Breast Radiotherapy Late Effects: Understanding the Challenge and Emerging Opportunities

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Living with and beyond

- ✅ Improved screening
- ✅ Improved systemic therapies
- ✅ Improved radiotherapy techniques
- ✅ Improved survival outcomes

However…

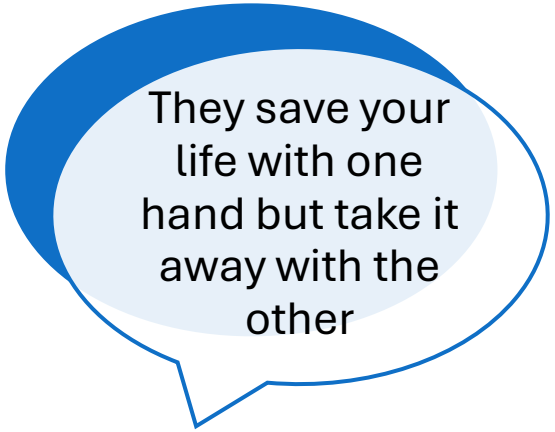
Many patients live for years or decades with the consequences of treatment.

As survival improves, survivorship outcomes matter more than ever.

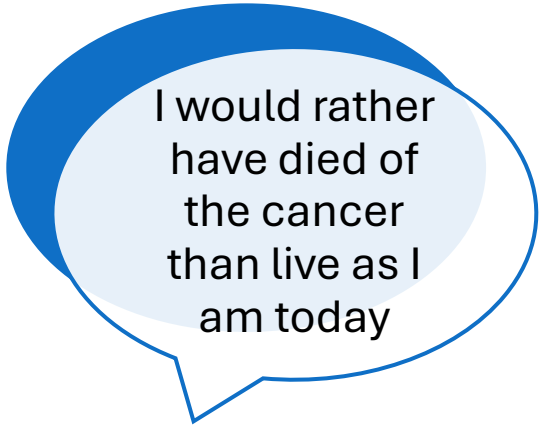
Impact on NHS services

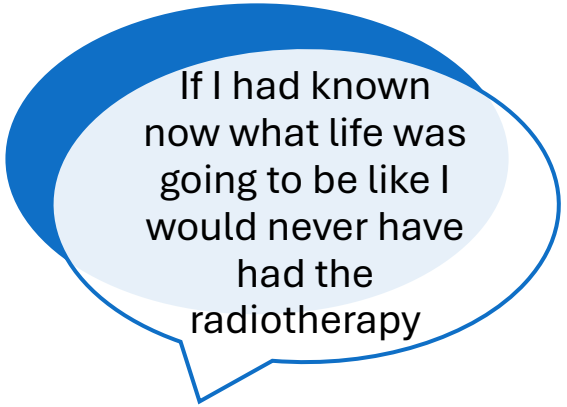
- 3+ million people living with and beyond cancer in the UK
- Over 400,000 new diagnoses each year
- 50% survive 10 years or more
- More than 50% experience at least one late effect
- Increasing numbers of patients are not simply surviving cancer.
- They are living with the long-term consequences of cancer treatment.

The Patient Voice…..









The Growing Challenge of Breast Cancer Survivorship

🎗️ Breast cancer is the most common cancer worldwide.

📈 Nearly 1 in 4 breast cancer survivors develop lymphoedema within 7 years of diagnosis.

📈 30-70% of patients receiving radiotherapy may develop some degree of radiation fibrosis.

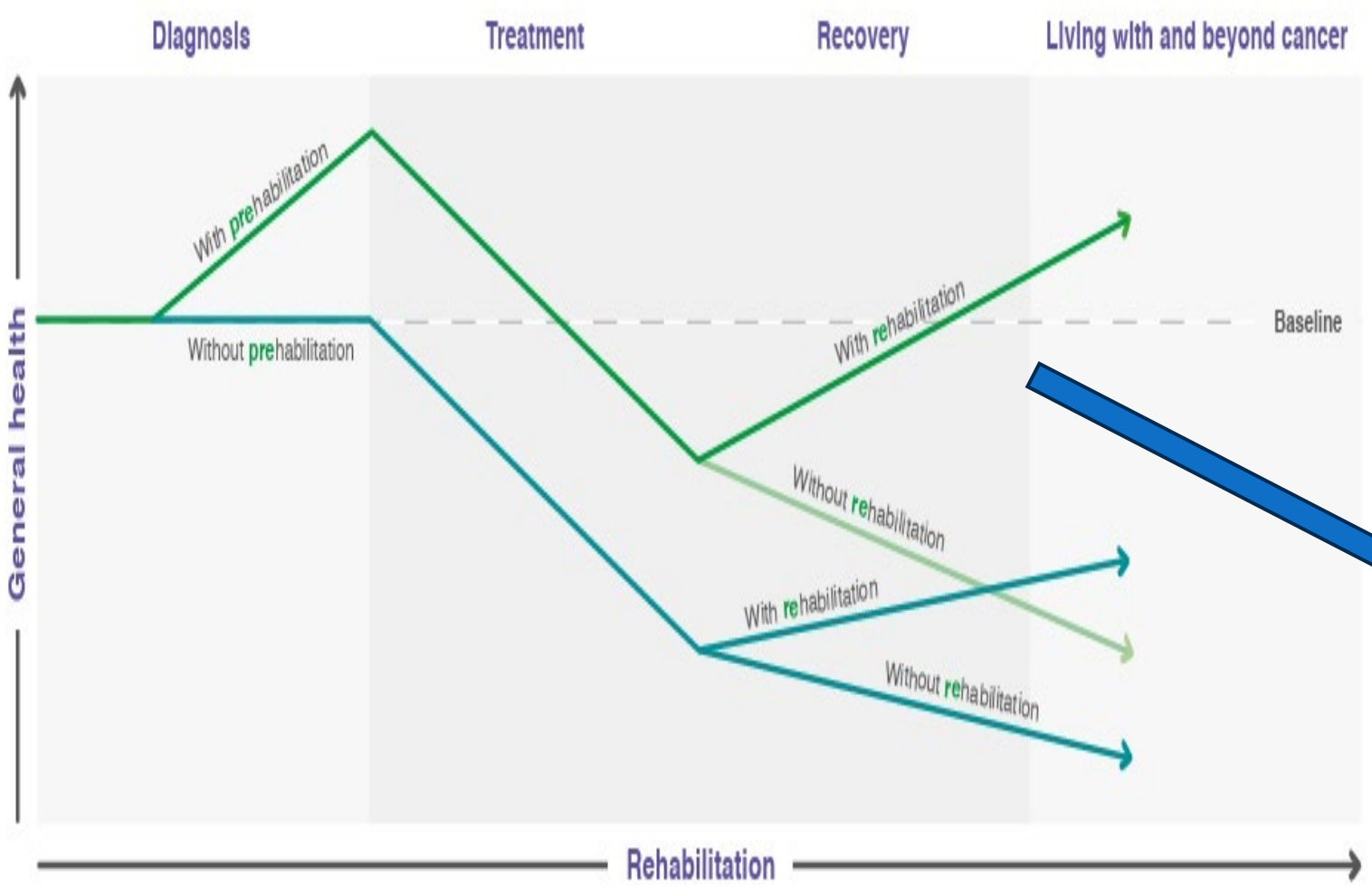
📈 Many patients continue to experience pain, tightness, movement restriction, body image concerns and reduced quality of life years after treatment.

The question is no longer: "How do we treat breast cancer?"
The question is: "Have we normalised toxicities that patients themselves find unacceptable?"
"How do we help people live well after breast cancer? "

Cured but at what cost……

Late Effects, Survivorship &Rehabilitation

Ref: Macmillan Cancer Support. Prehabilitation for people with cancer



Does this include management of late effects?

Prehabilitation, restorative and early supportive rehabilitation:

- Minimise deconditioning Promote recovery of acute effects
- Promoting healthy behaviours in the longer term

Late effects will still occur!

Long term, supportive and palliative rehabilitation vital

A Changing Model of Cancer Care

Traditional Follow-up

- Disease recurrence
- Surveillance
- Acute toxicity

Modern Survivorship Care Includes:

- ✅ Function
- ✅ Quality of life
- ✅ Rehabilitation
- ✅ Self-supported management
- ✅ Long-term toxicity
- ✅ Holistic care

Late Effects Clinics Are Growing Because
Patients often fall between services:
Not actively undergoing treatment
Not palliative
Not disease free from symptoms
Late effects services are providing a "home" for patients with chronic cancer treatment-related toxicity.

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South West Radiotherapy Late Effects Services

East Midlands Late Effects Network
Established 2023

RADIOTHERAPY LATE EFFECTS SERVICE
EAST OF ENGLAND

Late effects services providing bespoke support to help patients manage the consequences from radiotherapy treatment

Nottingham Data

2,359 new patients since Sept 2014

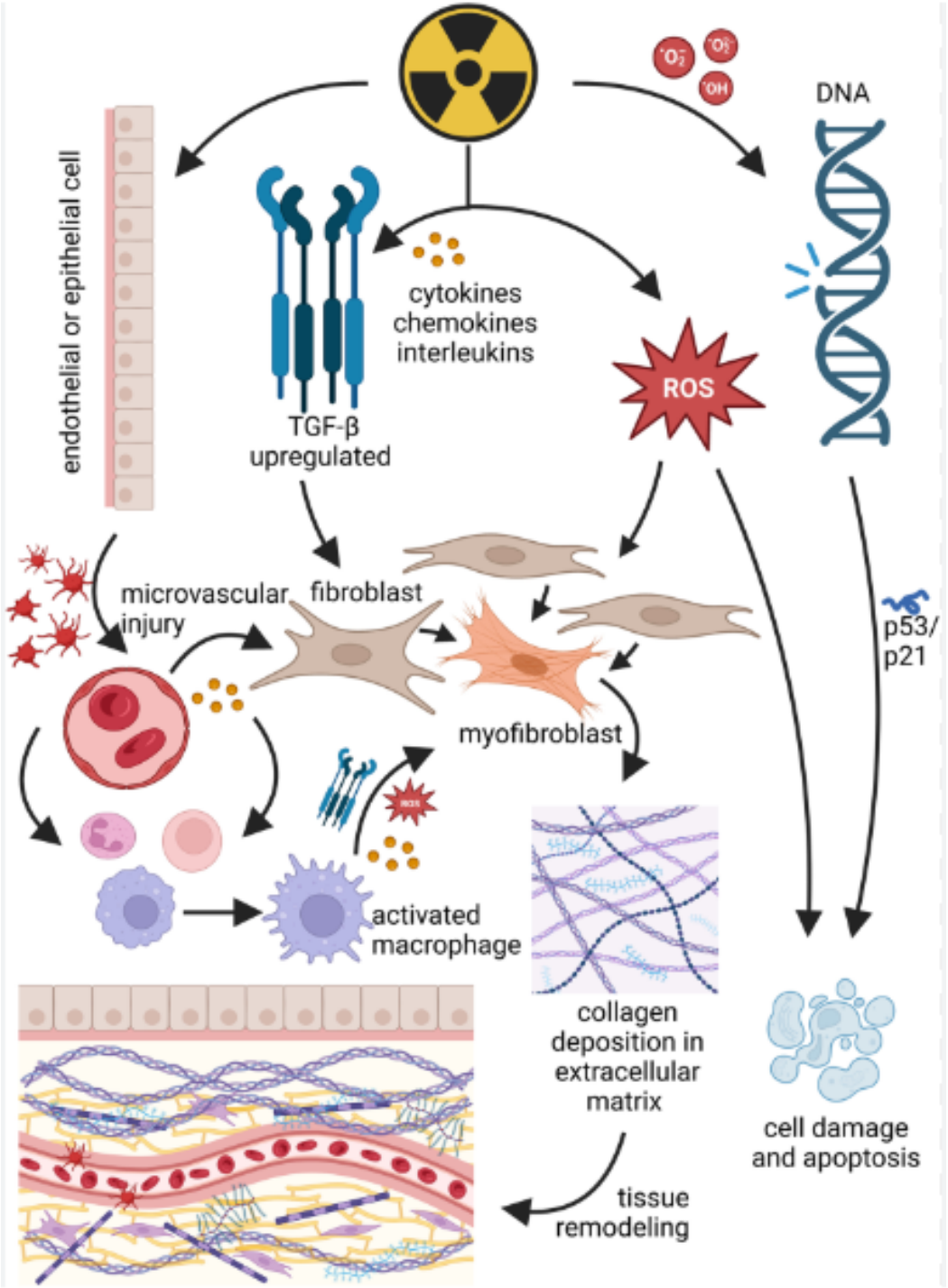
Longest post treatment 54 years

40 new breast referrals year

Longest breast post treatment 24 years

Radiation-Induced Fibrosis (RIF)

- A progressive, sclerotic disorder with many varying clinical symptoms
- 3 phases: Pre-fibrotic, Organised fibrosis, Late fibro-atrophic
- Compresses peripheral nerve tracts, tissue & muscle atrophy, brittle bones, vascular & lymphatic compromise
- Progressive, irreversible tissue compromise and stiffening
- Significant impact on function and QoL



Late fibro-atrophic phase; Point of No Return

Final, chronic stage of tissue injury.

Dynamic healing process stalls out into a static, scarred, and poorly vascularised state.

At this stage, the initial inflammatory "storm" has passed, leaving behind a depleted cellular landscape.

The primary characteristics include:

- Hypocellularity: The tissue becomes remarkably empty
- Avascularity & Ischemia: Small blood vessels and capillaries are destroyed
- Dense Collagen Deposition: The extracellular matrix is dominated by thick, disorganised bundles of Type I collagen



Breast RIF Features	Pre-Fibrotic (Inflammatory)	Active Fibrosis	Late Fibrotic / Atrophic
Pathophysiology	• Chronic inflammation • Endothelial dysfunction • Early fibroblast activation	• Myofibroblast proliferation • Progressive collagen deposition • Active tissue remodelling	• Dense collagen matrix • Reduced vascularity • Tissue atrophy and fixation
Tissue Changes	• Early fibro-lymphatic change • Oedema-dominant tissue	• Focal fibrosis (tumour bed) • Diffuse fibrosis • Subcutaneous fibrosis • Parenchymal fibrosis	• Advanced diffuse fibrosis • Dermal fibrosis • Fixed subcutaneous fibrosis
Clinical Features	• Breast heaviness • Mild swelling • Texture change • Early discomfort	• Firmness / induration • Tissue thickening • Reduced mobility • Localised palpable areas • Pain	• Breast shrinkage / asymmetry • Skin thickening ± telangiectasia • Chest wall fixation • Functional restriction • Reduced quality of life
Potential Opportunity	🟢 Highest potential for prevention	🟠 Active rehabilitation and remodelling	🔴 Focus on symptom management and function













WHAT DOES FIBROSIS LOOK LIKE

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Soft Tissue
Fibrosis
Breast firmness
Skin thickening
Tissue contracture
Musculoskeletal
Shoulder dysfunction
Reduced range of movement
Chest wall tightness
Neck and upper limb pain

Lymphatic
Breast lymphoedema
Arm lymphoedema
Truncal lymphoedema
Neurological
Altered sensation
Neuropathic pain
Brachial plexopathy (rare)
Cosmetic
Breast asymmetry
Retraction
Tissue distortion





Patients present with 1 or more consequences

- Psychological challenges
- Survivors guilt
- Adjustment difficulties
- Relationship and social changes
- Body image concerns
- Sexual difficulties
- Educational Challenges
- Vocational Challenges
- Reduced Cognitive Function



What can we do to reduce the impact of late effects?

- Early identification of late effects
- Validation
- Fibrosis & oedema management
- Patient education







Current Treatment Approaches

Physical/Therapy Management
Skin care
Stretching programmes
Physiotherapy
Pilates
Exercise
Scar mobilisation
Relaxation & mindfulness

Lymphoedema Management
SLD
Compression
Exercise
Self-management

Medical Treatments

Pentoxifylline

Vitamin E

Analgesia

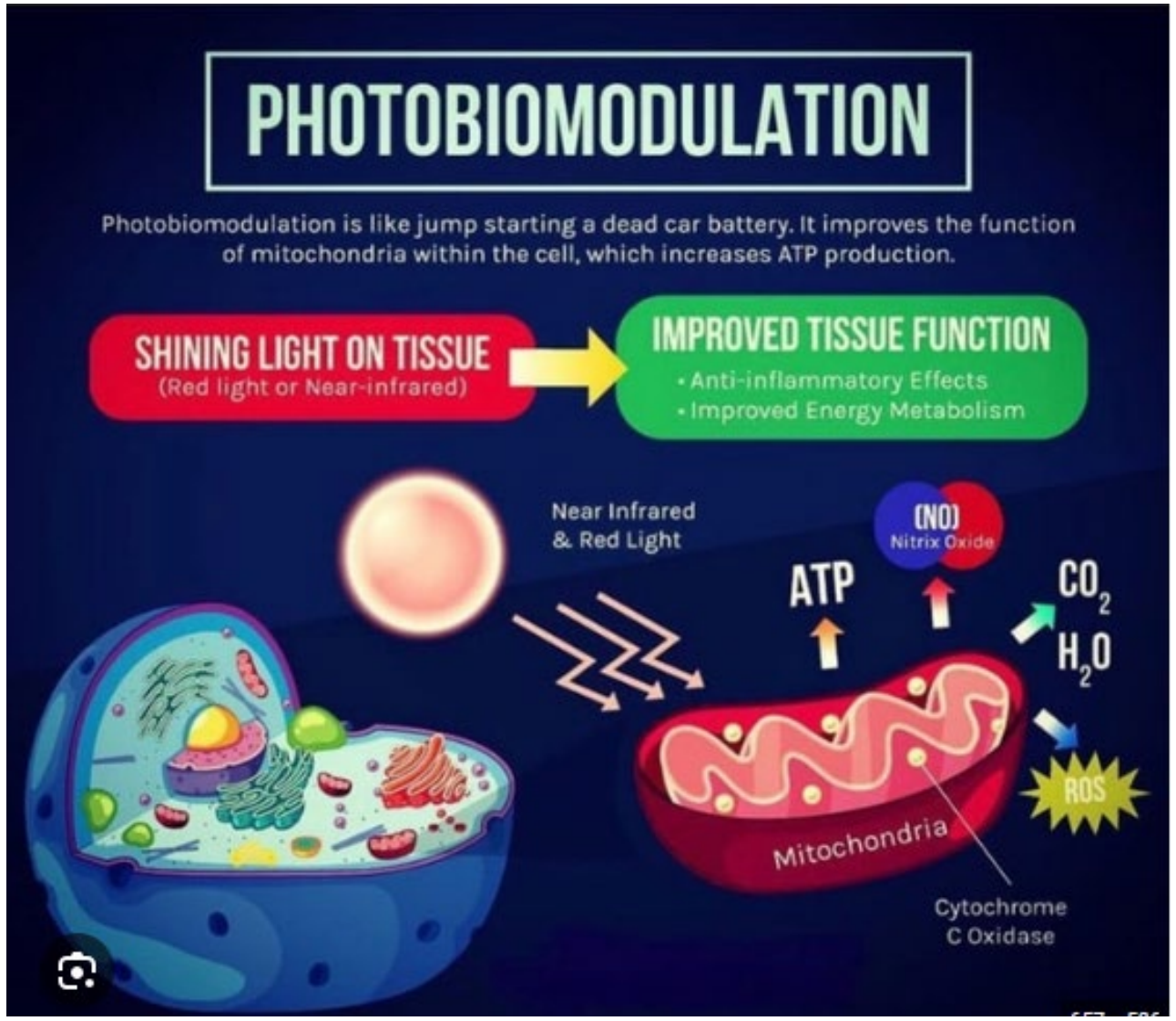
Psychological Support

Anxiety management

Confidence rebuilding

Body image support

Photobiomodulation Therapy



Targeting the Biological Drivers for RIF

Increased ATP Production (Increased cellular Energy)
Enhances cell proliferation and tissue repair in fibrotic areas
Modulation of Reactive Oxygen Species (ROS) and Nitric Oxide (NO)
Promotes repair signalling and improves blood flow via vasodilation, increasing oxygen and nutrient delivery
Reduced Inflammation
Helps prevent chronic inflammatory state seen in radiation fibrosis
Reduced Pain
Provides an analgesic effect and improves patient symptoms

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PBM may help by:

✅ Modulating inflammation
✅ Improving microcirculation
✅ Enhancing cellular signalling
✅ Supporting tissue repair
✅ Influencing collagen remodelling

Benefits in practice

- Reduced tissue tightness
- Improved movement
- Improved function
- Reduced pain
- Enhanced quality of life

Current Status

Evidence is emerging but remains limited.

Nottingham data

- Observed improvements across multiple domains
- Supports survivorship care models
- 93% clinically recorded improvement
- 79 % patients reported an improvement in QoL



Patient Testimonials

This has been life changing

The LEs clinic has literally saved my life. Previously I was existing in spite of how I had been left post treatment and felt terribly isolated

My experience with the LEs team has been life changing. The expert advice and compassionate guidance empowered me to manage and reduce my side effects. Thank you for helping me rediscover my strength and very importantly my independence, I am forever grateful

Gave me hope that the ever-current problem may be able to be controlled

The Future of Breast Late Effects Management

- ✅ Integrated survivorship services
- ✅ Late effects services & networks
- ✅ Rehabilitation pathways
- ✅ Earlier intervention
- ✅ MDT-led care

Research Priorities

- 🔬 PBM
- 🔬 Fibrosis interventions
- 🔬 Functional outcomes
- 🔬 Quality of life
- 🔬 Patient-reported outcomes

Take Home Messages

Breast RT late effects are common and under recognised

Radiation-induced fibrosis is a progressive biological process

Fibrosis rarely occurs in isolation

Multidisciplinary rehabilitation remains essential

PBM, an emerging area of interest with potential to reverse RIF

High-quality research is needed to establish its role

To Conclude

Living with and beyond cancer to be recognised as a complex long-term condition

Embedding late effects management as a core component of supportive oncology is essential

Without proactive management, late effects will drive a substantial and unsustainable clinical and economic cost

No longer acceptable to focus on acute toxicity & survival rates

Patients subjective bother and what matters to them

Need to improve quality of life, enabling people to thrive in the context of the consequences they are living with

Any Questions?

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