

**THE EFFECT OF IMAGE QUALITY ON RECALL RATES  
IN A BREASTSCREENING PROGRAM**

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## DECLARATION

*The thesis contains no material which has been accepted for the award of any other degree or diploma in any university or other tertiary institution and, to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference has been made in the text. I give consent to this copy of my thesis, when deposited in the University Library, being made available for loan and photocopying subject to the provisions of the Copyright Act 1968.*

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“The point at which the learner becomes satisfied with or indifferent to his attained level of competence defines the ultimate level of ability for that person. An attitude towards work that includes continual self-criticism, progressive problem solving and continual re-investment in improvement is the description of a profession, where expertise, accountability, autonomy and authority are interrelated.” (1)

# TABLE OF CONTENTS

LIST OF FIGURES.....	IX
LIST OF TABLES.....	XI
LIST OF TABLES.....	XI
ABBREVIATIONS .....	XII
ABSTRACT .....	XIV
<b>1 CHAPTER ONE: INTRODUCTION.....</b>	<b>1</b>
1.1 OVERVIEW.....	2
1.2 THESIS OUTLINE.....	2
1.3 STUDY BACKGROUND.....	3
1.3.1 <i>Breast Cancer</i> .....	3
1.3.2 <i>Mammography</i> .....	3
1.3.3 <i>Image Quality</i> .....	6
1.3.4 <i>Rationale For Study</i> .....	7
1.4 RESEARCH AIM.....	8
1.5 RESEARCH QUESTIONS.....	8
1.6 RESEARCH OBJECTIVES.....	8
1.7 SCOPE / LIMITATIONS OF RESEARCH .....	9
1.8 SIGNIFICANCE OF THE STUDY.....	11
<b>2 CHAPTER TWO: LITERATURE REVIEW.....</b>	<b>12</b>
2.1 INTRODUCTION.....	13
2.2 BREAST ANATOMY .....	13
2.2.1 <i>Breast Anatomy</i> .....	13
2.2.2 <i>Breast Density</i> .....	15
2.2.3 <i>Breast Regions</i> .....	16
2.3 BREAST CANCER .....	17
2.3.1 <i>Breast Cancer Definition</i> .....	17
2.3.2 <i>Incidence / Mortality of Breast Cancer</i> .....	19
2.3.3 <i>Breast Cancer Staging</i> .....	21
2.3.4 <i>Breast Cancer Risk Factors</i> .....	23
2.4 BREAST CANCER DETECTION .....	24
2.4.1 <i>Clinical Examination and Self-Examination</i> .....	24
2.4.2 <i>Imaging Modalities</i> .....	25

2.5	SCREENING MAMMOGRAPHY .....	31
2.5.1	<i>History</i> .....	31
2.5.2	<i>Advantages</i> .....	32
2.5.3	<i>Disadvantages</i> .....	32
2.5.4	<i>Accuracy</i> .....	35
2.5.5	<i>Mammography Screening Guidelines</i> .....	38
2.6	FILM / SCREEN MAMMOGRAPHY .....	39
2.6.1	<i>History And Development</i> .....	39
2.6.2	<i>Obtaining the Mammographic Image</i> .....	45
2.6.3	<i>Breast Anatomy Appearance</i> .....	49
2.6.4	<i>Technical Assessment</i> .....	50
2.6.5	<i>Screen Reader Review</i> .....	67
2.6.6	<i>Reasons for Recall</i> .....	72
2.7	SUMMARY .....	79
<b>3</b>	<b>CHAPTER THREE: METHODS .....</b>	<b>80</b>
3.1	INTRODUCTION .....	81
3.2	ETHICAL ISSUES .....	82
3.3	RESOURCES AND MATERIALS .....	82
3.3.1	<i>Expert Panel</i> .....	82
3.3.2	<i>Sets of Images</i> .....	82
3.4	PILOT STUDY (PHASE A).....	84
3.4.1	<i>Selection of sets of images</i> .....	84
3.4.2	<i>Retrieval, Data Collection and display of sets of images</i> .....	86
3.4.3	<i>Assessment of images</i> .....	88
3.4.4	<i>Consensus Agreement</i> .....	89
3.4.5	<i>Analysis of results</i> .....	90
3.5	MAIN COMPONENT (PHASE B).....	91
3.5.1	<i>Selection of sets of images</i> .....	92
3.5.2	<i>Retrieval, Data Collection and display of sets of images</i> .....	92
3.5.3	<i>Assessment of images</i> .....	92
3.5.4	<i>Consensus Assessment</i> .....	92
3.5.5	<i>Analysis of results</i> .....	92
3.5.6	<i>Intra-observer Consistency</i> .....	93
3.6	CONTROL COMPONENT (PHASE C) .....	93
3.6.1	<i>Selection of sets of images</i> .....	93
3.6.2	<i>Retrieval, Data Collection and display of sets of images</i> .....	93
3.6.3	<i>Assessment of images</i> .....	93
3.6.4	<i>Consensus Assessment</i> .....	93
3.6.5	<i>Analysis of results</i> .....	94

3.6.6	<i>Intra-observer Consistency</i> .....	94
3.7	ASSESSMENT OF PANEL CONSISTENCY .....	96
3.8	ASSESSMENT OF CLIENT RECORDS FOR THE DETERMINATION OF CANCER STATUS .....	96
3.9	CASE CONTROLLED STUDY .....	96
<b>4</b>	<b>CHAPTER FOUR: RESULTS</b> .....	<b>97</b>
4.1	INTRODUCTION TO RESULTS .....	98
4.2	RESOURCE AND MATERIALS .....	98
4.3	RESULTS FOR LEVEL OF AGREEMENT .....	101
4.3.1	<i>Pilot Study (Phase A)</i> .....	101
4.3.2	<i>Main Study (Phase B)</i> .....	109
4.3.3	<i>Control Component (Phase C)</i> .....	114
4.3.4	<i>Effect of Training on Panel Member Consistency</i> .....	118
4.4	INADEQUATE IMAGES .....	122
4.4.1	<i>Percentage of Inadequate Images</i> .....	122
4.4.2	<i>Reasons for Inadequate Images</i> .....	125
4.5	DO INADEQUATE IMAGES INFLUENCE CANCER DETECTION RATES .....	127
4.6	CASE CONTROLLED COMPONENT .....	129
4.6.1	<i>Patient Demographics</i> .....	130
4.6.2	<i>Breast Density</i> .....	131
4.6.3	<i>Imaging Sites (public / private)</i> .....	132
4.6.4	<i>Image Quality</i> .....	132
4.7	SUMMARY .....	133
<b>5</b>	<b>CHAPTER FIVE: DISCUSSION</b> .....	<b>134</b>
5.1	INTRODUCTION .....	135
5.2	HOW OBJECTIVE ARE CLASSIFICATION SYSTEMS? .....	135
5.2.1	<i>Use of PGMI</i> .....	135
5.2.2	<i>Training in classification systems</i> .....	137
5.2.3	<i>Intra-observer consistency</i> .....	138
5.3	ARE IMAGES ADEQUATELY ASSESSED FOR IMAGE QUALITY? .....	139
5.3.1	<i>Why were images considered inadequate?</i> .....	141
5.3.2	<i>Site of Production of Inadequate Images</i> .....	143
5.4	INFLUENCES OF INADEQUATE IMAGES ON CANCER DETECTION .....	144
5.5	CASE CONTROLLED COMPONENT .....	144
5.5.1	<i>HRT Use</i> .....	144
5.5.2	<i>Breast Density</i> .....	145
5.5.3	<i>Site of Production</i> .....	146
5.6	LIMITATIONS .....	146
5.6.1	<i>Selection Bias</i> .....	146
5.6.2	<i>Information Bias</i> .....	147

<b>6</b>	<b>CHAPTER SIX: CONCLUSION.....</b>	<b>148</b>
6.1	CONCLUSION .....	149
6.1.1	<i>What is the level of consistency between panel members in reviewing image quality?..</i>	<i>149</i>
6.1.2	<i>Can the level of agreement be improved with training?.....</i>	<i>149</i>
6.1.3	<i>What percentage of images is determined to be inadequate?.....</i>	<i>150</i>
6.1.4	<i>Public versus private sites of production for inadequate images .....</i>	<i>150</i>
6.1.5	<i>What are the common reasons for inadequate images? .....</i>	<i>151</i>
6.1.6	<i>What factors influence the recall versus non-recall of clients in screening mammography? .....</i>	<i>151</i>
6.2	FURTHER RECOMMENDATIONS .....	152
<b>7</b>	<b>REFERENCES .....</b>	<b>153</b>
	<b>APPENDIX ONE: ETHICAL APPROVAL .....</b>	<b>171</b>
	<b>APPENDIX TWO: STATISTICAL ANALYSIS TESTS .....</b>	<b>175</b>
A2.1	PAIRED T TEST .....	176
A2.2	WILCOXON MATCHED PAIRS TEST.....	176
A2.3	CONTINGENCY TABLES (CHI-SQUARE, RELATIVE RISK AND ODDS RATIO).....	177
A2.3.1	<i>Chi-square (<math>\chi^2</math>) and Fisher Exact test.....</i>	<i>177</i>
A2.3.2	<i>Relative Risk.....</i>	<i>177</i>
A2.3.3	<i>Odds Ratio.....</i>	<i>178</i>



## LIST OF FIGURES

FIGURE 1-1: HUNTER BREASTSCREEN CATCHMENT AREA .....	9
FIGURE 1-2: NEW SOUTH WALES WITH HBS HIGHLIGHTED .....	10
FIGURE 2-1: TANGENTIAL AND SAGITTAL VIEW OF BREAST AND ASSOCIATED CHEST WALL .....	14
FIGURE 2-2: BREAST SHOWING LYMPH NODES AND LYMPH VESSELS .....	15
FIGURE 2-3: DESCRIPTIVE BREAST TERMINOLOGY .....	16
FIGURE 2-4: FREQUENCY OF BREAST CANCERS BY LOCATION IN THE BREAST FROM A SERIES OF 961 CONSECUTIVE, HISTOLOGICALLY CONFIRMED CASES FROM THE FALUN CENTRAL HOSPITAL ...	17
FIGURE 2-5: PART OF THE BREAST SHOWING ENLARGED TDLU .....	18
FIGURE 2-6: BREAST DUCT SHOWING IN SITU AND INVASIVE CARCINOMA .....	18
FIGURE 2-7: BREAST CANCER INCIDENCE AND MORTALITY WORLD-WIDE .....	21
FIGURE 2-8: BREAST CANCER CHANGES IN INCIDENCE (1989-2003) AND MORTALITY (1990-2004) IN AUSTRALIA .....	22
FIGURE 2-9: PROCESS OF SCREENING .....	26
FIGURE 2-10: ULTRASOUND OF (A) SIMPLE CYST AND (B) CARCINOMA (24) .....	28
FIGURE 2-11: (A) MAMMOGRAPHY UNIT , (B) SCHEMATIC DRAWING .....	44
FIGURE 2-12: STANDARD MAMMOGRAPHY POSITIONS .....	46
FIGURE 2-13: COMPRESSION SIGN AT HBS .....	47
FIGURE 2-14: CLIENT QUESTIONNAIRE FOR HUNTER BREASTSCREEN .....	48
FIGURE 2-15: A 45° OBLIQUE MAMMOGRAPHY PROJECTION DEMONSTRATING ANATOMICAL STRUCTURES THAT ARE VISUALIZED WITH MAMMOGRAPHY .....	49
FIGURE 2-16: PATTERNS OF BREAST DENSITY PER BI-RADS, WOLFE & TABAR .....	51
FIGURE 2-17: IMAGE QUALITY PARAMETERS .....	56
FIGURE 2-18: X-RAY TUBE DETAIL .....	58
FIGURE 2-19: SCHEMATIC DIAGRAM OF AN AUTOMATIC EXPOSURE CONTROL CIRCUIT DESIGN .....	58
FIGURE 2-20: (A) COMPRESSION PLATE WITH AEC CHAMBERS (B) SHOWING CORRECT POSITION ON BREAST TISSUE .....	59
FIGURE 2-21: LINEAR ATTENUATION COMPARING TISSUE TYPE AND CARCINOMA .....	60
FIGURE 2-22: MOLYBDENUM SPECTRUM .....	62
FIGURE 2-23: MOLYBDENUM AND TUNGSTEN SPECTRA .....	62
FIGURE 2-24: SCHEMATIC DIAGRAM OF PROJECTION OF ACTUAL AND EFFECTIVE FOCAL SPOT .....	64
FIGURE 2-25: SCHEMATIC OF MAMMOGRAPHY EQUIPMENT SHOWING COMPRESSED BREAST TISSUE ..	64
FIGURE 2-26: DESCRIPTORS OF SHAPES AND MARGINS OF MAMMOGRAPHIC LESIONS .....	73
FIGURE 2-27: CIRCUMSCRIBED LESIONS ON CC MAMMOGRAMS – (A) BENIGN CYST AND (B) MALIGNANT CIRCUMSCRIBED LESION .....	74
FIGURE 2-28: DESCRIPTORS AND IMAGE OF TYPICALLY BENIGN MICRO-CALCIFICATIONS .....	75
FIGURE 2-29: DESCRIPTORS OF INDETERMINATE / MALIGNANT MICRO-CALCIFICATIONS AND IMAGE OF MALIGNANT MICRO-CALCIFICATIONS .....	75
FIGURE 2-30: CORE SPECIMEN RADIOGRAPH WITH CALCIFICATIONS .....	76

FIGURE 2-31: ASYMMETRY COMPARING RIGHT AND LEFT MLO .....	77
FIGURE 2-32: FOCAL ARCHITECTURAL DISTORTION SHOWING A (A) SLOW GROWING CANCER (B) OVER AN 8 YEAR TIME PERIOD .....	77
FIGURE 2-33: STELLATE LESION ON (A) CC MAMMOGRAM AND (B) SPOT VIEW .....	78
FIGURE 3-1: RESEARCH COMPONENTS .....	81
FIGURE 3-2: PHASE A - SELECTION OF SETS OF IMAGES .....	85
FIGURE 4-1: PHASES OF RESEARCH METHODOLOGY .....	98
FIGURE 4-2: DATES FOR RESEARCH IMAGES .....	99
FIGURE 4-3: PHASE A: DISTRIBUTION OF GRADES .....	103
FIGURE 4-4: PHASE A: INDIVIDUAL READER ASSESSMENT .....	103
FIGURE 4-5: PHASE A: LEVEL OF AGREEMENT PGMI .....	104
FIGURE 4-6: PHASE A: LEVEL OF AGREEMENT A/I .....	105
FIGURE 4-7: PHASE B: DISTRIBUTION OF GRADES.....	109
FIGURE 4-8: PHASES A & B: COMPARISON OF GRADES .....	110
FIGURE 4-9: PHASE B: INDIVIDUAL READER ASSESSMENT.....	110
FIGURE 4-10: PHASE B: LEVEL OF AGREEMENT PGMI .....	111
FIGURE 4-11: PHASE B: LEVEL OF AGREEMENT A/I .....	112
FIGURE 4-12: PHASE C: DISTRIBUTION OF GRADES.....	114
FIGURE 4-13: ALL PHASES: COMPARISON OF GRADES .....	114
FIGURE 4-14: PHASE C: INDIVIDUAL READER ASSESSMENT.....	115
FIGURE 4-15: PHASE C: LEVEL OF AGREEMENT PGMI .....	116
FIGURE 4-16: PHASE C: LEVEL OF AGREEMENT A/I .....	117
FIGURE 4-17: PHASES A & B: LEVEL OF AGREEMENT .....	119
FIGURE 4-18: PHASE A / A*: EFFECT OF TRAINING .....	120
FIGURE 4-19: PHASE B / B*: POST-TRAINING EFFECT .....	121
FIGURE 4-20: PERCENTAGE INADEQUATE FOR EACH PHASE .....	123
FIGURE 4-21: ALL PHASES: INADEQUATE IMAGES BY SIDE / PROJECTION.....	123
FIGURE 4-22: ALL PHASES: INADEQUATE IMAGES BY COMBINED SIDE AND PROJECTION.....	123
FIGURE 4-23: ALL PHASES: SITES OF PRODUCTION .....	125
FIGURE 4-24: ALL PHASES: INADEQUATE IMAGES BY SITES OF PRODUCTION .....	125
FIGURE 4-25: PHASES B & C: ADEQUATE / INADEQUATE WITH CANCER DETECTION.....	128
FIGURE 4-26: CASE CONTROL: AGES OF CLIENTS .....	130
FIGURE 4-27: CASE CONTROL: HRT STATUS .....	130
FIGURE 4-28: CASE CONTROL: BREAST DENSITY .....	131
FIGURE 4-29: CASE CONTROL: SITE OF PRODUCTION.....	132
FIGURE 4-30: CASE CONTROL: IMAGE QUALITY R4.....	133
FIGURE 5-1: RESEARCH METHODOLOGY FOR DISCUSSION OF PGMI .....	138

## LIST OF TABLES

TABLE 2-1: BREAST DENSITY DESCRIPTIONS .....	16
TABLE 2-2: 2002 BREAST CANCER INCIDENCE AND MORTALITY RATES .....	20
TABLE 2-3: STAGING OF BREAST CANCER .....	23
TABLE 2-4: RISK CLASSIFICATION DERIVED BY WOLFE .....	24
TABLE 2-5: NATIONAL ACCREDITATION STANDARDS GUIDELINES.....	41
TABLE 2-6: BREASTSCREEN AUSTRALIA STATISTICS.....	42
TABLE 2-7: ADVANCES IN MAMMOGRAPHY.....	43
TABLE 2-8: PGMI EVALUATION OF CLINICAL IMAGE QUALITY (NAS, 2001) .....	54
TABLE 2-9: DETECTION OF SMALL CANCER DETECTION RATE ON OPTICAL DENSITY .....	57
TABLE 2-10: DENSITY & LINEAR ATTENUATION COEFFICIENT - MAMMARY TISSUE & LESION TYPE ...	61
TABLE 2-11: CONDENSED VERSION OF EQUIPMENT RELATING TO IMAGE QUALITY AND MAMMOGRAPHY.....	66
TABLE 2-12: COMPARISON OF BI-RADS AND HUNTER BREASTSCREEN CATEGORIES OF MAMMOGRAPHIC BREAST ASSESSMENT / INTERPRETATION .....	67
TABLE 3-1: DATA COLLECTION SHEET A.....	87
TABLE 3-2: DATA COLLECTION SHEET B.....	88
TABLE 3-3: MODIFIED PGMI SHEET .....	89
TABLE 3-4: KAPPA STATISTIC AGREEMENT VALUES .....	91
TABLE 3-5: DATA COLLECTION SHEET PHASE C.....	95
TABLE 4-1: PANEL MEMBERS DEMOGRAPHICS .....	99
TABLE 4-2: BREAKDOWN FOR IMAGE SELECTION PHASE A .....	100
TABLE 4-3: PHASE B: REASONS FOR RECALL .....	101
TABLE 4-4: ASSESSMENT BY PANEL MEMBERS.....	102
TABLE 4-5: PHASE A: KAPPA STATISTICS PGMI.....	105
TABLE 4-6: PHASE A: KAPPA STATISTICS A/I.....	106
TABLE 4-7: PHASE A: COMPARISON FOR KAPPA PGMI & KAPPA A/I.....	106
TABLE 4-8: PHASE A: ASSESSMENT BY PANEL MEMBERS.....	107
TABLE 4-9: PHASE B: KAPPA STATISTICS PGMI .....	111
TABLE 4-10: PHASE B: KAPPA STATISTICS A/I.....	113
TABLE 4-11: PHASE B: COMPARISON FOR KAPPA PGMI & KAPPA A/I .....	113
TABLE 4-12: PHASE C: KAPPA STATISTICS PGMI .....	116
TABLE 4-13: PHASE C: KAPPA STATISTICS A/I.....	117
TABLE 4-14: PHASE C: COMPARISON FOR KAPPA PGMI & KAPPA A/I.....	118
TABLE 4-15: KAPPA OF INTRA-OBSERVER CONSISTENCY BASED ON FOUR CATEGORIES.....	122
TABLE 4-16: ALL PHASES: INADEQUATE IMAGES BY PUBLIC / PRIVATE SITES.....	124
TABLE 4-17: ALL PHASES: REASONS FOR INADEQUATE IMAGES.....	126
TABLE 4-18: CANCER DETECTION VERSUS ADEQUATE / INADEQUATE.....	127
TABLE 4-19: CASE CONTROL DATA .....	129

## **ABBREVIATIONS**

ACR - American College of Radiography

ACS - American Cancer Society

AEC - Automatic Exposure Control Device

BI-RADS - Breast Imaging-Reporting and Data System

BRCA - Breast Cancer Susceptibility Gene

BSA - BreastScreen Australia

BSE - Breast Self Exam

CAD - Computer-Aided Detection

CC - Cranio-Caudal Mammography View

CI - Confidence Interval

DCIS - Ductal Carcinoma In Situ

DES - Diethylstilbestrol

DMIST - Digital Mammographic Imaging Screening Trial

EAR - Excellent, Adequate, Repeat

ER - Estrogen Receptor

FDA - Food and Drug Administration

FNA - Fine Needle Aspiration

HBS - Hunter Region & Wyong Shire BreastScreen (Hunter BreastScreen)

HER2 - Human Epidermal Growth Factor Receptor 2

NHSBSP - National Health Service Breast Screening Programme

HRT - Hormone Replacement Therapy

kVp - Kilovoltage Peak

mAs - Milliampere-Seconds

MLO - Medio-Lateral Oblique Mammography View

MRI - Magnetic Resonance Imaging

NAS - National Accreditation Standards

NCI - National Cancer Institute

OD - Optical Density

OR - Odds Ratio

PET - Positron Emission Tomography

PGMI - Perfect, Good, Moderate, Inadequate

PIAA - Physician Insurers Association of America

PNL - Posterior Nipple Line

QA - Quality Assurance

RR - Relative Risk

SID - Source Image Distance

TDLU - Terminal Duct Lobular Unit

TNM - Tumour (T), Lymph Node Involvement (N) and Any Distant Metastases (M)

UK - United Kingdom

USA - United States of America

## ABSTRACT

**Introduction:** Between 6-10% of women attending breast screening are recalled to investigate an unclear area on the mammogram. Image quality is known to affect image interpretation and it has been suggested that the number of recalls could be reduced with improved image quality.

**Aim:** This study aimed to investigate the effect image quality has on recall rates, to assess reader consistency using the PGMI classification system and to establish factors leading to recall.

**Materials and Methods:** A six member panel assessed 904 sets of images (698 recalled; 206 non-recalled) through a BreastScreening Program during three separate phases (pilot, main and non-recall). The pilot study was conducted without additional training in PGMI. Levels of agreement and Kappa statistics were calculated to assess intra- and inter-consistency. The percentage of and reasons for inadequate images was calculated; while a case-control study was conducted to establish factors increasing the likelihood of a client being recalled.

**Results:** The level of agreement between panel members significantly increased from the pilot to the main study (45.5% to 57.7%) before decreasing slightly for the non-recall (57.7% to 52.2%). Overall, 3.3% of the 904 sets of images were classed as inadequate; the most common PGMI reason was exposure (31%); the left MLO was considered the most common inadequate projection (30%), with more privately produced (66%) images considered inadequate compared to public images (34%). Inadequate image quality did not hinder the cancer detection rates. The case-control component demonstrated current and previous HRT use, increased breast density, better image quality and images being taken at a public site all contributed to a client being recalled.

**Conclusion:** The results of this study demonstrated that inadequate image quality was not a major factor leading to recall; although twice the number of recalled images were considered inadequate compared to the non-recalled images. The use of the PGMI classification system is highly subjective, with low levels of agreement amongst users. The use of HRT, breast density, imaging site and image quality all contribute to a client being recalled.