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Multicancer Detection Using Whole-Body MRI in a Preventive Health Population: A Retrospective Observational Study of 1,011 Individuals

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Abstract

Background: Single-cancer screening (SCS) reduces mortality for select cancers but overlooks many malignancies that contribute to overall cancer deaths. Screening whole-body MRI (sWB-MRI) is an emerging modality for multi-cancer detection (MCD) with potential in preventive care. We assessed the diagnostic yield and clinical implications of sWB-MRI in a preventive health population.

Methods: In this retrospective single-center study, we evaluated 1,011 individuals without known active cancer who underwent noncontrast, multiparametric sWB-MRI (1.5 T with diffusion-weighted imaging) from January to December 2022. Of 2,632 individuals scanned, 1,044 (39.7%) completed routine clinical follow-up telephone calls approximately 12-16 months later; 33 with known active cancer were excluded. Imaging spanned head-to-ankle anatomy for the vast majority of studies, with structured reports available for primary care physician review. The primary outcome was the observed cancer detection percentage (CDP), based on patient-reported histopathological diagnoses of malignancy following evaluation or management of findings initially identified on sWB-MRI, along with the distribution of cancer types relative to established screening categories.

Results: The cohort consisted of 52% males, with a mean age of 56.4 ± 12.9 years. Tissue sampling was reported in 4.9% (n = 50), with diagnostic-intent tissue sampling (dTS) in 4.1% (n = 41). The overall cancer detection percentage (O-CDP) was 2.18% (95% CI: 1.37%-3.28%), with 3.0% observed among those aged 65-79 years. Of 22 detected cancers, 15 (68.2%) belonged to cancer types outside the five predefined SCS categories, and one (4.5%) was of unknown primary origin. Fourteen cancers (63.6%) were retrospectively estimated to have localized disease. Two additional interval breast cancer diagnoses (0.2%) were reported during follow-up but were not identified in the original sWB-MRI reports. Clinically significant noncancer findings (e.g., aneurysms, meningiomas, hepatosteatosis) were associated with reported subsequent clinical interventions or monitoring.

Conclusions: In this population, sWB-MRI enabled broad detection of some cancers not typically identified by SCS. The findings highlight the need to explore MCD imaging in larger, risk-stratified cohorts to inform screening policy, address missed cancer burdens, and enhance early detection strategies in population health. Prospective studies with standardized reporting frameworks (ONCO-RADS) and long-term outcomes are needed to support broader clinical integration.

Categories: Radiology, Oncology, Healthcare Technology
Keywords: cancer screening, diffusion-weighted imaging (dwi), early detection, multi-cancer detection, onco-rads, preventive health, whole-body mri

Introduction

Cancer remains a leading cause of death worldwide, with major gaps in early detection contributing to late-stage diagnoses and reduced survival outcomes [1]. Single-cancer screening (SCS) methods, such as mammography for breast cancer, low-dose computed tomography (CT) for lung cancer, colonoscopy for colon cancer, or Pap smears for cervical cancer, have led to earlier detection and improved survival outcomes in specific populations [2-5]. However, these approaches are targeted to individual cancers and predefined screening populations with specific risk profiles, leaving many cancers undetected until advanced stages. Notably, approximately 70% of cancer-related deaths in the United States result from cancers that lack routine screening methods, and only 14% of all diagnosed cancers are diagnosed after initial detection through a dedicated screening program [6]. This highlights a critical unmet need for strategies capable of broadening the scope of early detection.

Multicancer detection (MCD) technologies have emerged to address this gap by identifying multiple cancers through a single screening encounter [7]. Among the most established MCD approaches are blood-based techniques, such as those analyzing circulating tumor DNA (ctDNA), which is a tumor-specific subset of cell-free DNA (cfDNA) fragments that may circulate in the blood outside their cells of origin [8]. These methods have gained significant attention because of the hope that they may offer earlier cancer detection while achieving high specificity and minimal invasiveness [9]. Imaging-based approaches, such as whole-body MRI (WB-MRI), present an alternative or complementary modality within the MCD paradigm.

When optimized with carefully designed technical parameters, WB-MRI can integrate structural anatomical imaging with cellular-level functional imaging in a streamlined 30-50-minute protocol [10]. This positions WB-MRI as a potentially valuable tool at the point of screening in routine proactive and preventive healthcare, alongside periodic general health maintenance checkups. By facilitating noninvasive, efficient, and high-yield examination of the entire body, WB-MRI can enable detection of a wide spectrum of clinically relevant findings, including opportunistic detection of solid-tumor malignancies, without involving ionizing radiation.

Contemporary state-of-the-art screening WB-MRI techniques incorporate multiparametric protocols optimized to help with cancer detection, preferably performed without contrast injection in the screening context [11]. A cornerstone of these protocols is whole-body diffusion-weighted imaging (WB-DWI), which enhances tumor imaging capabilities independent of contrast injection. WB-DWI identifies signal changes indicative of restricted molecular water motion, a hallmark of increased cellular density often associated with solid neoplastic lesions. These signal changes generate strong endogenous image contrast, sharply delineating them from the relatively suppressed signal observed in normal background tissue on diffusion-weighted images [12]. This functional imaging capability complements structural anatomical imaging, offering an added dimension for helping identify and characterize neoplastic lesions [13].

Advances in screening WB-MRI protocol design, exemplified by the publication of the Oncologically Relevant Findings Reporting and Data System (ONCO-RADS) technical consensus guidelines in 2021, have standardized the integration of WB-DWI, clearly distinguishing modern techniques from earlier approaches that lacked these refinements [10]. A 2020 meta-analysis demonstrated that only five of 12 studies using WB-MRI for cancer screening in the general population incorporated WB-DWI; of these, four were small cohorts of 10-209 participants, and only one included more than 1,000 subjects [11]. More recently, Martins da Fonseca et al. (2025) [14] reported a pooled cancer detection rate of 1.57% across 10 studies involving more than 9,000 asymptomatic individuals, while Ahsan et al. (2026) [15] reported a pooled rate of 1.4% (95% CI, 0.9%-2.2%) among 4,463 participants in 11 studies with pathologically confirmed cancer outcomes. However, methodological differences were evident: several pre-2021 studies lacked WB-DWI coverage, and even post-ONCO-RADS cohorts (e.g., Hu et al. (2024) [16]) diverged from guidelines by using contrast agents and region-limited DWI. In contrast, the standardized noncontrast sWB-MRI protocol, with WB-DWI, referred to here as "sWB-MRI," is more closely aligned with ONCO-RADS principles and offers a consistent platform for MCD, while not replacing site-specific or contrast-enhanced diagnostic MRI when clinically indicated.

In this retrospective study, we evaluated patient-reported diagnostic outcomes following elective screening whole-body MRI (sWB-MRI) in a preventive health cohort without known active cancer at the time of scanning. The primary objective was to estimate the observed cancer detection percentage (CDP) among participants with available clinical follow-up, based on patient-reported histopathological diagnoses of malignancy following evaluation of findings initially identified on sWB-MRI. Secondary descriptive objectives included the frequency of reported interval cancers and the distribution of detected cancer types relative to established SCS categories. Additional exploratory objectives included retrospectively estimated cancer stage distribution and clinically significant noncancer findings associated with subsequent clinical management. The study was designed to characterize observed diagnostic outcomes rather than establish screening accuracy, comparative effectiveness, or clinical benefit.

Materials And Methods

Study design

This retrospective observational study evaluated the diagnostic outcomes of elective screening whole-body MRI (sWB-MRI) in a proactive health-screening population. The study was conducted at a single specialized WB-MRI clinic in Vancouver, Canada, analyzing scans performed between January and December 2022. The present analysis retrospectively evaluated clinical sWB-MRI imaging data obtained at the time of scanning, together with patient-reported outcomes collected through routine clinical continuity-of-care follow-up calls approximately 12-16 months later; these calls were not conducted as study-specific research procedures. This study was performed in compliance with the study protocol entitled "Whole Body Multi-Parametric MRI For Cancer And Disease Screening," which was approved by the Institutional Review Board (IRB) Advarra (approval number: Pro00082043), and it was conducted in accordance with the ethical standards outlined in the Declaration of Helsinki. Advarra IRB is registered with the Office for Human Research Protections (OHRP) and the Food and Drug Administration (FDA) under IRB registration number IRB00000971. Data for this retrospective study were accessed on November 1, 2024. Only authors directly

involved in the clinical care of patients had access to identifiable information, which was limited to screening WB-MRI, follow-up continuity-of-care, and associated medical record documentation. Authors not involved in patient care did not have access to identifiable data at any stage. All identifiable information was removed before data extraction and analysis.

Participants

The analytic cohort included adults who underwent elective sWB-MRI for preventive health evaluation and had documented patient-reported clinical follow-up data obtained at least 12 months after scanning. Individuals with a malignancy already diagnosed and considered active at the time of the index sWB-MRI were excluded. A previous personal history of cancer without known active disease, as well as reported symptoms or general health concerns, did not preclude inclusion. Standard MRI safety contraindications, pregnancy, and age under 18 years were exclusion criteria.

sWB-MRI protocol

sWB-MRI examinations were performed on a Siemens Espree 1.5-T MRI scanner (Siemens Healthineers, Erlangen, Germany) using a multiparametric protocol developed to approach the technical acquisition recommendations of the ONCO-RADS framework [10]. The standard protocol included coronal T1-weighted and short tau inversion recovery (STIR) imaging from head to ankles and diffusion-weighted imaging (DWI) with apparent diffusion coefficient (ADC) maps from head to upper thighs, supplemented by region-specific sequences detailed in the Appendices. Standard examinations were performed in approximately 60-minute sessions, subsequently optimized to 45 minutes. The complete head-to-ankle protocol was acquired in 87% of cases, while 7% underwent abbreviated head-to-torso examinations and 6% underwent torso-only examinations, at patient discretion. All examination variants included DWI/ADC, T1-weighted, and T2-weighted imaging within the anatomical regions covered. Although the lungs and breasts were included within the anatomical field of view, the protocol did not incorporate dedicated breast or lung cancer screening sequences.

No ionizing radiation was involved. No contrast injections were used. Participants were instructed to fast for four hours before scanning, though no additional preparation was required. Image examples from selected sequences are shown in a collage in Figure *1*.

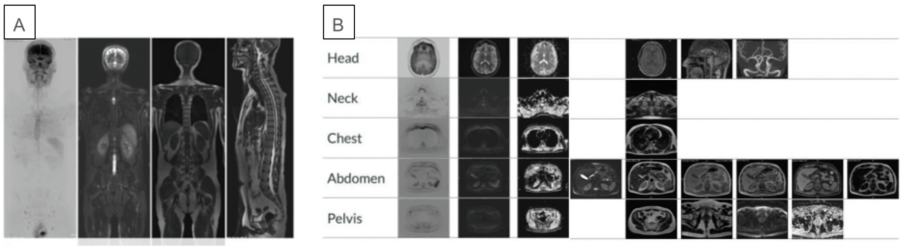


FIGURE 1: Snapshot of Our Comprehensive Multiparametric Screening Whole-Body Magnetic Resonance Imaging (sWB-MRI) Protocol

Panel A shows the following sequences from left to right: coronal whole-body diffusion-weighted imaging (WB-DWI), coronal whole-body short tau inversion recovery (WB-STIR), coronal whole-body T1-weighted imaging (WB-T1), and sagittal whole-spine T2-weighted imaging. Images of the lower extremities extending through the ankles are not included in the snapshot.

Panel B shows the following sequences from left to right, grouped by anatomical region.

Head: Axial diffusion-weighted imaging (DWI) with high b-value, axial DWI with low b-value, axial apparent diffusion coefficient (ADC) map, axial fluid-attenuated inversion recovery (FLAIR), sagittal T1-weighted imaging, magnetization-prepared rapid gradient echo (MPRAGE), and three-dimensional time-of-flight magnetic resonance angiography (3D TOF MRA).

Neck: Axial DWI with high b-value, axial DWI with low b-value, axial ADC map, and axial T2-weighted imaging.

Abdomen: Axial DWI with high b-value, axial DWI with low b-value, axial ADC map, axial T2-weighted fat-suppressed half-Fourier acquisition single-shot turbo spin echo (T2-FS HASTE), axial T2-weighted imaging, T1-weighted Dixon in-phase (IP), T1-weighted Dixon opposed-phase (OP), T1-weighted Dixon fat-suppressed (FS), and T1-weighted Dixon water-suppressed (WS) imaging.

Pelvis: Axial DWI with high b-value, axial DWI with low b-value, axial ADC map, large-field-of-view T2-weighted imaging, prostate (male) small-field-of-view (FOV) T2-weighted imaging, prostate (male) small-FOV DWI, and prostate (male) small-FOV ADC map.

Images were created using Figma (Figma, Inc., San Francisco, California) and Microsoft PowerPoint (Microsoft Corporation, Redmond, Washington).

Follow-up and data collection

sWB-MRI examinations were generally interpreted independently by a single radiologist using a structured, organ-by-organ reporting platform. Reports were organized into seven anatomical regions (head, neck, chest, abdomen, pelvis, spine, and musculoskeletal), each subdivided into organ-specific sections containing predefined condition templates for documenting individual findings, with free-text descriptions also permitted. Each finding included a description, an individualized severity/urgency grade, and a corresponding natural-language recommendation. Radiologists had access to the participant's medical intake form, including available clinical history and reported symptoms. Formal ONCO-RADS 1-5 scoring was not implemented in 2022, and examinations were not assigned a predefined binary positive/negative oncologic screening designation. Routine double reading or consensus interpretation was not performed. Reports were provided for review by participants' primary care or treating clinicians, who determined subsequent diagnostic evaluation based on the imaging findings and broader clinical context.

Approximately 12-16 months after their sWB-MRI examinations, participants were contacted by telephone as part of a piloted routine clinical continuity-of-care process. These calls were conducted for clinical follow-up rather than as dedicated research procedures. All follow-up calls included in the present analysis were conducted by a single investigator (M.D.) in a conversational format. Although a formal written questionnaire or validated interview instrument was not used for these calls, the clinical inquiries consistently addressed core domains, including cancer diagnoses occurring since the scan; whether subsequent diagnoses were associated with findings identified on sWB-MRI or diagnosed independently; tissue sampling and patient-reported malignant or nonmalignant biopsy outcomes; and follow-up of other clinically significant imaging findings, including reported clinical management or surveillance. Responses were recorded in a standardized data collection spreadsheet using predefined clinical outcome categories, supplemented by free-text information when appropriate. The present study retrospectively analyzed these previously collected clinical follow-up data.

Outcome measures

The primary descriptive outcome was the CDP, calculated as the proportion of participants with available

follow-up data who reported a histopathological diagnosis of malignancy following clinical evaluation or management of a finding initially identified on sWB-MRI. Cancer diagnoses and biopsy outcomes were ascertained through patient-reported clinical follow-up rather than independent review of source histopathology reports or treating-provider medical records. Accordingly, CDP represents the observed proportion of patient-reported, biopsy-associated cancer diagnoses within the follow-up cohort.

Tissue-sampling outcomes were further categorized retrospectively according to the reported primary purpose of the procedure. Diagnostic-intent tissue sampling (dTS) was defined as tissue sampling performed primarily to establish or exclude malignancy. Clinically indicated tissue sampling was defined as tissue obtained during procedures undertaken primarily for other clinical or therapeutic indications, including symptomatic disease requiring surgical intervention. The diagnostic-intent tissue-sampling CDP (dTS-CDP) was calculated as the proportion of dTS cases associated with a patient-reported malignant histopathological diagnosis. This descriptive measure is conceptually analogous to biopsy-level positive predictive value (PPV3), although it was not derived from a prospectively standardized screening-to-biopsy pathway.

Secondary descriptive outcomes included the frequency of patient-reported interval cancers, defined as cancers diagnosed during follow-up that were not identified in the original sWB-MRI reports, and the distribution of detected cancer types relative to established SCS categories. For this analysis, cancer types were classified according to whether they belonged to one of five organ-specific screening categories (breast, colorectal, lung, cervical, or prostate cancer), irrespective of individual patient eligibility for screening based on age or other risk factors. Cancers of unknown primary origin were retained as unclassified.

Additional exploratory outcomes included retrospectively estimated anatomical disease extent for detected malignancies, categorized using a Surveillance, Epidemiology, and End Results (SEER)-style localized/regional/distant framework. These estimates were assigned retrospectively by a radiologist co-author based primarily on the original sWB-MRI findings, supplemented by available patient-reported clinical information, without formal tumor, node, and metastasis (TNM) or SEER staging adjudication. Other exploratory outcomes included clinically significant noncancer findings associated with patient-reported subsequent medical intervention, surgery, or active clinical monitoring. These noncancer outcomes were summarized at the finding level rather than the participant level, allowing individual participants to contribute more than one finding.

Statistical analysis

Descriptive statistics were used to characterize the analytic cohort. Continuous variables were summarized using means, standard deviations, medians, and ranges, while categorical variables were summarized using counts and percentages. CDPs were calculated overall and across demographic, lifestyle, screening-motivation, and cancer-history subgroups. Exact binomial 95% confidence intervals were reported for the overall CDP and the subgroup estimates presented in Table *3*, using the University of California, San Francisco (UCSF) Clinical and Translational Science Institute (CTSI) Sample Size Calculators [17]. Subgroup analyses were descriptive and exploratory; no formal hypothesis testing or adjustment for potential confounding was performed. No a priori sample size calculation was conducted, as the retrospective analysis included all eligible participants with available clinical follow-up data.

Results

Study cohort characteristics

Of the 2,632 individuals who underwent sWB-MRI during the study period, 1,044 (39.7%) completed follow-up telephone interviews to capture patient-reported clinical outcomes at least 12 months after scanning. The remaining 1,588 (60.3%) did not provide follow-up interview data. Among respondents, 33 individuals with known active cancer at the time of scanning were excluded, as they were not considered true screening participants. The remaining 1,011 participants constituted the analytic cohort, comprising 526 males (52%) and 485 females (48%), with a mean age of 56.4 ± 12.9 years (range: 22-89 years). Figure *2* presents the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) participant flow diagram.

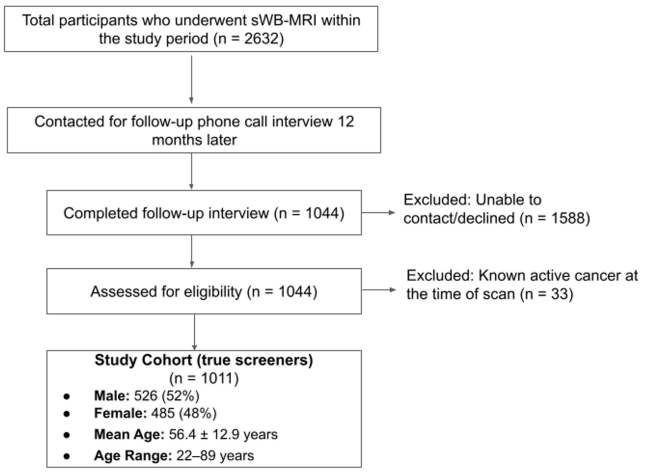


FIGURE 2: STROBE Participant Flow Diagram

STROBE: Strengthening the Reporting of Observational Studies in Epidemiology; sWB-MRI: screening whole-body MRI.

The Image was created using Microsoft PowerPoint (Microsoft Corporation, Redmond, Washington).

Participants completed standardized Medical Intake Forms (MIFs), selecting one of three primary reasons for undergoing sWB-MRI: (1) "being proactive," (2) "general concerns," or (3) "specific symptoms." Participants could also provide additional details in optional free-text fields, which radiologists could reference on a case-by-case basis during sWB-MRI review. However, these free-text responses were heterogeneous and nonstandardized and were not analyzed further in this study. Among the 1,011 participants, 646 (63.8%) identified "being proactive" as their primary motivation. Another 183 (18.1%) cited "general concerns," such as a family history of cancer, prolonged smoking, or unexplained pain, among others. Meanwhile, 182 (18.0%) reported "specific symptoms," including but not limited to weight loss, headaches, or abdominal pain.

Nine radiologists interpreted the sWB-MRI examinations, with five accounting for approximately 90% of cases (12%, 15%, 15%, 16%, and 32%, respectively). The mean follow-up interval was 13.98 ± 1.53 months (median: 14 months; range: 12-16 months). Most participants (92.3%) reported reviewing their sWB-MRI results with their primary care physician.

Cancer detection percentage

Following sWB-MRI, 50 participants (4.9%) reported undergoing tissue sampling associated with the evaluation or management of imaging findings. Of these, 41 participants (4.1%) underwent diagnostic-intent tissue sampling (dTS), while nine (0.9%) underwent tissue sampling during procedures performed primarily for other clinical or therapeutic indications. The reported tissue-sampling outcomes, stratified by primary procedural indication, are summarized in Table *1*.

Body region	Tissue sampling/biopsy frequency	Biopsy-confirmed cancer (n)	Other reported tissue-sampling outcomes (n)
Diagnostic-intent tissue sampling (dTS)[a]			
Total	41	21	20
Neck	16	Thyroid cancer (4)	Non-cancerous thyroid nodule (11); indeterminate thyroid nodule (1)
Chest	3	Breast cancer (1); Hodgkin's lymphoma (1); malignant thymoma (1)	
Abdomen	7	Leiomyosarcoma (1); liver metastasis, recurrence from primary breast CA (1); renal cell carcinoma (3); malignant neuroendocrine tumor with metastasis to liver, lungs (1)	Reported low-mitotic-rate GIST (1)[c]
Pelvis	12	Prostate cancer (2); ovarian cancer (1); bladder cancer (2)	Non-cancerous prostate lesion (3); non-cancerous cervical mass (1); non-cancerous endometrial polyp (2); non-cancerous adnexal cystic mass (1)
Extremities	3	Bone metastasis, recurrence of prostate primary CA (1); bone metastasis, recurrence of breast primary CA (1); femoral metastasis of unknown primary malignancy (1)	
Clinically indicated Tissue sampling[b]			
Total	9	1	8
Head	3	Glioblastoma (1)	Meningioma (2)
Abdomen	1		Non-cancerous gallbladder dilation and wall thickening (1)
Pelvis	4		Ovarian cystic mass (1); endometrial polyp (1); hydrosalpinx (1); scrotal cyst (1)
Spine	1		Non-cancerous tumor (1)

TABLE 1: Biopsy Outcomes by Body Region and Indication

Biopsy outcomes as reported by patients during follow-up phone calls. Histopathological reports were not available, as acknowledged in the limitations of the study.

[a]Primary indication of tissue sampling was to rule out the presence of cancer.

[b]Tissue sampling was done secondary to surgical excision due to clinical indications such as symptomatic concerns (not primarily for diagnostic purposes).

[c]The reported low-mitotic-rate GIST was not included among the 22 cancer diagnoses because its malignant potential could not be reliably characterized from the available patient-reported information. This exclusion should not be interpreted as confirmation of benign biological behavior.

Among the 1,011 participants comprising the analytic cohort, 22 reported malignancies diagnosed following the evaluation or management of findings initially identified on sWB-MRI, corresponding to an observed overall CDP (O-CDP) of 2.18% (95% CI: 1.37%-3.28%). Of the 41 diagnostic-intent tissue-sampling cases, 21 resulted in patient-reported malignant diagnoses, yielding a dTS-CDP of 51.2% (95% CI: 35.1%-67.1%). The remaining malignancy was a glioblastoma for which tissue was obtained during therapeutic surgical resection prompted by the development of symptomatic disease rather than a dedicated diagnostic biopsy. Accordingly, this case contributed to the O-CDP but was excluded from the dTS-CDP.

Detected cancers

A total of 22 malignancies were reported following evaluation of sWB-MRI findings, including four thyroid

cancers, three renal cancers, two bladder cancers, three prostate cancers (including one recurrence), and three breast-related cancers (including two metastatic recurrences). Additional malignancies comprised one case each of glioblastoma, leiomyosarcoma, neuroendocrine tumor, Hodgkin lymphoma, ovarian cancer, and malignant thymoma, as well as one femoral metastasis of unknown primary malignancy. Figure 3 illustrates the sWB-MRI findings of two representative malignancies: leiomyosarcoma and renal cell carcinoma.

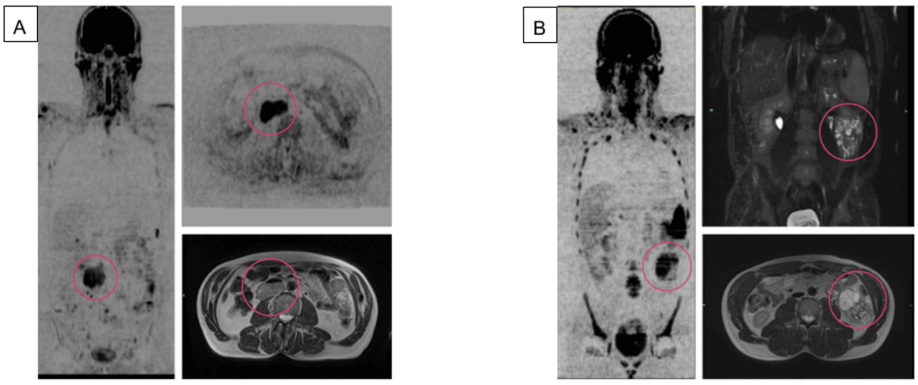


FIGURE 3: Illustration of Cancer Detected on Screening WB-MRI

Case A: A 60-year-old male had a right retroperitoneal prevertebral solid mass with marked diffusion restriction (red circle), subsequently confirmed histopathologically as leiomyosarcoma. Images include coronal WB-DWI (left panel), axial WB-DWI (upper right), and axial T2 (lower right).

Case B: A 47-year-old male had a suspicious heterogeneous exophytic mass arising from the lower pole of the left kidney (red circle), subsequently confirmed histopathologically as clear cell renal cell carcinoma. Images include coronal WB-DWI (left panel), coronal STIR (upper right), and axial T2 (lower right).

WB-MRI: whole-body magnetic resonance imaging; WB-DWI: whole-body diffusion-weighted imaging; STIR: short tau inversion recovery.

The images were created using Figma (Figma, Inc., San Francisco, California) and Microsoft PowerPoint (Microsoft Corporation, Redmond, Washington).

Among the 22 reported malignancies, 19 (86.4%) occurred in participants who did not report specific symptoms as their primary motivation for undergoing sWB-MRI. Fifteen malignancies (68.2%) belonged to cancer types outside the five predefined SCS categories, while six (27.3%) belonged to cancer types within those categories. One additional malignancy (4.5%) represented metastatic disease of unknown primary origin and could not be assigned to either category. These classifications were based on cancer type rather than individual eligibility for established screening recommendations.

Of the 22 reported malignancies, 14 (63.6%) were retrospectively estimated to have localized disease and eight (36.4%) to have regional or distant disease. These exploratory estimates were based primarily on a retrospective assessment of anatomical disease extent on the original sWB-MRI examinations, with limited corroboration from patient-reported clinical information, rather than independently verified clinical or pathological staging records.

Participant characteristics

Table 2 compares the demographics, cancer history, and lifestyle factors of participants diagnosed with cancer following WB-MRI-initiated follow-up with those of participants who were not diagnosed with cancer. Among the detected cancers, 14 (64%) occurred in individuals aged 60 years or older, with an equal distribution between males and females, and 10 (45%) occurred in individuals with a BMI of 25 or above. Lifestyle factors included smoking in 14 (64%) of the individuals and alcohol consumption in 18 (82%). Additionally, seven (32%) participants diagnosed with cancer had a history of previous cancer, while 15 (68%) reported a family history of cancer in first-degree or extended relatives. Among the participants with a prior cancer history, three (43%) were found to have cancer recurrences, while four (57%) were diagnosed with new and distinct primary cancers based on findings from the sWB-MRI.

Demographics	All patients	Cancer detected			
		No		Yes	
	N (%)	n	%	n	%

Total	1,011	989	97.8%	22	2.2%
Age					
Mean (SD)	56.4 (12.9)	56.3 (13.0)		60.6 (10.2)	
Median (Min, Max)	56 (22,89)	56 (22,89)		61.5 (42,77)	
Age categories					
<60 years	582 (57.5%)	574	58.1%	8	36.3%
≥60 years	429 (42.4%)	415	41.9%	14	63.6%
Gender					
Male	526 (52%)	515	52.1 %	11	50%
Female	485 (47.9%)	474	47.9 %	11	50%
Ever smoker[a]					
No	650 (64.2%)	642	64.9 %	8	36.3%
Yes	359 (35.5%)	345	34.8 %	14	63.6%
Ever consumed alcohol[a]					
No	246 (24.3%)	242	24.4%	4	18.1%
Yes	763 (75.4%)	745	75.3%	18	81.8%
Physical activity[b]					
No	256 (25.3%)	249	25.1%	7	31.8 %
Moderate/vigorous	754 (74.5%)	739	74.7%	15	68.1 %
Previous cancer history[c]					
No	880 (87%)	865	87.4 %	15	68.1%
Yes	128 (12.6%)	121	12.2 %	7	31.8 %
Family history of cancer (1st degree or extended)[c]					
No	259 (25.6%)	252	25.4%	7	31.8 %
Yes	750 (74.1%)	735	74.3%	15	68.1 %
BMI					
Mean (SD)	26.5 (5.1)	26.5 (5.1)		25.3 (4.1)	
Median (Min, Max)	25.9 (14.7,62.7)	25.9 (14.7,62.7)		24.11 (19.3, 38.42)	
BMI categories[d]					
Underweight/Normal (BMI below 25)	356 (35.2%)	344	34.7%	12	54.5%
Overweight/Obese (BMI ≥25)	514 (50.8%)	504	50.9%	10	45.4%

TABLE 2: Comparison of Patient Demographics, Lifestyle Factors and Cancer History Between Individuals Who Were Diagnosed With Cancer Following Investigations Prompted by Wb-MRI and Individuals Who Were Not Diagnosed With Cancer During the Follow-Up Period

[a]Two participants had missing data on smoking and alcohol consumption. Ever-smoking and ever-alcohol consumption were assessed using yes/no questions.

[b]One participant had missing physical activity information.

[c]Three participants had missing previous cancer history data, and two participants had missing family history of cancer data.

[d]BMI data were missing for 141 participants.

O-CDP by age and other factors

The observed O-CDP varied across demographic and clinical subgroups (Table 3). By age, no cancers were reported among participants younger than 35 years (0/36) or older than 79 years (0/29). The O-CDP was 1.39% among those aged 35-49 years (4/288), 2.54% among those aged 50-64 years (10/393), and 3.02% among those aged 65-79 years (8/265). The O-CDP was 3.90% among ever-smokers (14/359), 2.36% among participants reporting ever consuming alcohol (18/763), 5.47% among those with a previous personal cancer history (7/128), and 2.00% among those with a family history of cancer (15/750). Across BMI categories, the observed O-CDP was 3.49% in normal-weight participants (12/344), 2.24% in overweight participants (8/357), 0.98% in those with a BMI of 30-34.9 (1/102), and 1.82% in those with a BMI ⩾35 (1/55).

Variables	Overall, n	Cancer detected, n		95% CI[a]	
			O-CDP	LL	UL
All patients	1,011	22	2.18%	1.37%	3.28%
Age					
<35 years	36	0	-	-	-
35-49	288	4	1.39%	0.38%	3.52%
50-64	393	10	2.54%	1.23%	4.63%
65-79	265	8	3.02%	1.31%	5.86%
>79 years	29	0	-	-	-
Gender					
Male	526	11	2.09%	1.05%	3.71%
Female	485	11	2.27 %	1.14%	4.02%
Ever smoking[b]					
No	650	8	1.23%	0.53%	2.41%
Yes	359	14	3.90%	2.15%	6.46%
Ever alcohol[b]					
No	246	4	1.63%	0.45%	4.11%
Yes	763	18	2.36%	1.40%	3.70%
Physical activity[c]					
No	256	7	2.73%	1.11%	5.55%
Moderate/vigorous	754	15	1.99%	1.12%	3.26%
Previous cancer history[d]					
No	880	15	1.70%	0.96%	2.80%
Yes	128	7	5.47%	2.23%	10.94%
Family history of cancer[d]					
No	259	7	2.70%	1.09%	5.49%
Yes	750	15	2%	1.12%	3.28%
BMI[e]					
Underweight (<18.5)	12	0	-	-	-
Normal weight (18.5-24.9)	344	12	3.49 %	1.82%	6.01%

Overweight (25-29.9)	357	8	2.24%	0.97%	4.37%
Obese (30-34.9)	102	1	0.98%	0.02%	5.34%
Extremely obese (≥35)	55	1	1.82%	0.05%	9.72%

TABLE 3: Overall Cancer Detection Percentages (O-CDP) by Demographics, Lifestyle Factors and Cancer History

[a]Exact binomial confidence intervals.

[b]Two participants had missing data on ever-smoking and ever-alcohol consumption. Ever-smoking and ever-alcohol consumption were assessed using yes/no questions.

[c]One participant had missing physical activity information.

[d]Three participants had missing previous cancer history data; two participants had missing family history of cancer data.

[e]BMI data were missing for 141 participants.

n: number of participants; O-CDP: overall cancer detection percentage; LL: lower limit; UL: upper limit; CI: confidence interval; BMI: body mass index

Among participants who did not report specific symptoms as their primary reason for undergoing sWB-MRI, the observed O-CDP was 2.29% (19/829), compared with 1.65% (3/182) among those reporting specific symptoms. In the additional exploratory subgroup comprising participants with no prior personal cancer history and no specific symptoms reported as their primary screening motivation, the O-CDP was 1.66% (12/722). These subgroup estimates are descriptive and should not be interpreted as establishing statistically significant associations.

Interval cancers reported

Two additional breast cancer diagnoses that had not been identified in the original sWB-MRI reports were reported during follow-up among the 1,011 participants (0.2%). One participant reported stage II breast cancer, while the stage of the second cancer was unknown. The original sWB-MRI images were not retrospectively re-reviewed to assess whether these malignancies were present or detectable at the time of scanning. Accordingly, these cases were classified as patient-reported interval cancers based on the original imaging reports and subsequent clinical diagnoses, without definitive determination of whether they represented missed findings or malignancies developing after the index examinations.

Clinically actionable noncancer findings

A total of 39 clinically significant noncancer findings were reported for which participants subsequently underwent medical intervention or active clinical monitoring. These included vascular abnormalities, such as intracranial, aortic, and splenic artery aneurysms, associated with surgical intervention or clinical/imaging surveillance; intracranial masses and hydrocephalus requiring neurosurgical management or monitoring; infections treated medically; and other organ-specific conditions prompting clinical intervention or specialty follow-up. An additional 30 findings of severe fatty liver were tabulated separately, with reported follow-up including clinical assessment, laboratory evaluation, or lifestyle modifications. These counts represent findings rather than necessarily distinct participants, as individuals could contribute multiple findings. Subsequent clinical management was ascertained through patient-reported follow-up rather than independently verified medical records. These observations suggest the potential value of sWB-MRI for broader systemic health evaluation beyond oncologic detection, although downstream clinical benefit was not formally assessed. Representative cases are illustrated in Figure *4*, with further details summarized in the Appendices.

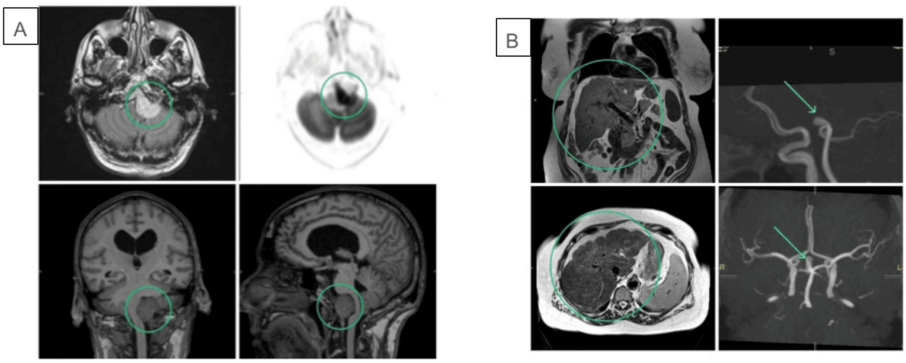


FIGURE 4: Illustration of Clinically Significant Noncancer Diagnoses Detected on Screening WB-MRI

Case A: A 65-year-old male had a dural-based, diffusion-restricting mass centered at the foramen magnum (green circle), histopathologically confirmed as a meningioma. The lesion caused posterior fossa mass effect, compressing the brainstem and resulting in obstructive hydrocephalus. Images include axial FLAIR (upper left), axial WB-DWI (upper right), coronal T1 MPRAGE (lower left), and sagittal T1 MPRAGE (lower right).

Case B: A 67-year-old female had multiple clinically actionable noncancer findings in distinct organ systems that were detected during the same screening encounter. A basilar-tip brain aneurysm (green arrow) and asymptomatic macronodular cirrhosis (green circle) were identified. Liver images include coronal T1 (upper left) and axial T2 (lower left), while brain artery images include 3D TOF MRA sagittal rotational and frontal oblique rotational views (upper right and lower right, respectively).

WB-MRI: whole-body magnetic resonance imaging; FLAIR: fluid-attenuated inversion recovery; WB-DWI: whole-body diffusion-weighted imaging; MPRAGE: magnetization-prepared rapid gradient echo; 3D: three-dimensional; TOF MRA: time-of-flight magnetic resonance angiography.

The image was created using Microsoft PowerPoint (Microsoft Corporation, Redmond, Washington).

Discussion

Study context and findings

This study evaluated patient-reported diagnostic outcomes following elective sWB-MRI in a real-world preventive health population, with an observed O-CDP of 2.18% (95% CI: 1.37%-3.28%) among participants with available follow-up. Previous WB-MRI screening studies have reported variable cancer detection rates ranging from approximately 0.3% to 10%, with meta-analytic estimates of 1.1%-1.6% [11,14,18,19]. Differences in cohort characteristics, imaging protocols, outcome ascertainment, and follow-up completeness limit direct comparisons across these studies.

Among the 22 patient-reported malignancies, 14 (63.6%) were retrospectively estimated to have localized disease, while 19 (86.4%) occurred in participants who did not identify specific symptoms as their primary motivation for screening. Fifteen malignancies (68.2%) belonged to cancer types outside the five predefined SCS categories, six (27.3%) belonged to cancer types within these categories, and one (4.5%) represented metastatic disease of unknown primary origin. These observations illustrate the potential breadth of cancer types identified through sWB-MRI, although retrospective estimates of localized disease do not establish earlier detection or improved clinical outcomes. As illustrative context, the National Lung Screening Trial reported that approximately 32% of incident cancers in its high-risk smoking population were lung cancers, with the remainder occurring at other sites [20]. Together, these findings emphasize the broader cancer burden that MCD modalities, such as sWB-MRI, may help address in both elevated-risk and broader screening populations, although differences in study populations and screening approaches preclude direct comparisons of diagnostic performance or clinical benefit.

Two additional breast cancer diagnoses were reported during follow-up but were not identified in the original sWB-MRI reports. These observations should be considered in the context of several factors, including the relatively high incidence of breast cancer in the general population, the absence of dedicated breast cancer screening sequences within the study protocol, and the availability of established breast-specific screening methods. However, because the original sWB-MRI images were not retrospectively re-reviewed, it remains uncertain whether these malignancies were present but unrecognized at the time of scanning or developed subsequently, and the contribution of individual factors to their nondetection cannot be established. These findings reinforce the importance of maintaining established, age- and risk-appropriate breast cancer screening, including mammography and dedicated breast MRI when indicated, and support positioning sWB-MRI as complementary to, rather than a replacement for, established SCS methods.

Beyond oncologic findings, sWB-MRI identified clinically significant noncancer abnormalities, including vascular conditions, intracranial masses, metabolic disease, and infections, for which participants reported subsequent medical intervention or clinical monitoring. These observations suggest a potential role for sWB-MRI in broader systemic health evaluation beyond cancer detection. However, the identification of clinically significant findings and reported downstream management should not be equated with demonstrated improvements in patient outcomes, which were not systematically assessed in this study.

The role of sWB-MRI in the MCD paradigm

sWB-MRI and blood-based MCD approaches offer potentially complementary capabilities rather than mutually exclusive strategies for early cancer detection. Blood-based MCD tests may identify cancer-associated molecular signals and predict a likely tissue or organ of origin, but generally do not provide direct anatomical localization of individual lesions. In contrast, sWB-MRI provides anatomical visualization and spatial localization of suspicious abnormalities, potentially informing subsequent targeted diagnostic evaluation. As a simultaneous opportunistic benefit at the point of screening, imaging may also provide an initial assessment of lesion size, anatomical extent, and possible regional or distant disease involvement, although definitive characterization and staging generally require additional clinical and diagnostic evaluation. These complementary characteristics may support future multimodal approaches aimed at broadening cancer detection across organ systems.

When comparing sWB-MRI with blood-based MCD technologies, important differences emerge in study populations, diagnostic pathways, and outcome definitions. The observed O-CDP of 2.18% in the present study may be considered alongside the approximately 0.5% CDP reported in the PATHFINDER study evaluating the GRAIL Galleri blood-based assay [21] and the approximately 0.19% detection percentage reported among 9,024 asymptomatic participants in the SPOT-MAS study conducted in Vietnam [22]. However, these figures should not necessarily be interpreted as demonstrating superior detection performance of sWB-MRI, given substantial differences in cohort selection, baseline cancer risk, screening methodology, and outcome ascertainment. Imaging and blood-based MCD approaches may instead offer complementary capabilities. For example, the NIH-funded IDENTITY study demonstrated the potential utility of whole-body MRI following unusual or nonreportable prenatal cell-free DNA screening results, reporting an MRI sensitivity of 98.0% and specificity of 88.5% for occult maternal cancer detection within that highly selected population [23]. These findings illustrate a potential role for complementary molecular and imaging-based diagnostic strategies, although their performance cannot be generalized to unselected screening populations.

Interpretation of false-positive findings in imaging-based cancer screening requires careful distinction between the successive steps of the screening-to-diagnostic pathway. In mammography, the BI-RADS framework supports standardized assessment and reporting of positive predictive values at different stages: PPV1 for positive screening examinations, PPV2 for examinations with a biopsy recommendation, and PPV3 for biopsies performed [24]. ONCO-RADS provides a framework for standardized oncologic risk stratification in sWB-MRI [10]. However, formal ONCO-RADS scoring and a predefined binary screening-positivity threshold were not implemented in the present cohort, precluding calculation of screening-level false-positive rates or PPV1 and PPV2. The observed dTS-CDP of 51.2% is conceptually analogous to biopsy-level PPV3 but was derived from patient-reported outcomes following diagnostic-intent tissue sampling rather than a prospectively standardized screening-to-biopsy pathway and should not necessarily be interpreted as a formally established PPV3.

Future prospective studies incorporating standardized ONCO-RADS reporting, predefined screening-positivity thresholds, systematic documentation of diagnostic recommendations and subsequent evaluations, and independent verification of clinical outcomes will be important for establishing screening-level and biopsy-level predictive values, including PPV1, PPV2, and PPV3. More complete longitudinal outcome ascertainment will also be necessary to evaluate sensitivity, specificity, interval cancer rates, and downstream diagnostic consequences. Such measurements would support more rigorous comparisons between sWB-MRI and established or emerging cancer-screening approaches.

Figure *5* illustrates the envisioned radiological screening continuum for sWB-MRI, as it may be applied within an imaging-based screening process toward early detection and diagnosis of cancers.

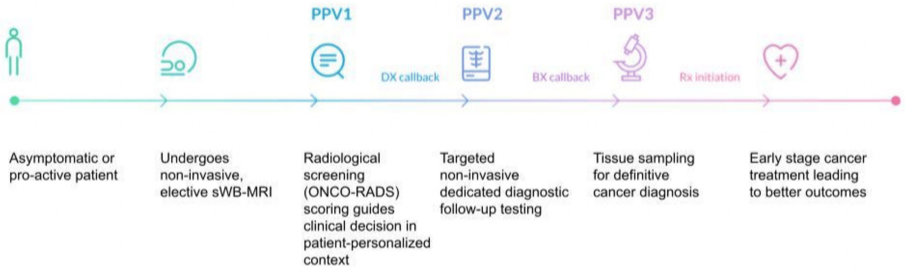


FIGURE 5: Conceptual Framework of a Radiological-Screening Continuum to Use for sWB-MRI-Based Early Cancer Detection and Diagnosis.

Analogous to the multistep framework used in established screening programs like mammography, a theoretical full-cycle screening whole-body MRI (sWB-MRI) program would involve sequential steps with increasing diagnostic specificity and corresponding positive predictive values (PPVs). PPV1 refers to the proportion of initial screening callbacks (for targeted diagnostic follow-up) that result in biopsy-confirmed cancer. PPV2 refers to the proportion of cases where biopsy is recommended that are subsequently confirmed as cancer on biopsy. PPV3 refers to the proportion of biopsies actually performed that are histologically confirmed as cancer.

The image was created using Figma (Figma, Inc., San Francisco, California).

Comparison with imaging-based SCS

The O-CDP of 2.18% for sWB-MRI may be considered in the context of reported cancer detection yields from established imaging-based SCS modalities. For example, screening mammography has reported CDPs of approximately 0.4%-0.5% [24], while low-dose chest CT screening has reported approximately 0.8%-1.1% in selected screening populations [25,26]. CT colonography has demonstrated detection of advanced colorectal neoplasia in higher-risk populations, with a reported yield of 15.3% that includes advanced adenomas rather than invasive cancers alone [27]. Although these figures are not directly comparable measures of cancer-screening performance, the observed aggregate sWB-MRI CDP is of the same broad order of magnitude as reported cancer detection yields from mammography and low-dose CT, providing a descriptive reference point for further evaluation of sWB-MRI as an imaging-based MCD approach.

These cross-modality comparisons are inherently limited by differences in study design, population characteristics, baseline cancer risk, screening eligibility criteria, diagnostic thresholds, and outcome ascertainment. Established SCS programs target specific cancer types using validated organ-focused protocols, with eligibility generally defined by age and/or other risk factors that identify population subgroups with relatively elevated pretest probability for the target malignancy. In contrast, sWB-MRI provides broader anatomical evaluation across multiple organ systems within a single examination, including for cancers for which a dedicated organ-targeted screening indication might not otherwise be apparent. Furthermore, the present cohort comprised self-selected individuals undergoing elective preventive health evaluation, including participants with prior cancer histories or reported symptoms, with incomplete longitudinal follow-up. Consequently, the observed aggregate CDP should be interpreted as a descriptive measure of cancer detection within this cohort. The illustrative comparison with established SCS approaches provides a reference point for considering the observed aggregate cancer detection yield of sWB-MRI rather than establishing greater screening sensitivity, effectiveness, or clinical utility for target cancers relative to established SCS approaches in guideline-eligible populations.

Importantly, sWB-MRI should not be considered a replacement for established, age- and risk-appropriate SCS methods but rather a potentially complementary approach. By enabling evaluation across multiple organ systems, including for malignancies outside the scope of routinely recommended organ-specific screening programs, sWB-MRI may help address broader unmet cancer detection needs. Its simultaneous identification of clinically significant noncancer findings may offer additional opportunities for preventive health evaluation and individualized risk assessment. However, prospective studies are needed to determine whether these broader detection capabilities translate into meaningful improvements in patient outcomes and to characterize associated diagnostic burdens, potential harms, and healthcare resource utilization.

Limitations

This study has several limitations. Examinations were interpreted before the implementation of formal ONCO-RADS scoring and without a predefined binary screening-positivity designation. Together with incomplete capture of intermediate diagnostic evaluations and the absence of systematic verification of negative clinical outcomes, these limitations precluded calculation of screening-level false-positive rates, PPV1 and PPV2, sensitivity, and specificity. Future prospective studies incorporating standardized risk-

stratified reporting, explicit screening-positivity thresholds, comprehensive documentation of diagnostic pathways, and systematic longitudinal outcome ascertainment will be needed to establish these performance metrics.

Inter-reader variability was not formally quantified, as examinations were generally interpreted independently by a single radiologist without routine double reading or consensus review. Our clinical workflow has since incorporated standardized ONCO-RADS and clinically significant diagnosis (CSD) scoring, which may support more consistent reporting, although their impact on inter-reader agreement remains to be formally evaluated. We intend to assess inter-reader agreement using kappa statistics in future prospective research.

Reliance on patient-reported clinical outcomes introduces potential recall, reporting, and verification biases. Although participants reported biopsy-associated diagnoses established through subsequent clinical care, source histopathology reports and treating-provider medical records were not independently reviewed for this study. Accordingly, the accuracy and completeness of reported diagnoses, staging information, and other clinical outcomes could not be independently verified. Similarly, the absence of systematic medical record or cancer registry linkage limited the ability to confirm negative outcomes and comprehensively ascertain interval cancers. These limitations should be considered when interpreting the observed CDP and other reported clinical outcomes.

An additional important limitation is the substantial loss to follow-up, with only 39.7% of the original scanned population completing follow-up interviews. Because baseline characteristics were not systematically compared between respondents and nonrespondents, and clinical outcomes among nonrespondents were unavailable, the magnitude and direction of potential selection and nonresponse bias could not be reliably determined. Participants with significant imaging findings or subsequent cancer diagnoses may have been more likely to complete follow-up, potentially inflating the observed CDP. Conversely, additional cancer diagnoses among nonrespondents may have gone unascertained. Accordingly, the observed CDP of 2.18% should be interpreted specifically within the follow-up respondent cohort and cannot be assumed to represent the CDP of the entire initially scanned population. Future prospective studies incorporating systematic longitudinal follow-up and more complete outcome ascertainment will be important to address these limitations.

The observation that 14 of 22 detected malignancies were retrospectively estimated to have localized disease is descriptive and does not establish a screening-related stage shift or improved clinical outcomes. Any inference of earlier detection or survival benefit would be subject to potential lead-time and length-time biases, as well as the possibility of overdiagnosis, whereby screening identifies malignancies that would not otherwise have become clinically consequential during a patient's lifetime. Overdiagnosis should be distinguished from overtreatment: appropriate risk-adapted surveillance and management may help mitigate unnecessary interventions but do not eliminate the potential harms associated with overdiagnosis itself. Prospective longitudinal studies will be necessary to evaluate these considerations.

Furthermore, although patient-reported tissue-sampling outcomes were collected, other components of the downstream diagnostic pathway, including additional imaging, referrals, procedure-related complications, psychological effects, and healthcare costs, were not systematically captured. Consequently, the overall burden of diagnostic evaluation, potential screening-related harms, and balance of clinical benefits and harms could not be comprehensively assessed.

Though we believe this cohort represents one of the largest sWB-MRI cancer detection studies in the literature [18,28,29], it remains objectively small for generating generalizable population-level conclusions. Much larger cohorts need to be followed and studied to draw robust and generalizable insights. The ongoing Hercules study seeks to address this limitation by enrolling 100,000 participants for sWB-MRI, including targeted health equity-motivated enrollment and longitudinal follow-up, to generate population-scale data [30].

Moreover, the sWB-MRI protocol utilized in this study was specifically optimized for high-yield, broad-spectrum screening in individuals undergoing elective preventive health screening rather than targeted diagnostic imaging. As such, it is not intended to replace dedicated diagnostic imaging protocols, which typically involve higher-resolution, region-specific sequences, additional specialized pulse sequences, and, when appropriate, the use of contrast agents. When a potentially oncologically significant finding is detected on screening WB-MRI, a comprehensive diagnostic workup incorporating targeted imaging and clinical correlation is generally necessary to achieve complete lesion characterization.

Finally, the study was conducted at a single specialized WB-MRI clinic in Canada, operating within a healthcare system distinct from that of the United States, which may limit how well the results apply to other healthcare systems. Since patients paid out of pocket for the elective scan, they were likely more proactive and financially able to seek advanced testing, leading to referral bias. Also, because access to other advanced imaging in Canada's public system can be limited, this may have influenced who chose to undergo WB-MRI. As a result, this group may not represent the general population in the U.S. or other countries with

different healthcare systems. More research, including cost-effectiveness studies in a variety of healthcare settings, is needed to understand how sWB-MRI could be used more widely for cancer screening.

Conclusions

In this retrospective observational study, sWB-MRI identified a broad spectrum of malignancies among individuals undergoing elective preventive health screening, with an observed CDP of 2.18% among participants with available clinical follow-up. Many detected malignancies belonged to cancer types outside the scope of established SCS programs, suggesting a potential complementary role for broad-scope imaging in addressing unmet cancer detection needs. Fourteen of the 22 reported malignancies (63.6%) were retrospectively estimated to have localized disease, although this observation does not necessarily establish a screening-related stage shift or improved clinical outcomes. The additional identification of clinically significant noncancer findings associated with subsequent patient-reported medical management further illustrates the potential broader role of sWB-MRI in systemic health evaluation.

Prospective studies involving standardized sWB-MRI risk-stratification reporting frameworks, larger cohorts, and designs that capture comprehensive intermediate diagnostic processes together with long-term health outcomes are essential to refine protocols and assess clinical validity (e.g., sensitivity, specificity, predictive values) and utility (e.g., patient outcomes, healthcare system impact).

Appendices

Category	Sequence Type (Field of View Coverage): Anatomical Plane
Whole-body imaging	WB-T1 (head to ankles): Coronal
	WB-STIR (head to ankles): Coronal
	WB-DWI (head to upper thighs): High and Low B-value Axial; High B-value coronal with 3D spinning MIP reformations; Axial apparent diffusion coefficient (ADC) map.
	Whole-Spine T2 (skull base to pelvis, centered at the midline with lateral extension to cover the entire spine): Sagittal
Region-specific imaging	
Brain	FLAIR: Axial
	Isotropic T1 MPRAGE: Sagittal acquisition
	Isotropic 3D TOF MRA (Circle of Willis): Axial acquisition
Neck	T2 (Skull-base to thoracic inlet): Axial
Torso	T2 (Chest, abdomen, and pelvis): Axial
	DIXON T1 in-phase, opposed-phase, fat-suppressed, and water-suppressed sequences for the upper abdomen (lower chest to bottom of kidneys): Axial
	T2 fat-suppressed HASTE (centered on the pancreas, gallbladder, and common bile duct): Axial
Male pelvis	T2 (Prostate-centered small field-of-view): Axial
	Multi-B-value DWI with ADC map (prostate-centered small field-of-view): Axial
Female pelvis	T2 (centered on the uterus with lateral extension to include the adnexa/ovaries): Sagittal

TABLE 4: Anatomic Coverage Details for the Respective Sequence Types Composing the sWB-MRI Protocol Utilized

WB-T1: whole-body T1-weighted imaging; WB-STIR: whole-body short tau inversion recovery; WB-DWI: whole-body diffusion-weighted imaging; 3D: three-dimensional; MIP: maximum intensity projection; ADC: apparent diffusion coefficient; FLAIR: fluid-attenuated inversion recovery; MPRAGE: magnetization-prepared rapid gradient echo; TOF MRA: time-of-flight magnetic resonance angiography; HASTE: half-Fourier acquisition single-shot turbo spin echo; DWI: diffusion-weighted imaging.

Category	Body Region	Condition	Cases Clinically/Diagnostically Confirmed	Clinical Action Taken
Total (n = 39)				
Vascular CSD	Head/neck	Brain aneurysms	8	1 neurosurgical clipping, 7 clinical/imaging monitoring
		Moya Moya Disease	1	Specialty followup/management
	Chest	Thoracic aortic aneurysm	3	Clinical/imaging monitoring
	Abdomen	Abdominal aortic aneurysm	1	Prophylactic surgical intervention
		Splenic artery aneurysm	1	Prophylactic surgical intervention
Non-cancerous/non-vascular CSD	Head/neck	Subdural hematoma	1	Neurosurgical intervention
		Cranial Meningioma	4	2 Neurosurgical intervention, 2 clinical/imaging monitoring
		Physiologically significant hydrocephalus	1	Neurosurgical intervention
	Chest	Lung infection/pneumonia	2	Medical treatment
	Abdomen	Compensated macronodular cirrhosis	1	Specialty followup/management, only lifestyle changes still while compensated
		Gallstone disease	1	Surgical intervention
		Non-cancerous gallbladder mass	1	Surgical intervention
		Pancreatic stent malposition	1	Stent revision procedure
		Kidney stone	1	Urological intervention
		Congenital unilateral hydronephrosis from UPJ obstruction	1	Urological intervention
	Female pelvis	Endometrial polyp	3	Gynecological intervention
		Postmenopausal complex Ovarian/adnexal cystic lesions	2	Gynecological intervention
		Hydrosalpinx	1	Gynecological intervention
	Male pelvis	Benign prostatic hyperplasia (BPH)	1	Urological intervention
		Large scrotal cystic lesion	1	Urological intervention
	Spine	Severe spinal stenosis with cord compression and signal change	1	Spinal surgery intervention
		Non-cancerous intradural extramedullary tumor	2	Spinal surgery intervention
Metabolic disease	Liver	Severe fatty liver	30	Discussed with doctor/lifestyle changes, underwent bloodwork.

TABLE 5: Non-cancerous Clinically Significant Diagnoses Confirmed and Addressed Following Detection on Screening WB-MRI

Counts represent individual findings rather than necessarily unique participants. The 39 vascular and other non-cancer findings exclude the 30 severe fatty liver findings tabulated separately. Individual participants may have contributed multiple findings, including findings also represented in Table 1. Clinical follow-up and management outcomes were patient-reported.

Additional Information

Author Contributions

All authors have reviewed the final version to be published and agreed to be accountable for all aspects of the work.

Concept and design: Yosef Chodakiewitz, Madhurima Datta

Acquisition, analysis, or interpretation of data: Yosef Chodakiewitz, Madhurima Datta, Candace Westgate, Rebecca Nayeri, Alex Exuzides, Jeffrey Venstrom, Daniel J. Durand, Pratik Shingru, Saqib Basar, Sam Hashemi

Drafting of the manuscript: Yosef Chodakiewitz, Madhurima Datta

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Supervision: Yosef Chodakiewitz, Alex Exuzides, Daniel J. Durand, Sam Hashemi

Disclosures

Human subjects: Informed consent for treatment and open access publication was obtained or waived by all participants in this study. Institutional Review Board Advarra issued approval Pro00082043. This study was conducted in accordance with the ethical standards outlined in the Declaration of Helsinki. The approved retrospective research protocol encompasses historical clinical imaging and follow-up data obtained through Prenuvo's standard commercial WB-MRI services. Under this protocol, eligible participants are required to have completed Prenuvo's standard commercial clinical informed-consent process, which includes provisions for potential de-identified research use, rather than a separate study-specific research consent form. The MRI examinations and subsequent continuity-of-care telephone follow-up in the present cohort were undertaken as routine clinical services rather than study-specific research procedures. Advarra IRB is registered with OHRP and FDA under IRB registration number IRB#00000971. Data for this retrospective study were accessed on November 1, 2024. Only authors directly involved in the clinical care of patients had access to identifiable information, which was limited to screening WB-MRI, follow-up continuity of care, and associated medical record documentation. Authors not involved in patient care did not have access to identifiable data at any stage. All identifiable information was removed prior to data extraction and analysis. **Animal subjects:** All authors have confirmed that this study did not involve animal subjects or tissue. **Conflicts of interest:** In compliance with the ICMJE uniform disclosure form, all authors declare the following: **Payment/services info:** Candace Westgate reports speaker and consulting relationships with Myriad Labs, GRAIL, and AstraZeneca. Jeffrey Venstrom is a consultant for Prenuvo. Madhurima Datta, Alex Exuzides, Daniel J. Durand, Pratik Shingru, Saqib Basar, Sam Hashemi, and Yosef Chodakiewitz are employees of Prenuvo. Rebecca Nayeri declares no competing interests. This retrospective study was supported internally by Prenuvo, Inc., through employee research time, access to existing clinical data, and analytical resources. No external research grant or independent study funding was received. **Financial relationships:** Madhurima Datta, Alex Exuzides, Daniel J. Durand, Pratik Shingru, Saqib Basar, Sam Hashemi, and Yosef Chodakiewitz declare(s) employment from Prenuvo. Candace Westgate declare(s) personal fees from Myriad labs, GRAIL, Astra Zeneca. Jeffrey Venstrom declare(s) personal fees from Prenuvo. Consultant. **Other relationships:** All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

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