10.1071/SH12169_AC

Accessory Publication: Sexual Health 2013, 10(4), 379–381

Heterosexual Partner Acquisition Rates in the Australian Population

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Complete Description of Methodology

ASHR respondents, who had been classified as heterosexual, were asked questions about their 'regular partner(s)' including how long ago they first had sex with them, i.e. when the partnership started. In the case of respondents with multiple regular partners, questions were asked about two regular partners. Respondents were also asked about their last 3 partners, i.e., the people with whom they most recently had sex, including a similar question as to when the partnership started. If any of these last 3 partners is one of the regular partners, no separate answers were recorded, and the regular-partner answers were used.

By analysing the ASHR dataset (using the weighted survey package for statistical software R (1, 2)), the fraction of the heterosexual population that acquired no new partner, one new partner, two new partners, and three or more new partners in the last year can be derived. Moreover, these fractions can be derived for a "compartment" of the population defined by age-band and gender (e.g. female 20-24). Because ASHR

only asks about the last 3 partners, no distinction can be made, for example, between people who acquired 3 partners and those who acquired 4 partners in the last year. These fractions can then be used to estimate the PAR of the population or compartment by assuming that the number of partners acquired in a year by a member of the population follows Poisson statistics as follows. If a population of N_f females and N_m males yields Λ new partnerships per year, the PARs are then given by $\lambda_f = \Lambda/N_f$ and $\lambda_m = \Lambda/N_m$ year^{-1}. A member of the population has a probability of acquiring ν partners in a specific year given by $p_\nu = (\lambda^\nu e^{-\lambda})/\nu!$. Hence the fraction of the population acquiring no new partner is given by $n_0 = N_0/N = e^{-\lambda}$, the fraction acquiring one new partner by $n_1 = N_1/N = \lambda e^{-\lambda}$, and so on. Because these fractions depend only on λ, the relationship can be inverted so that the fraction of the population, n, yields an estimate of the partner acquisition rate. For example, the partner acquisition rate (as estimated from n_0) $\lambda_0 = -\ln n_0$. The different fractions (n_0, n_1, n_2, n_{3+}) yield independent estimates ($\lambda_0, \lambda_1, \lambda_2, \lambda_{3+}$) of the same underlying PAR λ. In the Poisson model, n_1 increases steadily as the PAR rises from zero (more people have acquired one partner in the last year, rather than no partner), and reaches a maximum of 0.368 at a PAR of 1. As the PAR increases above 1, n_1 falls off again (as more people have acquired 2 or more new partners in the last year, and fewer have acquired only 1). Thus, n_1 can only take values <0.368 in this model.

Detailed Results

The numbers of partners acquired by ASHR respondents in the last 12 months was derived from their answers to questions about their regular partners and last few partners. In the majority of cases, their last partners were their regular partners. Respondents were also asked whether they had more than one regular partner; very

few people reported more than 2 regular partners. Respondents were asked when the partnership started for up to 2 regular partners; their answers classify them into the zero-new-partners, one-new-partner, or two-new-partners categories (N_0, N_1, N_2). Because these questions were asked only about 2 regular partners, the small number of respondents with more than 2 regular partners may have been misclassified. Respondents who reported no sexual activity over the past year were classified as N_0. ASHR respondents were also asked about their most recent, second- and third-most recent partners in the last 12 months; they were asked when they first had sex with these partners and, in principle, their responses define whether they had acquired no new partners, one, two, or at least three partners in the last year. Respondents were also asked whether their recent partners were regular partners previously mentioned in the survey – if so, the definition of whether that partner was acquired in the last year was taken from the regular-partner responses.

These criteria, which define N_0, N_1, N_2 and N_{3+}, were used to construct subsets of ASHR in R (2), and the population fractions accounted for by each subset (i.e. n_0, n_1, n_2, n_{3+}) were directly calculated from the weighted survey data. Table S1 gives these population fractions for each gender and age-band, together with the standard errors (SE) in the fraction, as calculated from the weighted survey data. Female n_1 starts at 0.3 for the 16-19 age-band, increases to 0.4 in the 20-24, and then declines sharply to 0.2, from which it slowly declines; female n_0 has the inverse pattern. Male n_1 starts at 0.2 for the 16-19 age-band, increases to 0.4 in the 20-24 age-band, stays high at 0.3 in the 25-29 age-band, and then decreases with age. Male n_0 follows the inverse of this pattern. Female n_2 and n_{3+} start below 0.1 for the 16-19 age-band, and decline steadily with age, while male n_2 and n_{3+} are rather higher (about 0.1 and 0.05 respectively) through the first 3 age-bands, before dropping off. Both male and female n_1 estimates

for the 20-24 age-band are >0.368, and the upper limit to female n_1 for 16-19 also exceeds 0.368. Because the lower limits of all these estimates are <0.368, they are not formally inconsistent with the Poisson model. We interpret $n_1 \geq 0.368$ as a PAR of 1. Estimates of the PAR, λ, derived from n_0, n_1, n_2 and n_{3+} for each gender and age-band are given in Table S2 (with a weighted-average estimate of the PAR $\langle\lambda\rangle$, and the weighted average of λ_0 and λ_1) and plotted in Figure S1.The estimates in Table S2 follow a pattern consistent with the population fractions in Table S1: they start at a fairly high level for the 16-19 age-band, reach a peak over the next two age-bands, and then decline with age. The female low-activity weighted average $\langle\lambda_{0,1}\rangle$ starts higher than its male equivalent in the 16-19 age-band (0.6 against 0.4), but then the male low-activity weighted average becomes higher than that for females in the 20-24 age-band (0.8 against 0.7), and remains higher in the 25-29 age-band (0.5 against 0.3). Over the next 4 age-bands, PARs for males and females are around 0.2, with a slow decrease over time, with slightly higher PARs for females. Figure S1 clearly shows that PAR estimates based on male respondents reporting 3 or more new partners in the last year (i.e. λ_{3+}) are significantly higher than any other estimate over all age-bands except for the 20-24 age-band.

Table S1: Estimated fractions of the population that have acquired zero, 1, 2, 3 or more partners in the last 12 months, given by gender and age-band, and with associated standard errors (SE).

Age	n_0	SE	n_1	SE	n_2	SE	n_{3+}	SE
				Female				
16-19	0.571	0.050	0.329	0.053	0.070	0.018	0.030	0.009
20-24	0.534	0.053	0.399	0.055	0.049	0.011	0.017	0.006
25-29	0.740	0.034	0.212	0.032	0.036	0.010	0.012	0.004
30-34	0.770	0.029	0.199	0.028	0.022	0.006	0.008	0.003
35-39	0.777	0.028	0.202	0.028	0.017	0.005	0.003	0.002
40-44	0.810	0.030	0.185	0.030	0.004	0.002	0.0009	0.0005
45-59	0.847	0.017	0.147	0.016	0.004	0.002	0.002	0.001
				Male				
16-19	0.611	0.045	0.242	0.045	0.108	0.018	0.039	0.011
20-24	0.479	0.042	0.371	0.044	0.085	0.015	0.065	0.012
25-29	0.570	0.042	0.256	0.038	0.127	0.022	0.047	0.009
30-34	0.786	0.025	0.149	0.023	0.039	0.008	0.026	0.006
35-39	0.817	0.024	0.144	0.023	0.022	0.006	0.017	0.005
40-44	0.782	0.026	0.187	0.025	0.022	0.005	0.009	0.003
45-59	0.849	0.016	0.132	0.015	0.011	0.002	0.008	0.002

Table S2 (Table 1 in main paper): Estimates of partner acquisition rates, λ, for each gender and age-band, derived from population fractions n_0, n_1, n_2, n_{3+}, together with a weighted average $\langle\lambda\rangle$. Table cells marked with an asterisk include estimates or limits set to 1 because $n_1 > 0.368$.

Age	λ_0	λ_1	λ_2	λ_{3+}	$\langle\lambda\rangle$	$\langle\lambda_{0,1}\rangle$
			Female			
16-19	$0.56^{+0.09}_{-0.08}$	$*\,0.60^{+0.40}_{-0.18}$	0.47 ± 0.08	$0.67^{+0.07}_{-0.09}$	0.57	0.56
20-24	0.63 ± 0.10	$*\,1.00^{+0}_{-0.32}$	$0.38^{+0.05}_{-0.06}$	$0.53^{+0.07}_{-0.08}$	0.49	0.72
25-29	$0.30^{+0.05}_{-0.04}$	$0.28^{+0.06}_{-0.05}$	0.31 ± 0.05	$0.47^{+0.05}_{-0.07}$	0.33	0.29
30-34	0.26 ± 0.04	0.26 ± 0.05	$0.24^{+0.03}_{-0.04}$	$0.40^{+0.05}_{-0.06}$	0.27	0.26
35-39	$0.25^{+0.04}_{-0.03}$	$0.26^{+0.06}_{-0.05}$	$0.20^{+0.03}_{-0.04}$	$0.28^{+0.06}_{-0.09}$	0.24	0.26
40-44	0.21 ± 0.04	$0.23^{+0.06}_{-0.04}$	0.09 ± 0.03	$0.18^{+0.03}_{-0.04}$	0.15	0.22
45-59	0.17 ± 0.02	$0.18^{+0.02}_{-0.03}$	0.09 ± 0.03	$0.24^{+0.04}_{-0.05}$	0.16	0.17
			Male			
16-19	$0.49^{+0.08}_{-0.07}$	$0.34^{+0.11}_{-0.09}$	0.64 ± 0.08	$0.74^{+0.08}_{-0.09}$	0.56	0.44
20-24	0.74 ± 0.09	$*\,1.00^{+0}_{-0.41}$	0.54 ± 0.07	$0.91^{+0.07}_{-0.08}$	0.73	0.78
25-29	$0.56^{+0.08}_{-0.07}$	$0.37^{+0.10}_{-0.08}$	0.72 ± 0.10	$0.80^{+0.06}_{-0.07}$	0.64	0.48
30-34	0.24 ± 0.03	0.18 ± 0.03	0.33 ± 0.04	$0.63^{+0.05}_{-0.06}$	0.28	0.21
35-39	0.20 ± 0.03	$0.17^{+0.04}_{-0.03}$	$0.24^{+0.03}_{-0.04}$	0.53 ± 0.06	0.23	0.19
40-44	$0.25^{+0.03}_{-0.04}$	0.24 ± 0.04	$0.24^{+0.03}_{-0.04}$	$0.42^{+0.05}_{-0.06}$	0.26	0.24
45-59	0.16 ± 0.02	$0.15^{+0.03}_{-0.02}$	0.16 ± 0.02	0.40 ± 0.04	0.18	0.16

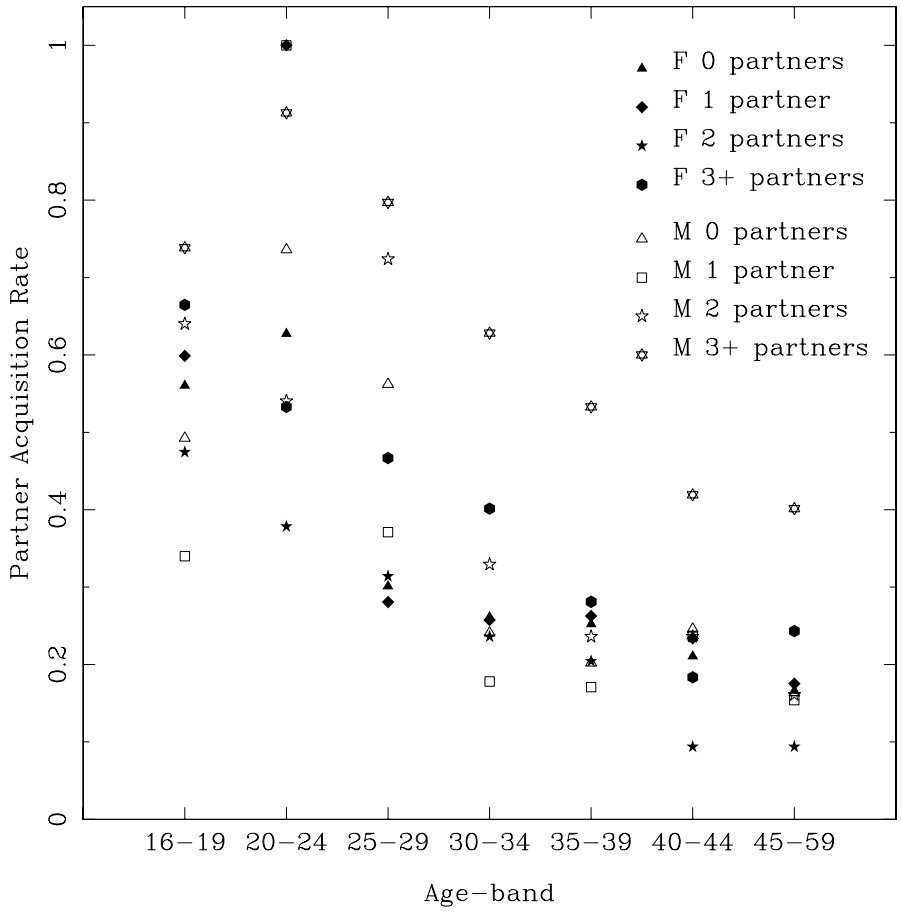

Figure S1: Estimates of PAR with age-band, with confidence intervals omitted for clarity. Filled symbols denote $\lambda_0, \lambda_1, \lambda_2, \lambda_{3+}$for female respondents, and open symbols denote $\lambda_0, \lambda_1, \lambda_2, \lambda_{3+}$ for male respondents (see symbol key). Estimates of 1 for age-band 20-24 are due to $n_1 > 0.368$.

References

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