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Social mixing patterns for transmission models of close contact infections: exploring self-evaluation and diary-based data collection through a web-based interface

P. BEUTELS[1,2]*, Z. SHKEDY[3], M. AERTS[3] AND P. VAN DAMME[1]

[1] *Centre for the Evaluation of Vaccination, Epidemiology and Social Medicine, University of Antwerp, Belgium*
[2] *National Centre for Immunisation Research and Surveillance, University of Sydney, Australia*
[3] *Centre for Statistics, Biostatistics, Hasselt University, Belgium*

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SUMMARY

Although mixing patterns are crucial in dynamic transmission models of close contact infections, they are largely estimated by intuition. Using a convenience sample ($n=73$), we tested self-evaluation and prospective diary surveys with a web-based interface, in order to obtain social contact data. The number of recorded contacts was significantly ($P<0{\cdot}01$) greater on workdays (18·1) *vs.* weekend days (12·3) for conversations, and vice versa for touching (5·4 and 7·2 respectively). Mixing was highly assortative with age for both (adults contacting other adults *vs.* 0- to 5-year-olds, odds ratio 8·9–10·8). Respondents shared a closed environment significantly more often with >20 other adults than with >20 children. The difference in number of contacts per day was non-significant between self-evaluation and diary ($P=0{\cdot}619$ for conversations, $P=0{\cdot}125$ for touching). We conclude that self-evaluation could yield similar results to diary surveys for general or very recent mixing information. More detailed data could be collected by diary, at little effort to respondents.

INTRODUCTION

Deterministic dynamic models of infectious disease transmission simulate the spread of infections in a population by multiplying the force of infection with the number of susceptible people at each point in time. The force of infection, in turn, depends on the infectious proportion as well as the probability of pathogen transmission between susceptible and infectious people, at each point in time. The modelled population can be structured according to characteristics relevant to various levels of interaction and transmission, such as age groups or/and sexual activity groups. Formally the age- and time-dependent force of infection $\lambda(a, t)$ can be written as

$$\lambda(a,\ t)=\int_0^L \beta(a,a')\,I(a',t)\mathrm{d}a'.$$

The transmission coefficients $\beta(a, a')$ represent the rate of transmission from infectious hosts $I(a', t)$ of age a' to susceptible hosts of age a [1, 2]. Anderson & May [3] introduced the WAIFW ('Who Acquires Infection From Whom') matrix C in which the ijth element, β_{ij}, is the transmission coefficient from age group j to age group i. Let

$$I_i(t)=\int_{L_i}^{U_i} I(a,t)\mathrm{d}a$$

be the total number of infectious individuals in the ith age group $[L_i, U_i]$ at time t ($i=1, \ldots, n$), then

* Author for correspondence: Dr P. Beutels, Center for the Evaluation of Vaccination, Epidemiology and Social Medicine, University of Antwerp, Universiteitsplein 1, 2610 Antwerp, Belgium.
(Email: philippe.beutels@ua.ac.be)

the age-time dependent force of infection can be approximated by $\lambda = C.I.$

Here, $I = (I_1, \ldots, I_n)$ is the number of infected individuals in the different age groups, whereas $\lambda = (\lambda_1, \ldots, \lambda_n)$ is a vector of the force of infection for each of the n age groups. Several methods exist to derive the force of infection from epidemiological data. An overview of these is given in Shkedy [4]. A transmission coefficient is a composite measure of the number of contacts and the probability of virus transmission during contact. If the probability of virus transmission per contact is known, the WAIFW matrix C could be directly estimated from surveys establishing face-to-face contact patterns between age groups. Given the considerable work it entails, this direct approach has only rarely been attempted to estimate mixing patterns in human societies. Indeed, it has been applied almost uniquely to map networks of partnerships for highly specific types of contact [such as sexual intercourse and needle sharing for drug use (e.g. see refs [5] and [6])]. Instead, matrix C for airborne and saliva-borne close contact infections is usually estimated from the force of infection based on age-specific serological or case-notification data. However, for n age groups, such an approach would allow calculating n values of λ, whereas a complete assessment of the matrix requires the estimation of n^2 elements. Therefore, in practice, analysts have forced a structure upon the matrix that limited the number of elements to be estimated to n (e.g. by assuming that C is symmetric and mixing occurs mainly within age groups). A major weakness in applied analyses to date is that the matrix structure analysts choose (conceptually constrained by limiting the number of different contact frequencies to n), is traditionally based on intuition, and not on actual observations. Several configurations for the matrix and indirect derivations of contact patterns are discussed in the literature (see, e.g. refs [1, 7–10]). As illustrated, for instance, by Farrington *et al.* [9] and Whitaker & Farrington [11], the choice of the matrix structure alone can be highly influential for the model output. Given the sensitivity of these models to contact patterns, it seems surprising that thus far there is little research aimed to quantify human contact patterns for the spread of close contact infections directly. Clearly, there exists an extensive sociological literature on non-sexual social contacts, but these do not focus on contacts that enable transmission of pathogens. Social studies have documented social interactions (including phone, mail and email exchanges), often over long periods of time (exceeding infectious periods of most close contact infections) and typically do not record the characteristics of people (e.g. age) who have contact with the respondents in such studies. The importance of documenting host contact patterns for close contact infections, and previous attempts to obtain important parameters to describe these were discussed by Wallinga *et al.* [12]. In the first study on this subject, Edmunds *et al.* [13] tested a diary-based approach in which the participants were asked to monitor their contact patterns. The aims of our study are to further examine this approach and to compare it with an alternative approach, which may have intuitive appeal. More specifically, we explored the feasibility of and differences between a self-evaluation survey based on recollection and a prospective diary approach, for varying proxies of pathogen-transmissible host mixing incidents and levels of detail in the surveyed information.

METHODS

The study protocol, as outlined in this paper, was favourably reviewed by the ethical committee of the University of Antwerp.

Different types of contact were defined. These were meant to be relevant for discerning major contact types enabling pathogen transmission by close contact. However, they needed to be specific and pragmatic for respondents to easily distinguish and recall them. Two types of contact were thus defined: (1) a two-way conversation of at least three words ('type I contact') and (2) a contact which involved any sort of physical skin-to-skin touching ('type II contact'). Examples of type I contact included any fleeting verbal encounter in service facilities (e.g. shops) or at the work-place. Type II contacts were hypothesized to be indicative of a more close nature, which would usually be accompanied by a two-way conversation (but not necessarily, by our definition). In the development stages of the survey, more intensive levels of contact (e.g. direct exchange of saliva and sexual intercourse) were considered but not withheld, because we feared it would negatively impact on recruitment, and ultimately these additional levels of contact would add little information for most close contact infections (and specific studies for sexual contact patterns are available). In our study such more intensive contacts are captured in type II contacts. In practical terms, infections like influenza, measles, pertussis and varicella would be transmissible by contact types I or II, whereas meningococcal, rotavirus or pneumococcal infections are unlikely to be transmitted by conversation alone (and therefore the contact type II patterns would be more relevant for these).

From March to May 2003, students and personnel from two Belgian universities were recruited to participate in a two-stage survey. Recruitment involved about 10 min of explanation of the requirements for respondents and the relevance of the study for modelling infectious diseases. In order to encourage potential participation, respondents completing both stages of the survey were entered into a lottery for five digital cameras. In the first stage, the participants were asked to fill out a web-based questionnaire, which aimed to record their physical contacts as they recalled them. In particular, the respondents were asked to estimate the number of persons they would contact on a typical workday and a typical weekend day. Additionally similar information was asked about a specific day, 'yesterday', which should be the freshest completed day in the respondent's memory. Furthermore, the latency period of many close contact infections is typically in the order of 3 days to about 2 weeks. This inspired us to ask about contacts during 'the past week (last 7 days)'. In doing so, we hypothesized that there would be no proportionate relationship between the number of different people contacted in a day, and the number of different people contacted in a week. In order to answer these questions, participants needed to recall roughly the characteristics of each of their contacts in terms of gender and approximate age.

Participants were encouraged to read first all the contact information questions, and to make notes on a separate piece of paper to work out the answers.

Each participant who completed this self-evaluation part on the website was randomized to two different future days (one workday and one weekend day, also random in sequence). They were asked to record all their contacts on these days. In order to keep a timely record of contacts, each participant was given a small paper diary in which s/he could record the gender and the approximate age of each individual with whom a contact was made, as well as the location (post code or community name) and circumstance of contact ('home', 'work', 'school', 'social', 'transport', 'other'). They were encouraged to update the diary at regular intervals during the day, and – after completing the diary – had to enter their diary-recorded data into a second web-based questionnaire. Both the first and second web-based survey and entry forms are available upon request. Persons with whom respondents had multiple contacts over the course of the day had to be reported only once, and only for the most intensive type of contact (i.e. if they had both type I and type II contact with the same person at different times, only one type II contact needed to be reported).

Participants received unique codes for themselves and for each day allocated to them. All data were anonymous from the moment the participants entered them on the website.

Table 1. *Characteristics of respondents*

		Number (proportion)
Occupation	Student	61 (83·6%)
	Office worker	9 (12·3%)
	Manual worker	1 (1·4%)
	Unemployed	1 (1·4%)
	Housewife	1 (1·4%)
Gender	Male	25 (34·2%)
	Female	48 (65·8%)
Age group* (years)	20–24	52 (71·2%)
	25–29	10 (13·7%)
	30–34	7 (9·6%)
	>40	4 (5·5%)

* No participants in the 35–40 years age group.

RESULTS

Self-evaluation based on recollection

Seventy-three participants (mean age 25·1 years) completed the self-evaluation questionnaire. Table 1 shows the participants' profile in terms of age, gender and occupation.

Personal interactions

During their most recently completed day (i.e. 'yesterday'), respondents estimated, on average, they had made type I contact with 17·9 different people [of which 8·3 (46%) were men] and type II contact with 5·8 different people [of which 3·0 (52%) were men].

On a weekly basis, the participants recalled making on average 91·2 type I contacts with 37·1 different people, and 29·9 type II contacts with 13·1 different

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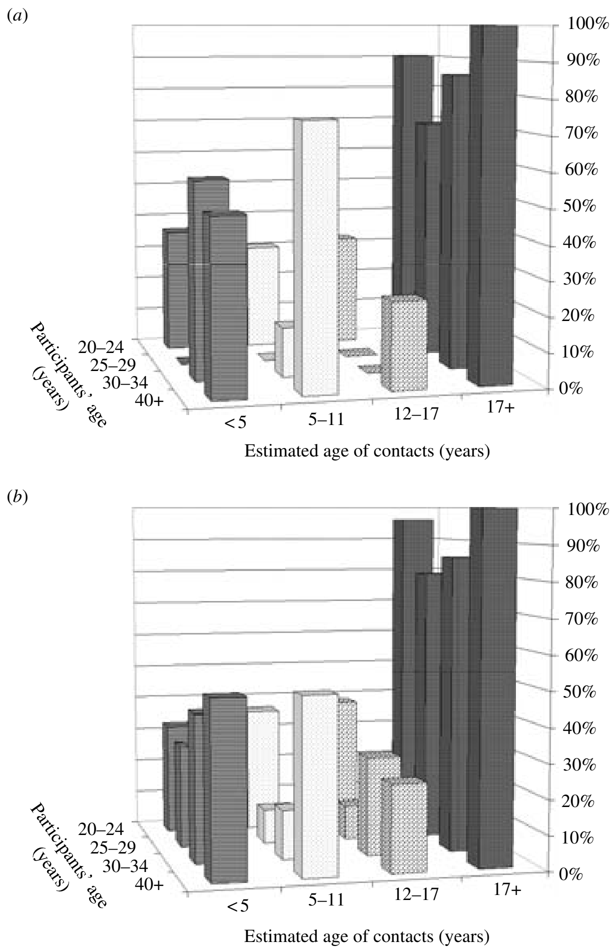

Fig. 1. Proportion of participants reporting at least one contact during the past week with four age groups (based on self-evaluation). (*a*) Type I contacts and (*b*) type II contacts.

people (note that they were asked to count only the most intense contact once per person per day, even if they had met a particular person several times on the same day). As can be seen in Figure 1, participants appear more likely to contact someone of their own age group. On average they estimated that they had type I contact with 1·3, 1·9, 2·4 and 31·5 different people aged <5, 5–11, 12–17 and >17 years respectively, whom they each contacted, on average, on 2·4, 1·9, 2·3 and 2·5 different days of the week respectively. They established type II contacts with fewer people (0·6, 1·5, 1·4, 9·7 people respectively), and they contacted them each on 3·3, 1·8, 1·9 and 2·3 different days of the week respectively. In comparison to the contacts over one day ('yesterday', which is inevitably one day of 'the last week') the weekly result indicates that the same people are contacted several times over the course of a week. The number of contacted

Table 2. *Mixing by age based on self-evaluation: odds ratios obtained with the Cochran–Armitage trend test*

Age group (years)	Odds ratio Type I	Type II
0–4	Baseline	Baseline
5–11	2·20	2·07
12–17	4·89	4·29
>17	10·82	8·89

people over the past week was strongly correlated with those of yesterday ($P<0{\cdot}0001$ for types I and II). Nonetheless, linear regression models ($Y=aX+b$) with number of contacts 'over the last week' as dependent (Y) and 'yesterday' (X) as independent variables left most of the variance unexplained (e.g. for type I: $a=0{\cdot}908$, $b=0{\cdot}886$, $R^2=0{\cdot}200$, and for type II: $a=1{\cdot}35$, $b=5{\cdot}278$, $R^2=0{\cdot}234$). It is also noteworthy that no significant correlation between household size (defined by number of persons sharing the kitchen) and number of contacts 'yesterday' was found, for either type of contact.

The Cochran–Armitage test for trend [14] was used to determine associations between the age of participants and the age of contacts. Significant results were found for both types I and II contacts (P values for both types $<0{\cdot}001$). Table 2 presents the odds ratios of respondents contacting an individual of a particular age group (with the <5 years age group defined as the baseline). The odds ratio clearly increases with the age of the contacts. For example the odds ratio to make type I contact with an individual from the 5–11 years age group is 2·20 compared to the baseline, and this ratio roughly doubles for each older age group. A similar trend can be observed for type II contacts. Since the respondents are all older than 20 years, this result suggests that people mix substantially more with their own age group.

Because within-age group mixing was anticipated to be of particular interest, the participants were asked to estimate the number of contacts with their own age group (defined as their own age ±5 years) on a typical workday and on a typical weekend day. The mean number of contacts by day and contact type reveal two patterns, which are in agreement with the overall results. First, the number of type I contacts is significantly greater than the number of type II contacts. Second, the number of type I contacts per day at the weekend is significantly lower than the number of type I contacts per day during the week. Indeed, an average of 12·3 type I contacts are made per typical weekend day, which is significantly lower than per workday (18·8 contacts) (Wilcoxon signed ranks test, $P<0{\cdot}0001$). For type II contacts, the difference between number of contacts on workdays (6·8) and on weekend days (5·5) was found to be non-significant. Analysing work and weekend days separately, the difference between type I and type II contacts, remained statistically significant. No statistically significant differences were found in relation to gender of contacts or to Saturdays and Sundays on a weekend day.

Sharing a closed environment

Having a conversation is not always a minimal requirement to enable transmission of a pathogen. Indeed, some infections can be transmitted between people sharing the same environment (e.g. a class room, a bus, a bar, etc.), in which they may breathe the same air particles, or touch the same objects as other people whom they do not converse with or touch. About 44% of respondents indicated sharing a closed environment with at least 20 adults on a daily basis, and another 43% several times per week. Only 4% of respondents would 'never' (or 'almost never') do so. Women indicated sharing a closed environment significantly more often than men ($\chi^2=2{\cdot}86$, $P=0{\cdot}025$).

There is a different pattern for sharing a closed environment with children (<12 years). About 80% of respondents would never (38%) or almost never (41%) share a closed environment with children, whereas 18% would do so once or twice per month, up to once per week. Here, no significant difference between female and male respondents was found.

These results seem logical, given the composition of the convenience sample this study is based upon (cf. Table 1).

Diary questionnaire

The participants were asked to record their contacts on two separate days, a workday and a weekend day. This diary-based part of the study was completed by 51 (69·8%) of the participants who also filled out the self-evaluation questionnaire. These participants were not significantly different from those who quit the study after the first part, in terms of gender, contact frequency, experienced difficulty and over/under-estimation, reported in the self-evaluation. However, the drop-outs had a tendency to be older.

A total of 1598 contacts were recorded using the diaries, 64·1% of which were classified as type I contacts, and 54·2% of which were with men.

Diary-based personal interactions

On a workday, the participants had an average of 18·1 type I and 5·4 type II contacts. On a weekend day, this was lower for type I contacts (12·3), but higher for type II contacts (7·2). The number of type I contacts was significantly greater than the number of type II contacts on either day (Wilcoxon signed ranks test, $P<0{\cdot}0001$).

The study's participants recorded the age of each contact that they made in the two days to which they were assigned. Figure 2 presents the age distribution of the contacts by age of participants and type of contact. It shows that for both types of contact, the distribution peaks in the 20–30 years age group, and is skewed towards older age groups (although type II contacts seem slightly more spread out, as they include children of various ages, for participants aged >30 years). Kendall's tau [14] for an ordinal by ordinal test equalled 2·78 and −1·75 for type I and type II respectively (with $P=0{\cdot}005$ and $P=0{\cdot}079$ respectively). There were also significant correlations between number of type II contacts on the workday and the number of type II contacts on the weekend day (Pearson correlation 0·295, $P=0{\cdot}036$), as well as between type I and type II contacts on the weekend day (Pearson correlation 0·473; $P<0{\cdot}0001$).

There was no significant correlation between age of participant and number of contacts (Pearson correlation $P>0{\cdot}3$). Also no significant correlation between household size (defined here by number of people with whom a kitchen is shared) and number of contacts was detected, with the exception of the number of type I contacts on a workday (Pearson correlation 0·362, $P=0{\cdot}009$). This last result seems surprising in the sense that household size intuitively would seem more closely associated with type II than type I contacts. The specific occupational characteristics of the sample (students may not usually touch those they share their kitchen with) could explain this counterintuitive result. Indeed, respondents who indicated that they were 'living alone' shared their kitchen with significantly more others than

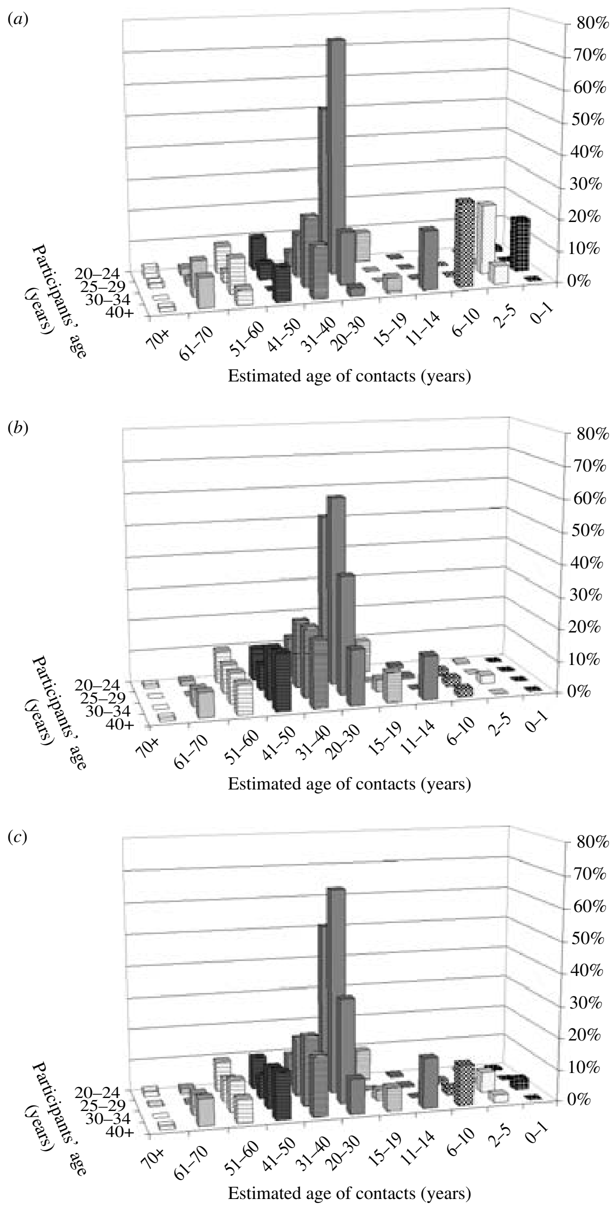

Fig. 2. Age distribution of contacts registered by diary over one workday and one weekend day. (*a*) Type I contacts, (*b*) type II contacts and (*c*) any contact.

people indicating 'living with others'. This unexpected result seems directly related to students living alone, but sharing their kitchens.

Circumstance of contacts

The circumstances in which the contacts were made are given in Table 3, by type of contact. By far most contacts were made in social circumstances (43%). Pearson's χ^2 is equal to 130·5 on 5 degrees of freedom indicating significant association between circumstance and type of contact. The standardized residuals

Table 3. *Number of contacts by contact type and circumstance, as recorded by diary*

Circumstance	Type I	Type II	Total (%)
Home	133 (−3·8)*	154 (5·0)*	287 (18%)
School	168 (2·6)*	47 (−3·4)*	215 (13·5%)
Work	152 (1·8)*	53 (−2·4)*	205 (12·8%)
Travel	80 (2·6)*	13 (−3·5)*	93 (5·8%)
Shop	104 (3·3)*	14 (−4·4)*	118 (7·4%)
Social	388 (−2·3)*	292 (3·1)*	680 (42·6%)
Total	1025	573	1598 (100%)

* The standardized residual under the independence model. Negative for lower, positive for higher tendencies.

(given in parentheses in Table 3) reveal that for type I contacts fewer contacts than expected (under the independence model) were made at home and in social circumstances. The opposite pattern is observed for type II contacts. That is, the participants had a tendency to make more type II contacts at home and in social circumstances, in comparison to type I contacts.

Sharing a closed environment

The majority of participants (67% on the workday, 59% on the weekend day) shared a closed environment with more than 20 adults during the days on which they kept the diary. In contrast, relatively few (2% on the workday, 14% on the weekend day) shared a closed environment with more than 20 children (<12 years).

Self-evaluation *vs.* diary

Table 4 illustrates that the difference between estimated number of contacts by self-evaluation for 'yesterday', compared with number of contacts recorded per day (adjusted for workdays and weekend days) is statistically non-significant for either type of contact (Wilcoxon matched pairs signed rank test $P=0{\cdot}619$ for type I and $P=0{\cdot}125$ for type II contacts). The frequency of sharing a closed environment with either adults or children was also found to be similar for both survey methods.

Almost two thirds of the respondents found the self-evaluation to be 'very difficult' (23%) or 'difficult' (41%), whereas a quarter thought it was 'neither difficult, nor easy'. Only a small minority said it was 'rather easy' (8·2%), or plain 'easy' (2·7%).

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Table 4. *Comparison of number of contacts by contact type, day and survey method*

	Type I Mean (range) (a)	Type II Mean (range) (b)	Statistical differences† (b) − (a)	(d) − (c)	(f) − (e)
Diary work day (c)	18·06 (2–198)	5·45 (0–22)	**	(a)*	
Diary weekend day (d)	12·31 (0–70)	7·23 (0–39)	**	(b) N.S.	N.A.
Self-evaluation yesterday (e)	17·88 (0–133)	5·82 (0–30)	**	N.A.	(a) N.S.
Diary any day (f)	17·24 (2–171)	5·71 (0–24)	**		(b) N.S.

N.A., not applicable.
* Significant: $0{\cdot}0001 < P < 0{\cdot}05$; ** highly significant: $P < 0{\cdot}0001$; N.S., non-significant: $P \geqslant 0{\cdot}05$.
† By Wilcoxon signed ranks test.

For type I, most participants (60·3%) thought that they 'underestimated' their contacts, whereas a third (32·9%) thought they got them 'about right'. For type II, the majority (56·2%) thought that they estimated their contacts 'about right', whereas 37·0% said they 'probably underestimated' them. Although men seemed to exert slightly more confidence than women, this difference was not significant ($\chi^2 = 7{\cdot}6$ and 5·21 for type I and type II respectively). As expected there was a strong correlation between stated difficulty and stated confidence in the estimates (Pearson $\chi^2 < 0{\cdot}0001$). For instance, all those who thought they overestimated their type II contacts considered the self-evaluation very difficult, whereas 96% of those who thought they underestimated their type II contacts considered it to be 'difficult' (55·6%) or 'very difficult' (40·7%).

Keeping the diary was experienced to require 'little effort' for 64·7%, 'rather much effort' for 31·4%, and 'very much effort' for 3·9% of participants. In cross-tabulation, there was a tendency for those who considered the self-evaluation more difficult, to experience less effort keeping the diary. The activity of keeping the diary itself was generally not such that it influenced the number and nature of contacts made, with most participants reporting there was 'no influence at all' (51% for type I, 40% for type II), or 'hardly any influence' (11% for type I, 18% for type II). A more disturbing influence ('a little': 6·8% for type I; 9·6% for type II; 'rather much' or 'much': 1·4% for type I; 2·8% for type II) may have been due, for instance, to contacts intentionally touching participants when they would normally not have done so. Nonetheless, the difference in influence was non-significant between type I and type II contacts (Pearson's χ^2 $P = 0{\cdot}4419$).

DISCUSSION

Recruitment for mixing pattern surveys is difficult, because participants must be willing to give information about their social behaviour. The required efforts of respondents to produce this information can be substantial. As in Edmunds *et al.* [13], the surveyed population in this study consisted of a convenience sample of people (mainly of university students and employees, although the invitation to participate was open to anyone) to whom the purpose of the survey could easily be communicated in detail, and who were relatively easily persuaded to enlist. Thus, the results of the current survey, as well as results reported previously [13] should be interpreted with caution, because the data are subject to selection bias.

The collection of mixing information can quickly give rise to large datasets (due to the number of contacts and the range of characteristics linked to them). This is more an issue for data entry and management than for analysis. By using a web-based interface, through which participants could enter their own data directly into an anonymous database, we avoided ethical problems with data entry, and noted that this task was easily taken on board by respondents, at no apparent loss in reliability of collected data. Standard statistical tests, such as the ones we used here, seem adequate to obtain mixing information useful for modelling. Such information could be used to support the choice of structure of the WAIFW matrix C, could serve as a Bayesian prior of C, or could, in combination with appropriate epidemiological data (e.g. combining age-specific seroprevalence data of a group of similarly transmitted infections, with varying probability of infection, given contact) ultimately allow a direct estimate of all the mixing coefficients of the matrix.

We found a greater average number of daily contacts (23·5 on workdays and 19·5 on weekend days) than Edmunds *et al*. [13] (20·9 and 11·2 respectively). This may be due to the composition of the sample (e.g. our study population was, on average, younger), or differences in methods [e.g. our participants were asked to distinguish between two levels of contact, whereas in Edmunds *et al*. only one level (a two-way conversation) was recorded]. Furthermore, various external factors could have contributed to differences in mixing attitudes (e.g. weather conditions during the allocated days). Finally, there may exist true differences in social mixing between Belgians and Britons, which could only be verified by applying the same methodology on a random sample in both countries.

The British and Belgian studies are consistent in finding that close contact patterns are strongly assortative with age [13]. We explored this finding extensively, and found it to be supported by both the self-evaluation and diary-based approaches. Keeping in mind that the study sample consisted uniquely of adults, there are several factors that could contribute to this association: (1) social activities are more likely to involve people of similar age, especially if they are not family; (2) people in service jobs (e.g. retailers, public transport workers, physicians), who are often high contact generators, are usually adults; (3) approximately 80% of the Belgian population is aged >17 years (about half of which is >45 years old), implying that, if mixing is random, an average person is more likely to contact adults than children. It is also noteworthy that we found no difference in the number of type II contacts between weekend and workdays for within-age group mixing (i.e. adult ages only).

The participants had a tendency to make type I contacts at work or school and type II contacts at home and in social circumstances. This is consistent with our finding that fewer type I contacts were made on weekends compared to workdays, and vice versa for type II contacts. Perhaps the most surprising result was that household size was only associated with number of type I contacts on a workday, and not with type II contacts. Together with possible international (cultural) variation in within-household mixing, this observation could indicate the interest of determining household contacts (in addition to household size) and other contacts separately in future studies. Of further related interest could be the prevalence of dishwashers (and its disinfecting properties) in kitchens, particularly in specific households such as student communities [15]. Nonetheless, the overall importance of this effect, as well as the slowly increasing prevalence of children growing up in multiple households (i.e. due to divorce), is likely to be negligible for the transmission dynamics of most infectious diseases.

It is often assumed that retrospective self-evaluation inevitably leads to underestimates of the frequency of contacts, and presumably more so for the less memorable type I contacts. However, when comparing the number of contacts in the self-evaluation part (total number of estimated contacts 'yesterday') with those recorded in the diary-based part of our survey, the results were remarkably similar.

In this respect it is of note that many questions in the self-evaluation part were framed in a simpler (or less detailed) way than the information gathered using the diary. Furthermore, our study population is probably more apt than the average person in answering demanding questions correctly. However, providing the mixing information in the self-evaluation part proved 'very difficult' for 23% and simply 'difficult' for another 41% of them. Only 11% thought it was 'easy', or 'very easy'. Conversely, keeping the diary was generally felt to be a non-demanding activity that had little impact on the number and nature of contacts.

We would, therefore, recommend that a small number of general mixing questions be included in large national health surveys (only related to contacts on the day prior to the survey, to household size and composition, and possibly to sharing specific closed environments with a large number of people). Based on our survey, we expect respondents to have little difficulty distinguishing simple types of contacts [i.e. having a conversation without touching, and touching (with or without a conversation)]. Our study indicates, however, that more detailed information could be collected by a diary-based approach, and that this would be less demanding for respondents, and probably more accurate, particularly over longer periods of time. We noted that it might be important to have people keep a diary over random weeks, instead of random days, as both parts of our survey showed that there are significant differences between workdays and weekend days, for both levels of contact. Additionally the self-evaluation part of our survey indicated that the relation between contacts over workdays and weekend days *vs*. contacts over entire weeks is nonlinear. That is, it does not suffice to weigh contacts over 1 workday by 5/7 and contacts over 1 weekend day by 2/7 in order to obtain weekly contacts. Indeed, the same people are contacted on multiple days, but not all of these on each day. Expanding the collected information in this respect one further level would lead to mapping social (and spatial) contact networks. Obtaining such information by surveys could pose ethical problems regarding anonymity of respondents and the relationships they are involved in. Our survey was far less ambitious, and designed primarily to enable more data-driven modelling.

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DECLARATION OF INTEREST

None.

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