



Sexual assault and general body injuries: A detailed cross-sectional Australian study of 1163 women



Renate R. Zilkens^a, Debbie A. Smith^b, Maire C. Kelly^b, S. Aqif Mukhtar^a,
James B. Semmens^a, Maureen A. Phillips^{a,b,*}

^a Centre for Population Health Research, Curtin University, Perth, Western Australia, Australia

^b Sexual Assault Resource Centre, Women and Newborn Health Service, Subiaco, Western Australia, Australia

ARTICLE INFO

Article history:

Received 16 December 2016
Received in revised form 3 March 2017
Accepted 2 August 2017
Available online 9 August 2017

Keywords:

Sexual assault
Injury
Female
Intimate partner violence
Domestic violence
Mental health

ABSTRACT

Objectives: To describe the frequency and severity of general body injury in women alleging recent sexual assault and then identify demographic and assault characteristics associated with injury severity.

Design: Cross-sectional study.

Setting: Sexual Assault Resource Centre (SARC), Western Australia.

Participants: Total of 1163 women attending SARC from Jan-2009 to Mar-2015.

Methods: Women underwent a standardised medical examination and data collection by forensically trained doctors. Multivariate ordinal logistic regression analyses were performed. An algorithm was used to classify general body injuries as mild, moderate or severe.

Results: General body injury was observed in 71% of women; 52%, 17% and 2% were classified as having respectively, mild, moderate and severe injuries. Moderate or severe injury was observed in 30.4% of women assaulted by intimate partners, 16.4% of women assaulted by strangers and 14.9% of women assaulted by friends/acquaintances. In regression analysis, an interaction between mental illness and assailant type existed after adjusting for age, intellectual disability, time-to-examination, number of assailants and location. Mental illness was an independent predictor for lower injury severity (adjusted odds ratio = 0.5, 95% CI 0.3, 0.9) in women assaulted by strangers and higher injury severity in women assaulted by a friend/acquaintance (adjusted odds ratio = 2.4, 95% CI 1.6, 3.6). While women assaulted by intimate partners had more frequent moderate-to-severe injuries than other women their current mental illness status was not associated with risk of injury severity.

Conclusion: This study highlights the increased injury severity in women assaulted by intimate partners. The risk of moderate/severe injury for women with mental illness assaulted by their acquaintances was unexpected and requires further investigation.

© 2017 The Authors. Published by Elsevier Ireland Ltd. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

1. Introduction

Prevalence data for sexual assault in Australia in 2012 [1] estimated that 17% of all women aged 18 years and over and 4% of all men aged 18 years and over, had experienced sexual assault since the age of 15. There are no large cohort Australian studies which have examined either general body injury prevalence or

general body injury severity following allegations of recent sexual assault.

Earlier studies conducted in Australia [2], United States [3], Sweden [4], United Kingdom [5,6], Ireland [7], France [8], Serbia [9] and New Zealand [10] describe the frequency of general body injury and associated factors in females with a history of recent sexual assault. The frequency of non-genital injury reported in the literature ranges from 39% [8] to 82% [5]. The presence of general body injuries has been associated with higher rates of laying charges and prosecution of sexual assault [11–16]. In a large South African study [17] both general body and genital injury were strongly associated with conviction.

Only two studies address the severity of injuries sustained by women reporting sexual assault [9,18]. How injury severity varies according to the patient-assailant relationship or other potential risk factors is unknown. Women who are sexually assaulted by

* Corresponding author at: Sexual Assault Resource Centre, PO Box 842, Subiaco 6904, Australia.

E-mail addresses: r.zilkens@curtin.edu.au (R.R. Zilkens), Debbie.Smith@health.wa.gov.au (D.A. Smith), Maire.Kelly@health.wa.gov.au (M.C. Kelly), Aqif.Mukhtar@curtin.edu.au (S. A. Mukhtar), james.semmens@curtin.edu.au (J.B. Semmens), Maureen.Phillips@health.wa.gov.au (M.A. Phillips).

their intimate partner are at greater risk of non-fatal strangulation [19]. Whether women sexually assaulted by their intimate partner are also at greater risk of more severe injuries than women assaulted by other types of assailants, such as strangers or friends, remains to be investigated. In recognition of this, the Sexual Assault Resource Centre (SARC) designed a Medical Services Clinical Information System (SARC-MSCIS) [20]. SARC is the sole sexual assault referral centre for police and other emergency providers in Perth, the capital of Western Australia.

The aim of the study was to describe the frequency and severity of general body injury in a large cohort of female sexual assault presentations and to identify both demographic and assault characteristics associated with increased risk of injury severity.

2. Methods

2.1. Definitions

Any physical assault included a history of blunt force assault, non-fatal strangulation, being bitten and reported weapon use.

Assailant types were categorized as stranger, intimate partner, friend/acquaintance, accidental acquaintance (known <24 h), unknown (no memory), and others (e.g. employer/colleague, carers, relatives, taxi-driver). Intimate partner included current and ex-partners (including husbands, de factos and boyfriends).

Blunt force assault included a history of being punched, kicked, slapped, dragged, stomped, hit, pushed, knocked, beaten, and pulled hair.

Current mental illness was based on the patient's self-reported history and included psychotic (e.g. schizophrenia, bipolar disorder) and non-psychotic (e.g. anxiety, depression) disorders.

General body (non-genitoanal) injury included injuries found on the head (scalp/hair, eyes, ears, facial), mouth (lips, teeth and oral cavity), neck, torso (chest, breasts, upper back, abdomen, lower back and buttocks), arms (inner upper arms, remainder of arms, hands, and fingernails), and legs (inner thighs, remainder of thighs, lower legs, feet, knees).

Indecent assault was a non-consensual sexual act in the absence of completed or attempted penetration.

Injury types included bruises, abrasions, lacerations, incised wounds, penetrating (stab) wounds and burns. Yellow bruises detected within 18 h of the assault time were considered to predate the assault and excluded. Redness and/or tenderness were not included due to their non-specific nature. Injuries considered by the forensic clinician to be self-inflicted were excluded. Injuries due to firearms were absent in this cohort.

2.2. Injury severity

A SARC derived algorithm was used to allocate the women according to injury severity: (i) no injury, (ii) mild injury which had no impact on physical function and did not require any medical treatment (e.g. bruises/abrasions ≤ 3 cm, laceration < 2 cm), (iii) moderate injury which impacted on function and/or required treatment/hospital referral (e.g. incisions, burns, laceration > 2 cm, signs of non-fatal strangulation, 10 or more bruises > 3 cm), or (iv) severe injury (e.g. admitted to intensive care or high dependency unit, stab wounds, fracture, required treatment for non-fatal strangulation). Details on the algorithm use to classify injury severity are given in Table 3.

Non-fatal strangulation included manual, ligature and choke-hold methods of neck pressure.

Sexual assault included non-consensual completed or attempted penetration of the patient's vagina or anus by a penis, mouth, finger or other objects or penetration of the patient's mouth by a penis. The nature of the penetration was classified as

unknown if the patient suspected sexual assault but had no or incomplete recollection of the incident.

2.3. Selection of study participants

Study participants included females aged 13 years and older referred to the Sexual Assault Resource Centre (SARC) in Perth, Western Australia for an emergency consultation between 1 January 2009 and 31 March 2015 following alleged recent sexual assault. Excluded from the study were patients who (i) did not give consent for research, (ii) were indecently assaulted, (iii) did not know either the date of the sexual assault or could not estimate time since assault, (iv) referred to SARC for emergency consultation more than 10 days after the sexual assault, (v) did not consent for general body physical examination, (vi) admitted that the report was fallacious and/or the alleged assault was considered to be a false report by the police or the forensic clinician.

Children who allege sexual abuse from a family member, pre-pubertal children, children with late disclosure of the abuse and those for whom child protection agencies are involved, are examined by paediatricians from the children's hospital and not referred to SARC. As a result, these cases did not form part of the study population.

2.4. Forensic examination and data collection

Forensically trained doctors from SARC conducted physical examinations using a standard sexual assault examination protocol, as outlined in the SARC Medical and Forensic Manual, Western Australia. This includes physical examination of the entire body (head to toe, front and back), with measurement and documentation of any injuries and findings on standardized body diagrams in the SARC Forensic Record. Patient and/or guardian informed consent was obtained for use of de-identified data for research. The attending clinician entered history and examination data into the SARC-MSCIS. Missing or inconsistent database data was queried and amended where possible following clinician chart review.

2.5. Statistical analysis

Descriptive statistics were used to describe characteristics of the women and the sexual assault and summarized as means \pm standard deviations for continuous data and as percentages for categorical data. Contingency tables and chi-square tests were used to test associations between each patient/assault characteristic and injury severity. Purposeful selection of covariates was used to assess predictive factors for injury severity in patients to construct multivariate ordinal logistic regression models. All initial models included covariates that had a p-value < 0.25 in bivariate analyses along with factors of known clinical importance; model covariates with p-values of 0.15 or less were retained in the model. The purposeful selection model for the covariates and the modelling processes were described by Hosmer et al. [21]. Adjusted odds ratios and 95% confidence intervals were estimated. Plausible interactions significant at $p < 0.01$ were retained. The Brant test was used to test that the parallel regression assumption was not violated (p-value level 0.01). Two multivariate models, one without (Model 1) and one with (Model 2) adjustment for types of physical assault (e.g. blunt force, weapon) were used to identify factors independently associated with injury severity. Adjusted predictions at representative values were estimated to show how injury risk varied by varying the predictor characteristics of the women. All statistical analyses were performed using Stata version 14.1 (College Station, TX, USA).

Table 1
Demographic and clinical characteristics of 1163 women alleging recent sexual assault, by injury severity.

	All		General body injury at time of examination						X ² p-Value ^c
	n	(%) ^a	None		Mild		Mod/Severe		
			n	(%) ^b	n	(%) ^b	n	(%) ^b	
Age									
13–19	359	(30.9)	132	(36.8)	178	(49.6)	49	(13.6)	<0.001
20–29	450	(38.7)	115	(25.6)	235	(52.2)	100	(22.2)	
30–39	210	(18.1)	49	(23.3)	121	(57.6)	40	(19.0)	
40–49	104	(8.9)	25	(24.0)	54	(51.9)	25	(24.0)	
>49	40	(3.4)	15	(37.5)	23	(57.8)	2	(5.0)	
Current mental illness									
No	695	(59.8)	225	(32.4)	357	(51.4)	113	(16.3)	0.002
Yes	468	(40.2)	111	(23.7)	254	(54.3)	103	(22.0)	
Physical disability									
No	1,135	(97.6)	324	(28.5)	601	(53.0)	210	(18.5)	0.165
Yes	28	(2.4)	12	(42.9)	10	(35.7)	6	(21.4)	
Intellectual disability									
No	1,121	(96.4)	317	(28.3)	590	(52.6)	214	(19.1)	0.014
Yes	42	(3.6)	19	(45.2)	21	(50.0)	2	(4.8)	
Alcohol used ^d									
No	451	(38.8)	145	(32.1)	227	(50.3)	79	(17.5)	0.173
Yes (not intoxicated)	183	(15.7)	50	(27.3)	90	(49.2)	43	(23.5)	
Yes (intoxicated)	518	(44.5)	137	(26.4)	290	(56.0)	91	(17.6)	
Uncertain/Missing	11	(0.9)	4	(36.4)	4	(36.4)	3	(27.3)	
Sedating agents ^e									
No	1,070	(92.0)	312	(29.2)	563	(52.6)	195	(18.2)	0.542
Yes	93	(8.0)	24	(25.8)	48	(51.6)	21	(22.6)	
Stimulants ^f									
No	1,111	(95.5)	326	(29.3)	582	(52.4)	203	(18.3)	0.215
Yes	52	(4.5)	10	(19.2)	29	(55.8)	13	(25.0)	
Time to examination									
<24 h	624	(53.7)	194	(31.1)	315	(50.5)	115	(18.4)	0.056
24 to <72 h	359	(30.9)	90	(25.1)	197	(54.9)	72	(20.1)	
3 to <5 days	113	(9.7)	25	(22.1)	66	(58.4)	22	(19.5)	
5 to <10 days	67	(5.8)	27	(40.3)	33	(49.3)	7	(10.4)	

^a Column percentage.

^b Row percentage.

^c χ^2 , chi-square p-value.

^d Alcohol use refers to alcohol consumed in the 6 h period prior to the assault.

^e Non-prescribed sedating agents include cannabinoids (marijuana & synthetic), opiates (heroin) and benzodiazepines.

^f Stimulants include amphetamine, ecstasy, cocaine (there were no hallucinogens in this cohort).

2.6. Ethics approval

Ethics approval was obtained from both the Women and Newborn Health Services Human Research Ethics Committee (Approval number 2014089EW) and the Curtin University Human Research Ethics Committee, Western Australia (Approval number HR98/2015).

3. Results

A total of 1755 women (and 103 men) presented to SARC for emergency consultation during the 75 month study period, of whom 1163 were included in the study. Those excluded consisted of 33.7% (n = 592) of all presenting women: 5.4% (n = 95) not consenting to research, 2.0% (n = 35) presented following indecent assault, 1.1% (n = 19) sexual assaults considered to be a false report, 4.0% (n = 70) presenting >10 days after assault and 21.3% (n = 373) not consenting to general physical examination. Police involvement at the time of emergency consultation was 68.7% (n = 799). Seventeen women presented with two or more separate sexual

assaults during the study period with each consultation included in the analysis.

The flow diagram in Fig. 1 provides an overview of the study design, together with a breakdown of the types of assailants and the prevalence of moderate/severe general body injury by assailant type.

3.1. Demographic and assault characteristics

Table 1 presents the participants' demographic characteristics (mean \pm SD age 26.5 \pm 10.9 years, range 13–95 years) and prevalence of general body injury severity level by demographic factors with statistical associations as determined by chi-square test. Demographic factors associated with injury severity level included age, current mental illness, intellectual disability and time to examination. Clinical factors not associated with injury severity included use of alcohol, sedating agents and stimulants. Current mental illness was reported by 40.2% of all participants. There was no statistical difference in the prevalence of self-reported patient mental illness by assailant type ($\chi^2_{(5df)} = 3.746$, $p = 0.586$).

Table 2
Assault characteristics in 1163 women alleging recent sexual assault by injury severity.

	All		General body injury at time of examination						X ² p-value ^c
	n	(%) ^a	None		Mild		Mod/Severe		
			n	(%) ^b	n	(%) ^b	n	% ^b	
Assailant type^d									
Intimate partner	204	(17.5)	39	(19.1)	103	(50.5)	62	(30.4)	<0.001
Stranger	195	(16.8)	46	(23.6)	117	(60.0)	32	(16.4)	
Accidental acquaintance	220	(18.9)	65	(29.5)	121	(55.0)	34	(15.5)	
Friend/Acquaintance	376	(32.3)	137	(36.4)	183	(48.7)	56	(14.9)	
Unknown (no memory)	100	(8.6)	21	(21.0)	53	(53.0)	26	(26.0)	
Other	68	(5.8)	28	(41.2)	34	(50.0)	6	(8.8)	
Number of assailants									
Single	1000	(86.0)	307	(30.7)	514	(51.4)	179	(17.9)	<0.001
Multiple	101	(8.7)	14	(13.9)	69	(68.3)	18	(17.8)	
Uncertain	62	(5.3)	15	(24.2)	28	(45.2)	19	(30.6)	
Location of assault									
Indoor	819	(70.4)	260	(31.7)	421	(51.4)	138	(16.8)	<0.001
Outdoor	305	(26.2)	67	(22.0)	172	(56.4)	66	(21.6)	
No memory	22	(1.9)	0	(0.0)	11	(50.0)	11	(50.0)	
No information	17	(1.5)	9	(52.9)	7	(41.2)	1	(5.9)	
Type of sexual assault^e									
Oral only assault	13	(1.1)	4	(30.8)	3	(23.1)	6	(46.2)	0.139
Attempted penetrations	44	(3.8)	17	(38.6)	20	(45.5)	7	(15.9)	
Vaginal	730	(62.8)	218	(29.9)	389	(53.3)	123	(16.8)	
Anal	38	(3.3)	12	(31.6)	20	(52.6)	6	(15.8)	
Anal & vaginal	120	(10.3)	28	(23.3)	64	(53.3)	28	(23.3)	
Unknown	213	(18.3)	57	(26.8)	111	(52.1)	45	(21.1)	
Only vaginal tongue	5	(0.4)	0	(0.0)	4	(80.0)	1	(20.0)	
Type of physical assault reported^f									
None	696	(59.8)	263	(37.8)	359	(51.6)	74	(10.6)	<0.001
Weapon use	19	(1.6)	4	(21.1)	12	(63.2)	3	(15.8)	
Non-fatal strangulation	13	(1.1)	1	(7.7)	8	(61.5)	4	(30.8)	
Blunt force	278	(23.9)	57	(20.5)	162	(58.3)	59	(21.2)	
Bitten	21	(1.8)	4	(19.0)	12	(57.1)	5	(23.8)	
Multiple types	136	(11.7)	7	(5.1)	58	(42.6)	71	(52.2)	

^a Column percentage.

^b Row percentage.

^c χ^2 , chi-square p-value.

^d Friend/acquaintance includes internet acquaintance. Accidental acquaintance defined as known for <24 h.

^e Type of sexual assault. • Oral only defined as solely completed oral penetration. • Attempted penetrations is defined as attempted vaginal penetrations ± attempted anal or oral penetration. • Vaginal penetration is defined as completed vaginal penetration ± attempted oral or attempted anal penetrations. • Anal assault is defined as completed anal penetration plus attempted vaginal penetration ± oral penetration. • Anal & vaginal is defined as completed anal plus completed vaginal penetration ± oral penetration. • Unknown is defined as patient does not know the nature of the penetration.

^f Type of physical assault. • Blunt force assault includes being punched, kicked, restrained, slapped, dragged, stomped, hit, pushed, knocked, beaten and having hair pulled. • Multiple types includes women reporting at least two of the four types of physical assault (i.e. weapon use, non-fatal strangulation, blunt force and/or being bitten).

Table 2 presents the assault characteristics (including patient-assailant relationship, types of sexual and physical assaults perpetrated, number of assailants and location of the assault) and prevalence of injury severity by assault characteristics. Friends/acquaintances were the most frequent type of assailants (32.3%) with intimate partners and strangers representing, respectively, 17.5% and 16.8% of the study participants. Table 2 shows that, while there was evidence that injury severity was associated with assailant type, number of assailants, location of assault and types of reported physical assault (Chi-square p-values <0.001), there were no statistical associations between the types of reported sexual assaults and general body injury severity (Chi-square p-value = 0.139).

3.2. Classification of injury severity

Table 3 presents details on frequency of different injury types and classification of injury by severity. Just over half (52.5%) of the women had mild injuries, 16.7% moderate and 1.9% serious injuries.

Non-genital injury was absent in 29% of women alleging recent sexual assault.

3.3. The reported use of physical assault during sexual assault

Table 4 presents the frequency of type of physical assault by assailant type. Strong associations (Chi-square p-values < 0.001) were identified between each type of physical assault (i.e. non-fatal strangulation, blunt force assault, reports of being bitten and weapon use) and assailant type. Women sexually assaulted by an intimate partner had a 5.2 fold (95% CI 3.6, 7.5) increased risk of reporting 'Any Physical Assault' when compared to women sexually assaulted by a friend/acquaintance, and 2.5 fold increased risk (95% CI 1.6, 3.7) when compared to women assaulted by a stranger. Women sexually assaulted by a stranger had a 2.1 fold (95% CI 1.5, 3.0) increased risk of reporting 'Any Physical Assault' when compared to women sexually assaulted by a friend/acquaintance.

Table 3

Frequency of injury type and classification of injury by severity in 1163 sexually assaulted women who consented to a general body examination.

Injury severity Diagnostic criteria	Injury type		Injury severity	
	n	(%)	n ^a	(%)
No Injury			336	(28.9)
1. No general body injuries	336	(28.9)		
Mild ^b			611	(52.5)
1. Mild classification given to women who do not meet criteria for any other classification	611	(52.5)		
Moderate ^c			194	(16.7)
1. Physical injury requiring hospital referral	34	(2.9)		
2. Incised wounds	10	(0.9)		
3. Hand/foot fractures	1	(0.1)		
4. Physical signs suggestive of non-fatal strangulation and a history of non-fatal strangulation but not referred to hospital	15	(1.3)		
5. At least 10 bruises/abrasions >3 cm (excludes linear abrasions)	145	(12.5)		
6. At least one laceration >2 cm	12	(1.0)		
7. Burns	11	(0.9)		
Severe ^d			22	(1.9)
1. Required ICU/HDU Care due to general body injuries	2	(0.2)		
2. Stab wounds	5	(0.4)		
3. Gunshot wounds	0	(0.0)		
4. Fractures (excluding hand/foot fractures)	3	(0.3)		
5. Hospital referral required for assessment of non-fatal strangulation due to symptoms and/or signs of non-fatal strangulation.	13	(1.1)		

^a The total number of injury types for moderate and severe injury does not add up to number allocated to injury severity classification because some patients satisfied multiple diagnostic criteria.

^b Mild injury defined as injuries having no discernible impact on the patient's physical function or not requiring treatment.

^c Moderate injury defined as impacting on function and/or requiring medical treatment. Patients needed at least one out of the seven moderate diagnostic criteria to qualify for allocation to moderate injury category.

^d Severe injury category, defined as having at least one out of the five severe diagnostic criteria. Where the patient experienced both moderate and severe types of injuries the reported injuries are for the severe injuries. ICU, intensive care unit. HDU, high dependency unit. Symptoms of non-fatal strangulation include neck/throat pain, tender neck on palpation, pain and/or difficulty swallowing, vocal changes, shortness of breath, loss of consciousness, feeling dizzy/faint, blurred vision, urinary incontinence, loss of voice, unable to talk, pain on talking. Signs of non-fatal strangulation include linear neck abrasions, non-petechial bruising neck, upper-neck/facial petechial bruising, subconjunctival haemorrhages, conjunctival petechiae, neck soft-tissue swelling.

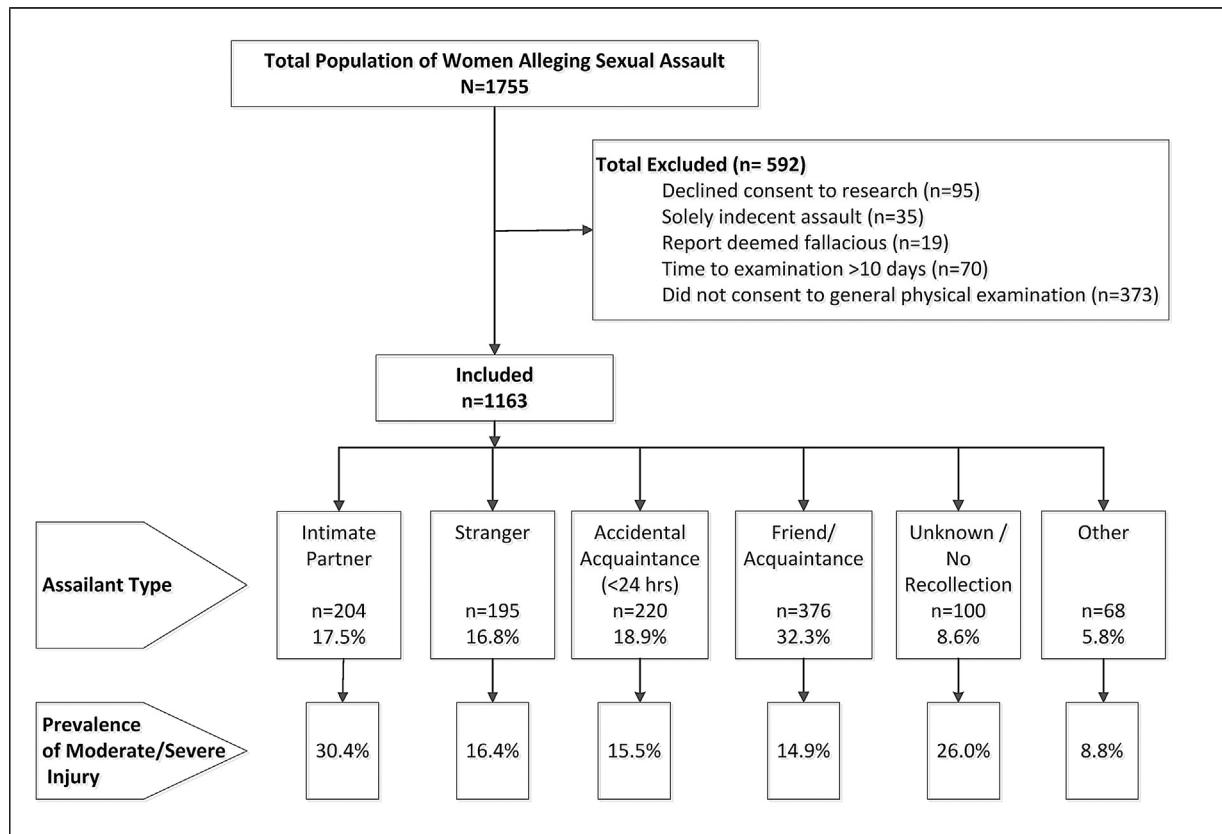
**Fig. 1.** Flow diagram of study population showing prevalence of moderate/severe general body injury by assailant type.

Table 4

Frequency of types of physical assault reported by 1163 sexually assaulted women and assailant type.

	n	Non fatal strangulation		χ^2 p-Value ^a	Blunt force ^b		χ^2 p-Value	Bitten		χ^2 p-Value	Weapon use		χ^2 p-Value	Any physical assault ^c		χ^2 p-Value
		n	(%)		n	(%)		n	(%)		n	(%)		n	(%)	
Assailant type																
Intimate partner	204	46	(22.5)	<0.001	130	(63.7)	<0.001	19	(9.3)	<0.001	33	(16.2)	<0.001	144	(70.6)	<0.001
Stranger	195	11	(5.6)		81	(41.5)		1	(0.5)		24	(12.3)		96	(49.2)	
Accidental acquaintance	220	8	(3.6)		66	(30.0)		8	(3.6)		10	(4.5)		78	(35.5)	
Friend/Acquaintance	376	12	(3.2)		104	(27.7)		19	(5.0)		20	(5.3)		119	(31.6)	
Unknown (no memory)	100	0	(0.0)		5	(5.0)		0	(0.0)		1	(1.0)		5	(5.0)	
Other	68	2	(2.9)		24	(35.3)		2	(2.9)		4	(5.9)		25	(36.8)	
All women	1163	79	(6.8)		410	(35.3)		49	(4.2)		92	(7.9)		467	(40.2)	

^a χ^2 , Chi-square test of proportions.^b Blunt force includes included a history of being punched, kicked, slapped, dragged, stomped, hit, pushed, knocked, beaten, pulled hair.^c Any physical assault includes non-fatal strangulation, blunt force, bitten and/or reported weapon use.

There were no statistical associations between the types of reported physical assaults and current mental illness status (Chi-square p-values > 0.05).

3.4. Multivariable models examining factors independently associated with injury

The best fitting ordinal logistic regression model for injury severity (that excluded adjustment for types of physical assault) contained an interaction of current mental illness with assailant type in addition to adjustment for age, intellectual disability, time to examination, number of assailants and physical location of assault (Model 1, Table 5). This model shows that current mental illness was associated with increased injury severity in women assaulted by friends and acquaintances and decreased injury severity if assaulted by a stranger. If the assailant was an intimate partner, or the patient did not know her relationship to the assailant, the mental health status of the patient neither increased nor decreased injury risk.

Model 1 was used to compute adjusted predictions at representative values to demonstrate the effect of the interaction between mental illness and assailant type on the predicted probability of presenting to SARC with a moderate/severe injury. Modal values for main effects in Model 1 (i.e. age 20–49 years, no intellectual disability, examined within 24 h, assaulted indoors by a single assailant) were selected to be representative values. Fig. 2 gives the predicted probabilities for moderate/severe injury by patient mental illness status and assailant type for women with aforementioned representative modal values.

In Table 5 the friend/acquaintance assailant type has been used as the reference group to demonstrate the relative risk of injury by assailant type for women with and without a current mental illness. It shows, for example, that in the absence of mental illness, the odds of 'moderate/severe injury' versus the combined 'no injury' and 'mild injury category' were estimated to be 3.9 times greater in women assaulted by an intimate partner when compared to women assaulted by a friend/acquaintance.

Women assaulted by intimate partners tended to report more frequent physical assault (e.g. weapon use, blunt force) compared with other assailant types (Table 3). Thus, additional adjustment for reported types of physical assault (Model 2, Table 5), attenuated the increased risk of body injury in women without a mental illness assaulted by intimate partners when compared to women without a mental illness assaulted by a friend/acquaintance (Odds Ratio Model 1 = 3.9 vs Odds Ratio Model 2 = 2.1).

4. Discussion

This Australian study quantified the presence and severity of general body injuries in a group of over eleven hundred women referred to SARC (Perth) for examination by clinical forensic medical practitioners following recent sexual assault. The study has identified and confirmed many demographic and assault characteristics associated with increased risk of physical injury during sexual assault. Factors including age, current mental illness, assailant type (e.g. intimate partner) and multiple assailants were all independently associated with increased risk of any injury and injury severity. Women assaulted by intimate partners were more likely to have injuries of greater severity.

Regardless of mental health status, the prevalence of a body injury was highest in women sexually assaulted by an intimate partner when compared to any other assailant type, as was the prevalence of non-fatal strangulation, biting, use of other blunt force and weapons. Indeed, women sexually assaulted by their partner were five times more likely to report physical violence than women assaulted by a friend/acquaintance, similar to what has been observed in a recent Swedish study published by Moller et al. [4]. As with the Swedish study, we also found that risk of physical violence in sexual assaults perpetrated by strangers was significantly higher than in those by acquaintances and significantly lower than those perpetrated by intimate partners. Consequently, when we controlled for the presence of different types of physical assault, the assailant type became less strongly associated with increased risk of general body injury. Our findings are similar to a study by Sugar et al who concluded that strangers were independently associated with increased body injury after adjusting for hitting, kicking and strangulation [3]. However, unlike Sugar we also found that women assaulted by an intimate partner were at an even greater risk of injury. Although we adjusted for reported physical assault in one of our regression models, we did so to demonstrate why we do not advocate this approach. We believe that adjusting for use of physical violence conceals the magnitude of the increased risk of having an injury and of the injury being of greater severity when assaulted by an intimate partner.

The increased risk of injury severity in women assaulted by an intimate partner warrants emphasis in sexual assault training for police and/or sexual assault health care providers. Currently in Australia sexual assault services and those services for domestic violence tend to be separate. We have demonstrated that this separation is artificial, with many of the most 'at-risk' women being simultaneously affected by both sexual assault and domestic violence. We have shown previously that women sexually assaulted by their intimate partner, particularly those aged in

Table 5
Ordinal logistic models measuring higher risk of injury severity^a in sexually assaulted women.

Interactions terms	Model 1			Model 2			
	OR ^b	p-Value	95% CI ^c	OR	p-Value	95% CI	
Current mental illness Yes vs No ^d	Assailant						
	Intimate partner	0.9	0.655	0.5–1.5	0.9	0.629	0.5–1.5
	Stranger	0.5	0.020	0.3–0.9	0.5	0.045	0.3–1
	Accid. acquaint ^e	1.8	0.026	1.1–3.1	1.6	0.079	0.9–2.8
	Friend/Acquaint	2.4	<0.001	1.6–3.6	2.2	<0.001	1.4–3.3
	No memory	0.8	0.534	0.3–1.8	0.8	0.709	0.3–2.1
Other ^f	1.9	0.185	0.7–4.8	2.0	0.166	0.8–5	
Assailant type Int. partner vs friend/acquaint ^g	Mental illness						
	No	3.9	<0.001	2.5–6.2	2.1	0.002	1.3–3.3
Stranger vs friend/acquaint ^g	Yes	1.4	0.183	0.8–2.4	0.8	0.493	0.5–1.4
	No	2.2	<0.001	1.4–3.5	1.9	0.006	1.2–3
Accid. acquaint vs friend/acquaint ^g	Yes	0.5	0.008	0.3–0.8	0.5	0.013	0.3–0.9
	No	1.4	0.137	0.9–2.1	1.4	0.099	0.9–2.2
No memory vs friend/acquaint ^g	Yes	1.0	0.861	0.6–1.8	1.1	0.801	0.6–1.8
	No	2.1	0.039	1–4.4	2.6	0.012	1.2–5.5
Other vs friend/acquaint ^g	Yes	0.7	0.320	0.3–1.5	1.0	0.991	0.4–2.2
	No	0.8	0.534	0.4–1.6	0.7	0.368	0.4–1.5
Yes	0.6	0.225	0.3–1.3	0.6	0.260	0.3–1.3	
Main effects	Model 1			Model 2			
	OR	p-Value	95% CI	OR	p-Value	95% CI	
Age							
13–19	1		Ref	1		Ref	
20–49	1.6	<0.001	1.3–2.1	1.4	0.012	1.1–1.8	
>49	0.9	0.863	0.5–1.8	0.8	0.601	0.4–1.6	
Intellectual disability							
No	1		Ref	1		Ref	
Yes	0.5	0.041	0.3–1	0.6	0.087	0.3–1.1	
Time to examination							
<24 h	1		Ref	1		Ref	
24 to <72 h	1.2	0.131	0.9–1.6	1.5	0.005	1.1–1.9	
3 to <5 days	1.5	0.034	1–2.3	1.7	0.010	1.1–2.6	
5 to <10 days	0.7	0.137	0.4–1.1	0.8	0.387	0.5–1.3	
Number of assailants							
Single	1		Ref	1		Ref	
Multiple	1.8	0.004	1.2–2.7	1.5	0.042	1–2.3	
Uncertain	1.1	0.710	0.6–2.3	1.4	0.381	0.7–2.9	
Location of assault							
Indoor	1		Ref	1		Ref	
Outdoor	1.6	0.001	1.2–2.1	1.6	0.002	1.2–2.1	
Types of physical assault reported							
None				1		Ref	
Weapon				2.0	0.132	0.8–4.9	
Non-fatal strangulation				4.9	0.004	1.6–14.5	
Blunt force only				2.5	<0.001	1.8–3.3	
Bite only				2.5	0.046	1–6.3	
Multiple				9.9	<0.001	6.5–15.1	

^a Ordinal logistic models odds ratio measuring higher risk of injury severity in this order: no injury, mild injury, moderate/severe injury.

^b OR, adjusted odds ratio.

^c 95% CI, 95% confidence interval.

^d No current mental health illness is reference group.

^e Accid. Acquaint, are accidental acquaintances known for <24 h.

^f Other includes relatives.

^g Friend/Acquaint (friends/acquaintances known for >24 h) is reference group. Models based on 1124 women; 22 women who could not remember whether they were assaulted indoors or outdoors were not included because all these 22 women had injuries (i.e. “not knowing location of assault” predicted injury perfectly); 17 women with missing information for assault site were excluded due to small sample size. Model 1 adjusted ORs estimated from an ordinal logistic regression model containing interactions of current mental health conditions with assailant type, in addition to adjustment for age, intellectual disability, and time to examination, number of assailants and location of assault as main effects. Model 2 includes Model 1 covariates plus history of physical assault (including non-fatal strangulation, being bitten, use of blunt force and weapons).

their 30's, have a very high risk of non-fatal strangulation [19]. It appears that women sexually assaulted by an intimate partner may benefit from improved coordination of or integration of services that address their particular ‘high risk’ needs.

Few studies classify injuries by their severity. Mild, moderate and severe general body injury was present in, respectively, 52%,

17% and 2% of the 1163 sexually assaulted women who consented to general body examination at SARC. General body injury was absent in 29% of women. These results are similar to a Serbian study of 101 women, which reported that 44%, 18% and 1% sustained, respectively, light, moderate and severe injuries [9]. However the Serbian study is not directly comparable to ours since

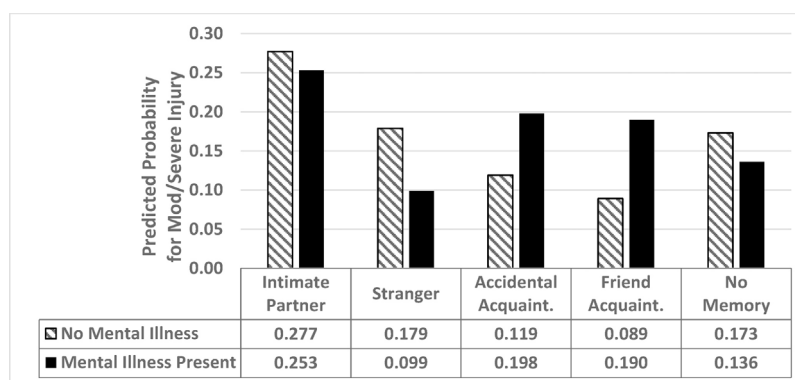


Fig. 2. Model 1^a adjusted predicted probability estimates for moderate/severe injury in women without a current mental illness (diagonal pattern) and with a current mental illness (solid black) by assailant type. These estimates are for representative women aged 20–49 years with no intellectual disability, examined within 24 h, and assaulted indoors by a single assailant.

Model 1 predicted probability from an ordinal logistic regression model containing interactions of current mental health conditions with assailant type, in addition to adjustment for age, intellectual disability, and time to examination, number of assailants and location of assault as main effects.

it used a Clinical Injury Extent Score that included both genital and non-genital injury. Our findings also show less moderate and less severe injuries when compared to a Canadian study of 95 women sexually assaulted in 1992 [18]. The prevalence of moderate body injuries was over three times higher in the Canadian cohort (i.e. 59% Canadian versus 17% Australian). A possible explanation for greater injury severity in the Canadian study is that all their participants had police involvement compared with only two-thirds in our study. Women with moderate/severe injuries may be more likely to report the assault to police. Additionally, the Canadian study findings were based on agreements between four clinicians who rated each case based on their own personal criteria as opposed to using a pre-defined algorithm.

A novel and unexpected finding was the strong interaction between current mental illness and assailant type on injury severity. Forty percent of the women in our study had a mental illness at the time of the sexual assault. This is similar to levels found in Canadian [22], English [23] and Dutch [24] studies where prevalence of mental illness ranged from 34% to 45%. In our study mental illness prevalence levels were similar in women sexually assaulted by a complete stranger, intimate partner, friend/acquaintance or accidental acquaintance (known <24 h). However, depending on the assailant type, there was a different level of injury severity in those women without a current mental illness. Specifically, we found that, after controlling for other factors, the risk of moderate or severe general body injury was almost halved if a woman had a mental illness at the time of being sexually assaulted by a stranger. In contrast, women with a mental illness assaulted by either a friend/acquaintance or accidental acquaintance had about twice the risk of moderate or severe injury when compared to women without a mental illness. Moreover, even though intimate partner sexual assaults were associated with the highest risk of moderate/severe injury, having a current mental illness neither increased nor decreased the risk of injury if an intimate partner was involved.

The majority of people with a mental illness are not violent. People with mental illness are far more likely to be victims than perpetrators of violent crime [25]. Those with severe mental illnesses, especially those with a psychotic disorder are 2.5 times more likely to be physically assaulted or sexually assaulted than the general population [26]. Nevertheless, there is some evidence that alcohol dependence, marijuana dependence and schizophrenia-spectrum disorder are linked to increased violence [27–29]. Thus, a possible explanation for increased injuries in women with a mental illness who are assaulted by a friend/acquaintance is that their friend/acquaintance may be more likely to have a mental

health or substance abuse disorder contributing to violent behaviour. Further studies focusing on the mental history of the sexual assailant (if known by the patient) and/or identifying how they met the “friend/acquaintance” are needed to test this hypothesis.

A possible explanation for fewer injuries in women with mental illness assaulted by strangers is that the nature of their mental illness brought about a dissociative or passive response (froze) so that consequently less violence occurred. Alternatively, some women may themselves have had a psychotic illness, and formed the delusional belief that they have been assaulted by a stranger. Again, further studies designed to test this theory are required.

4.1. Strengths and limitations

There are a number of study strengths. The first is that by including a relatively large number of study participants we were able to use multivariate regression to identify which factors were independently associated with injuries. Furthermore, the use of a standard protocol by forensically trained clinicians to examine all study participants and the subsequent entry of this information by the treating clinician into the bespoke SARC information system provides confidence in the quality of the injury data.

A number of study limitations exist. The study results are not generalizable to all women following sexual assault for a number of reasons. Firstly, 5% of women referred to SARC did not consent to use of their data for research. This group may also include some women incapacitated with severe injuries where consent was unable to be obtained. Also, 11% of those referred within 10 days of the sexual assault declined a general body physical examination. Secondly, sexual assault is under-reported to police and health services [30,31]. Although there is evidence that injury does not motivate US women to report to police [32], it is possible that Australian women referred to SARC may have more injuries than those not referred to SARC. If so then our injury prevalence findings may over estimate population rates. Alternatively, some women with more severe (non-life threatening) injuries sustained from intimate partner assaults may be reluctant to attend SARC resulting in an underestimate of injury prevalence. In addition women with life-threatening injuries treated in hospital may not be identified as having been sexually assaulted.

As with all studies examining associations between sexual assault and injury the history of the assault was subjective and reliant on the patient. In an attempt to minimise error we excluded women with confirmed false allegations. Some women did not recollect or report comprehensive assault details.

Another limitation is that mental illness was self-reported and therefore relies on the patient's understanding and insight into their own mental health. Specific mental health diagnoses were not recorded in the SARC-MSCIS thus limiting out capacity to investigate which, if any, of the mental health conditions, are associated with greater risk of injury during sexual assault.

5. Conclusion

In conclusion, this study demonstrates high rates of violence in intimate partner sexual assault scenarios highlighting the need for comprehensive improvements to social policy, hospital emergency and clinical forensic services. The finding that having a current mental illness increases the risk of more severe injuries in women assaulted by a friend/acquaintance and decreases the risk of injury if assaulted by a stranger was unexpected and requires further investigation.

Disclosure of interests

The authors declare that they have no competing interests.

Contribution to authorship

The study was designed by RZ, DS, MK, SM, JS and MP. RZ analysed the data, and interpreted the results with help from DS, MK and MP. RZ wrote the article and all authors commented on and contributed to the revision of drafts and the final version of the article.

Funding

R. Zilkens and S. Mukhtar were funded by the Lotterywest Data Linkage Infrastructure Grant (Grant Application number #421003516).

Acknowledgements

We thank Dr Alexandra Welborn for critical review of the manuscript. The authors would like to acknowledge Ms Rae Cummins, administrative Assistant, SARC Medical and Forensic Service, SARC Western Australia for her assistance with the project.

References

- [1] Australian Bureau of Statistics, Personal Safety Survey, 2012, Australian Bureau of Statistics, Canberra, 2013.
- [2] C.M. Palmer, A.M. McNulty, C. D'Este, B. Donovan, Genital injuries in women reporting sexual assault, *Sex. Health* 1 (2004) 55–59.
- [3] N.F. Sugar, D.N. Fine, L.O. Eckert, Physical injury after sexual assault: findings of a large case series, *Am. J. Obstet. Gynecol.* 190 (2004) 71–76.
- [4] A.S. Moller, T. Backstrom, H.P. Sondergaard, L. Helstrom, Patterns of injury and reported violence depending on relationship to assailant in female Swedish sexual assault victims, *J. Interpers. Violence* 27 (2012) 3131–3148.
- [5] L. Bowyer, M.E. Dalton, Female victims of rape and their genital injuries, *Br. J. Obstet. Gynaecol.* 104 (1997) 617–620.
- [6] C. White, I. McLean, Adolescent complainants of sexual assault; injury patterns in virgin and non-virgin groups, *J. Clin. Forensic Med.* 13 (2006) 172–180.
- [7] W. Maguire, E. Goodall, T. Moore, Injury in adult female sexual assault complainants and related factors, *Eur. J. Obstet. Gynecol. Reprod. Biol.* 142 (2009) 149–153.
- [8] C. Grossin, I. Sibille, G. Lorin de la Grandmaison, A. Banas, F. Brion, M. Durigon, Analysis of 418 cases of sexual assault, *Forensic Sci. Int.* 131 (2003) 125–130.
- [9] D. Alempijevic, S. Savic, S. Pavlekcic, D. Jecmenica, Severity of injuries among sexual assault victims, *J. Forensic Leg. Med.* 14 (2007) 266–269.
- [10] F.A. Goodyear-Smith, Medical evaluation of sexual assault findings in the Auckland region, *N. Z. Med. J.* 102 (1989) 493–495.
- [11] M.J. McGregor, J. Du Mont, T.L. Myhr, Sexual assault forensic medical examination: is evidence related to successful prosecution? *Ann. Emerg. Med.* 39 (2002) 639–647.
- [12] D. Lievore, Prosecutorial Decisions in Adult Sexual Assault Cases: An Australian study, Australian Government's Office of the Status of Women, Australian Institute of Criminology, Canberra, 2004.
- [13] R. Kingsnorth, D. Cummings, J. Lopez, J. Wentworth, Criminal sentencing and the court probation office: the myth of individualized justice revisited, *Justice Syst. J.* 20 (1999) 255–273.
- [14] B. Rambow, C. Adkinson, T.H. Frost, G.F. Peterson, Female sexual assault: medical and legal implications, *Ann. Emerg. Med.* 21 (1992) 727–731.
- [15] C. Spohn, D. Beichner, E. Davis-Frenzel, Prosecutorial justifications for sexual assault case rejection: guarding the "gateway to justice", *Soc. Probl.* 48 (2001) 206–235.
- [16] R. McLean, J. Goodman-Delahunty, The influence of relationship and physical evidence on police decision-making in sexual assault cases, *Aust. J. Forensic Sci.* 40 (2008) 109–121.
- [17] R. Jewkes, N. Christofides, L. Vetten, R. Jina, R. Sigsworth, L. Loots, Medico-legal findings, legal case progression, and outcomes in South African rape cases: retrospective review, *PLoS Med.* 6 (2009).
- [18] M.J. McGregor, G. Le, S.A. Marion, E. Wiebe, Examination for sexual assault: is the documentation of physical injury associated with the laying of charges? A retrospective cohort study, *Can. Med. Assoc. J.* 160 (1999) 1565–1569.
- [19] R.R. Zilkens, M.A. Phillips, M.C. Kelly, S.A. Mukhtar, J.B. Semmens, D.A. Smith, Non-fatal strangulation in sexual assault: a study of clinical and assault characteristics highlighting the role of intimate partner violence, *J. Forensic Leg. Med.* 43 (2016) 1–7.
- [20] S.A. Mukhtar, D.A. Smith, M.A. Phillips, M.C. Kelly, R.R. Zilkens, J.B. Semmens, Capturing sexual assault data: an information system designed by forensic clinicians and healthcare researchers, *Health Inf. Manag. J.* (2017) 1–10.
- [21] D.W. Hosmer, S. Lemeshow, R.X. Sturdivant, *Applied Logistic Regression*, John Wiley & Sons, Inc, New York, NY, USA, 2013.
- [22] R. Brown, J. Du Mont, S. Macdonald, D. Bainbridge, A comparative analysis of victims of sexual assault with and without mental health histories: acute and follow-up care characteristics, *J. Forensic Nurs.* 9 (2013) 76–83.
- [23] C. Brooker, E. Durmaz, Mental health, sexual violence and the work of Sexual Assault Referral centres (SARCs) in England, *J. Forensic Leg. Med.* 31 (2015) 47–51.
- [24] I. Bicanic, H. Snetselaar, A. De Jongh, E. Van de Putte, Victims' use of professional services in a Dutch sexual assault centre, *Eur. J. Psychotraumatol.* 5 (2014).
- [25] U. Hiroeh, L. Appleby, P.B. Mortensen, G. Dunn, Death by homicide, suicide, and other unnatural causes in people with mental illness: a population-based study, *Lancet* 358 (2001) 2110–2112.
- [26] V.A. Hiday, Putting community risk in perspective: a look at correlations, causes and controls, *Int. J. Law Psychiatry* 29 (2006) 316–331.
- [27] L. Arseneault, T.E. Moffitt, A. Caspi, P.J. Taylor, P.A. Silva, Mental disorders and violence in a total birth cohort: results from the Dunedin Study, *Arch. Gen. Psychiatry* 57 (2000) 979–986.
- [28] P.A. Brennan, S.A. Mednick, S. Hodgins, Major mental disorders and criminal violence in a Danish birth cohort, *Arch. Gen. Psychiatry* 57 (2000) 494–500.
- [29] F. Pinna, M. Tusconi, C. Dessi, G. Pittaluga, A. Fiorillo, B. Carpinello, Violence and mental disorders. A retrospective study of people in charge of a community mental health center, *Int. J. Law Psychiatry* 47 (2016) 122–128.
- [30] D. Lievore, Non-Reporting and Hidden Recording of Sexual Assault: An International Literature Review, Commonwealth office of the status of women, Canberra, 2003.
- [31] J. Mouzos, T. Makkai, Women's Experience of Male Violence: Findings from the Australian Component of the International Violence Against Women Survey (IVAWS) Research and Public Policies Series No 56, Australian Institute of Criminology, 2004.
- [32] J.S. Jones, C. Alexander, B.N. Wynn, L. Rossman, C. Dunnuck, Why women don't report sexual assault to the police: the influence of psychosocial variables and traumatic injury, *J. Emerg. Med.* 36 (2009) 417–424.