMA¹), a psychosocial information manual and professional support for 6 weeks. The researchers confirmed that the MMA was installed on the smartphone of the participants in the MPI group. The participants could talk with the trained nurse separately, through the MMA or telephone, any concerns related to PCa. An experienced nurse in urology provided professional support. The trained nurse was to understand and clarify the participants' questions and difficulties in learning and using information and to listen to their problems and feelings separately. With regard to their problems and feelings, the trained nurse offered available information and encouraged them to use previously learned coping skills or referred them to the urologist or case manager.</p>			
Couper et al., 2015 [33]	<ul style="list-style-type: none"> Relationship function 	<p>Cognitive existential couples therapy (CECT²). Six sessions delivered once a week for 60-90 minutes each week focusing of supportive, existential and cognitive therapy. Sessions were adapted to address identified needs of each couple.</p>	Face-to-face	6 week course	<p>Younger carers had significantly lower distress (p=0.008), avoidance (p=0.04) intrusive thoughts (p=0.006) and hyper arousal (p=0.01) at T1. Significance was maintained to T2 for distress (p=0.04), avoidance (p=0.05) and intrusive thoughts (p=0.02). Partner who completed the CECT program showed significant improvements in cohesion (p=0.007) conflict</p>

					resolution (p=0.01) and relational function (p=0.009)
Karlsen et al., 2021 [41]	<ul style="list-style-type: none"> • Sexual functioning • Sexual distress 	ProCan - six counselling sessions and three pelvic floor muscle training sessions with a home video training program.	Face-to-face, video	24 weeks	No significant change in sexual function or sexual distress at T2 or T3 months, or between IG and CG. A significant improvement in carers physical function was seen between IG and CG (p=0.012)
Lyons et al., 2016 [34]	<ul style="list-style-type: none"> • Physical intimacy • Relationship quality 	"Exercising together" Exercise sessions led by a physiologist. Twice weekly sessions for 1 hours, lasting for 6 months. Each partner in the dyad acted as the other persons coach and would monitor and assist one another to perform exercises.	Face-to-face	26 week course	Wives had significant increase in engagement in affectionate behaviours over time p<0.001
Malcarne et al., 2018 [39]	<ul style="list-style-type: none"> • Distress 	Problem solving therapy - sessions were delivered in the dyads home and focused on problems identified by spouses. Therapy involved developing and choosing coping strategies and evaluating strategies. Partners were asked to complete homework sheets related to identified problems.	Face-to-face	6-8 sessions	IG showed significant improvements in distress at post-intervention (p=0.044) and 6 months (p=0.032). Dyadic adjustment was significantly improved at post intervention (p=0.049) but not 6 months. Constructive problem solving significantly improved from baseline to post intervention (p=0.014) and to 6 months (p=0.044).
Manne et al., 2004 [35]	<ul style="list-style-type: none"> • General distress, cancer specific distress • Coping • Post traumatic growth 	Six one hour group sessions to learn about cancer care. Topics included: medical information, nutrition, stress management and coping training, communication and meeting needs, maintaining intimacy and survivorship issues. Homework activities	Face-to-face	6 week course	No significant impact on distress. Women in the intervention group had significant improvements in subsections of coping including denial and subsections of post traumatic growth including relating to others, spiritual growth, personal growth and

	<ul style="list-style-type: none"> • Cancer specific marital interactions (communication) 	included relaxation activities, talking about feelings and asking for support.			appreciation for life (all p=0.00)
Manne et al. 2019 [43]	<ul style="list-style-type: none"> • General psychological adjustment • Depression • Cancer-specific distress • Cancer-related concerns • Relationship satisfaction 	Intimacy-enhancing therapy (IET ^k) & General health and wellness intervention (GHW ^l). Both consisted of five 90-min couples' sessions and one 30–45 min booster call. IET focused on improving a couples' ability to share their thoughts and feelings regarding cancer, promoting mutual understanding and support, facilitating constructive discussions regarding cancer concerns, and enhancing emotional intimacy. GHW focused on a healthy lifestyle	Face-to-face Telephone	5x 90 minute couple sessions and one phone call (30-45 mins)	Among spouses in longer relationships, psychological adjustment increased in both IET (p < .001) and GHW (p =0.09). Psychological adjustment was significant in IET (p<0.001) compared to GHW, but not compared to usual care.
McCaughan et al., 2018 [44]	<ul style="list-style-type: none"> • Self-efficacy • Quality of life • Symptom distress • Communication • Uncertainty and illness benefit • Social support 	CONNECT: Based upon the FOCUS ^m program. 5 intervention sessions are delivered to prostate cancer patients and their partners over a 9 week period of time. The sessions consist of 3 2-hour small group sessions (on weeks 1, 3 and 9) and 2 telephone sessions (weeks 5 and 7) with men and their partners. The aim was to enhance the couple's belief in their ability to manage their cancer and related issues. The sessions consisted mainly of discussions on symptom	Face-to-face Telephone	9 week program (three group, two telephone sessions)	No statistical results due to low control numbers, only means for comparison.

		management, sexual and urinary dysfunction, uncertainty management, positive thinking and healthy lifestyles			
Northouse et al., 2007 [45]	<ul style="list-style-type: none"> • Quality of life • Appraisal variables: Appraisals of illness/caregiving • Uncertainty • Hopelessness • Coping resource • Coping strategies • Self-efficacy • Communication about the illness • Symptoms • Risk for distress 	FOCUS: family based intervention focused on support and education. Has five core areas: Family involvement, Optimistic attitude, Coping effectiveness, Uncertainty reduction, and Symptom management	Face-to-face Telephone	8 week course	Spouses reported better physical QOL than controls at 8 months ($p < .05$) and at 12 months ($p < .01$), intervention spouses had better mental QOL scores ($p < .05$) and overall QOL scores ($p < .01$). Intervention spouses had significantly less negative appraisal of caregiving ($p < .01$), significantly less uncertainty about the illness ($p < .01$), and less hopelessness ($p < .05$) than control spouses at 4 months higher self-efficacy about ways to manage the illness than control spouses at 4 months ($p < .05$) and 12 months ($p < .05$), better communication with patients than control spouses at 4 months ($p < .01$), 8 months ($p < .05$), and 12 months ($p < .01$), used more active coping at 12 months than control spouses ($p < .05$), significantly less general symptom distress of their own than control spouses ($p < .01$) and had fewer problems related to their husbands' urinary incontinence at 4 months ($p < .05$) and at 8 months ($p < .01$).

Walker et al., 2013 [46]	<ul style="list-style-type: none"> • Intimacy in relationships • Dyadic Adjustment 	Information Booklet: Androgen Deprivation Therapy: A Guide for Prostate Cancer Patients and Their Partners	Face-to-face Hardcopy	2 weeks provide to read booklet plus a subsequent 1hr education review session	Intimacy in relationships: e effect size for partners' change scores was observed at 0.04, treatment group scoring lower ($M^v=-9.21$, $SD^u=24.80$) than the control group ($M=-8.38$, $SD=19.60$), dyadic adjustment: medium effect size was observed at 0.50, with the treatment group scoring better ($M=-9.12$, $SD=22.10$) than the control group ($M=-21.40$, $SD=26.90$), sexual activity: baseline= 42.9% active in the last month, 6 month follow up= 30% active in the last month.
Winters-Stone et al., 2016 [37]	<ul style="list-style-type: none"> • Self-reported demographics • Health status • Body composition • Maximal muscle strength • Physical function • Self-reported physical & mental health • Self-reported moderate-vigorous intensity physical activity • Adherence 	The Exercising Together Project - strength training program focused on the physical and mental health of prostate cancer survivors and their spouse caregivers.	Face-to-face	26 week course	Spouses in Exercising Together had slight gains in lean mass compared to no change in controls ($p = 0.05$), significantly improved their upper ($p < 0.01$) and lower body ($p < 0.01$) strength, chair stand time ($p=0.02$), and physical performance battery scores ($p=0.01$).
Wittman et al., 2022 [51]	<ul style="list-style-type: none"> • Satisfaction with sex life • Sexual 	A tailored web-based platform for sexual intimacy delivered over 6 modules.	Online	6 modules, 28 weeks	No significant impact in sexual function between intervention and control group. Partners in

	function				the IG reported more sexual activity (p=0.037) between baseline and 3 months.
Canada et al., 2005 [32]	<ul style="list-style-type: none"> Female sexual function index Distress Quality of life Dyadic adjustment 	Four sessions (approx. 60 mins each) with a counsellor focusing on sexual communication using CBT techniques specific to each partner. Participants were asked to complete homework. In the comparison group, men attended sessions alone.	Face-to-face	4 week course	Females sexual functioning scores significantly improved overtime from baseline to 6 month follow up (p<0.05). No impact on marital adjustment or distress.
Carlson et al., 2017 [52]	<ul style="list-style-type: none"> Mood disturbance 	Six weekly 1.5hr group Supportive Expressive Therapy (SET [®]) sessions focused on coping with distress through emotional expression, discussing uncertainty in a supportive environment, fostering communication, and finding meaning. Sessions were facilitated by two experienced doctoral-level psychologists.	Group sessions (specific modality not identified)	6 week course	Regardless of group membership, partners reported improvements in total mood disturbance (p=.011), tension (p<.001), anger (p=.041), confusion (p<.001), state anxiety (p<.001), and emotional support (p=.037)
Hampton et al., 2013 [30]	<ul style="list-style-type: none"> Sexual functioning Feasibility Acceptability 	One 3.5 hour workshop on sexuality including changes in functionality, understanding values and expectations, maintaining intimacy, committing as a couple to the sexual relationship	Face-to-face	Single session	Partners had significant improvements in medical impact scores (p=0.008) sexual interest (p=0.008), problems (p<0.01) and total sexual function (p=0.011) after the workshop
Karlsen et al., 2017 [42]	<ul style="list-style-type: none"> Erectile functioning (males) 	ProCan- so one-hour couples counselling sessions, one group and three individual PFMT ^o sessions, DVD ^p of PFMT for home training plus standard care including preoperative information.	Face-to-face DVD	6 week course	On average female seal function increased from 15 to 21 from baseline to 12 month follow up.

Levesque et al., 2015 [47]	<ul style="list-style-type: none"> • Biopsychosocial concerns • Perceptions of information received. 	Coping Together - 4 booklets providing information on symptom management, communication with healthcare professionals, support for partners and dealing with emotions. A relation CD ^a , DVD and newsletter were provided as additional supplements.	Hardcopy CD Newsletter	Resource provided post randomisation and accessed as needed.	Top unmet needs were in relation to worries, concerns and emotions. Partners reported receiving less information on self-management and support services than patients and were overall less satisfied with the intervention (P<0.007)
Manne et al., 2011 [36]	<ul style="list-style-type: none"> • Distress, • Wellbeing • Cancer-Specific Distress • Cancer Concerns • Relationship satisfaction • Relationship intimacy 	IET: intervention consisting of five 90 minute couples' sessions. Focus is on improving couples' ability to comfortably share their thoughts and feelings regarding cancer, promote mutual understanding and support regarding their own and one another's cancer experience, facilitate constructive discussion of cancer concerns, and to enhance and maintain emotional intimacy	Face-to-face	8 weeks (5x90 minute sessions)	No significant treatment differences. Moderator effect was found for baseline cancer specific distress (p=0.005), second moderator effect was found for baseline relationship satisfaction (p<0.0001), third moderator effect was found for baseline relationship intimacy (p<0.0001))
Robertson et al., 2016 [38]	<ul style="list-style-type: none"> • Sexual bother subdomain of the Expanded Prostate Cancer Index Composite 	Relational Psychosexual Treatment for Couples With Prostate Cancer: psychosexual intervention comprised of assistance with emotional disclosure, psychoeducation, relational and sexual needs, and dyadic adjustment and coping	Face-to-face	6 X 50 minute sessions - time frame varied per couple	Statistically significant effect on sexual bother immediately following the intervention (p=.04)(patient only). Small decreases in anxiety and depression for the intervention couples - not statistically significant
Song et al., 2021 [50]	<ul style="list-style-type: none"> • Quality of Life 	Prostate Cancer Education and Resources for Couples (PERC ^c) - web-based mHealth program accessible via any device. Includes modules on working effectively as a team,	Online	Accessed as needed	No significant results for carers outcomes.

		<p>assessing and managing prostate cancer treatment-related side effects and symptoms (including urinary and bowel problems, sexual dysfunction, hormonal symptoms, pain, fatigue, sleep disturbance, and stress), and improve healthy behaviours.</p>			
<p>^aIG1= Intervention group one, ^bIG2=intervention group 2, ^cT1= follow up time one, ^dT2 = follow up time 2, ^eTIP-C= Telephone interpersonal counselling, ^fHEAC= health education attention condition, ^gPIP=psychosocial information package, ^hMPI=multimedia psychosocial intervention, ⁱMMA= mobile messaging application, ^jCECT= Cognitive existential couples therapy, ^kIET=Intimacy enhancing therapy, ^lGHW= General health and wellness, ^mFOCUS= Family involvement, optimistic attitude, coping effectiveness, uncertainty reduction, and symptom management, ⁿSET= supportive expressive therapy, ^oPFMT=pelvic floor muscle training, ^pDVD=digital video disc, ^qCD= computerised disc, ^rPERC=prostate cancer education and resources for couples, ^sQOL=quality of life, ^uSD= standard deviation, ^vM=mean.</p>					

Supplementary Table 3. The types of unmet needs addressed in each study, tailoring of content to carers and impact on outcomes														
Authors	Intervention modality	Types of unmet needs that may have been addressed in interventions								Number of supportive care needs	Tailored to carers	Intervention delivery		Impact on outcomes
		Information	Support	Marital	Sexual	Psychological	Practical	Physical	Other			Only to carers	To dyads	
Randomised Controlled Trials														
Borji et al., 2017 [31]	Face-to-face					ü				1	Y ^a	ü		S ^d
Couper et al., 2015 [33]	Face-to-face			ü						1	Y		ü	S
Lyons et al., 2016 [34]	Face-to-face				ü					1	N ^b		ü	S
Manne et al. 2004 [35]	Face-to-face					ü				1	U ^c	ü		S
Winters-Stone et al., 2016 [37]	Face-to-face					ü		ü		2	Y		ü	S
Wittman et al., 2022 [51]	Online				ü					1	Y		ü	S
Badger et al., 2011 [48]	Telephone					ü				1	Y		ü	S
Campbell et al., 2007 [49]	Telephone	ü				ü				2	Y		ü	E ^f
Chambers et al., 2015; 2019 [27, 28]	Combination			ü	ü				ü	2	N		ü	S
Chien et al., 2020 [40]	Combination	ü			ü	ü			ü	4	Y		ü	S
Karlsen et al., 2021	Combination				ü					1	Y		ü	S

[41]														
Malcarne et al., 2018 [39]	Combination					ü				1	Y	ü		S
Manne et al. 2019 [43]	Combination			ü		ü			ü	2	Y		ü	S
McCaughan et al., 2018 [44]	Combination	ü	ü			ü			ü	3	Y		ü	NS ^e
Northouse et al., 2007 [45]	Combination	ü	ü			ü			ü	3	Y		ü	S
Walker et al., 2013 [46]	Combination	ü		ü	ü					3	U		ü	E
Pilot studies														
Canada et al., 2005 [32]	Face-to-face					ü				1	Y		ü	S
Hampton et al., 2013 [30]	Face-to-face					ü				1	Y		ü	S
Robertson et al., 2016 [38]	Face-to-face					ü	ü			2	Y		ü	NS
Manne et al., 2011 [36]	Face-to-face			ü		ü			ü	3	Y		ü	M ^g
Song et al., 2021 [50]	Online					ü				1	Y		ü	NS
Karlsen et al., 2017 [42]	Combination					ü				1	Y		ü	NS
Levesque et al., 2015 [47]	Combination	ü								1	N		ü	NS
Carlson et al., 2017 [52]	NS					ü				1	Y		ü	NS

^aY= yes, ^bN=no, ^cU=unsure, ^dS=significant impact on carers' outcomes, ^eNS= no significant impact on carers' outcomes, ^fE=effect sizes indicate positive change in carers' outcomes, ^gM=moderator effect in carers' outcomes.