Introduction

There is an increasing recognition that our well-being is shaped by social factors such as our social relationships [1–3]. Various processes have been posited to explain this relationship. Some of these concern the beliefs and practices of particular groups. Others concern the more general features of group life.

For example, being religious has a positive impact on well-being. In part, this is because religious beliefs provide cognitive schemas or encourage meditative practices relevant to the appraisal of life events and coping [4,5]. In part, it is also because of one’s participation in a congregation and the fact that one acts alongside others [6–11]. In similar vein, research on work groups operating in stressful environments shows that the more one feels a part of the team, the better one’s well-being [12,13], and evidence from studies of the elderly living in residential homes reveals that a range of activities (from drinking water to avoid dehydration to reminiscing about the past) bring about benefits because they are done in groups [14,15].

The underlying psychological process that link group membership with well-being is argued to derive from a sense of shared identity (‘we-ness’) that develops in groups. This leads people to experience mutual trust, respect and cooperation [16,17]. It can also lead people to expect support from their fellow group members and develop greater resilience [18]. Building upon such insights it has been argued that since we spend most of our time in the company of others, we should study health in group settings [19].

To date, though, research in this tradition has been done principally upon small and organized groups. Our focus here is on a very different type of collectivity – a long-duration mass gathering. When it comes to such gatherings (e.g., pilgrimage events such as the Hajj) a very different viewpoint tends to prevail. They are viewed as posing significant risks to well-being and health [20,21]. Some risks concern the dangers posed by communicable diseases [22]. Some relate to the rudimentary living and sanitary facilities at such events [23]. Still other risks arise from the presence of others. These latter include the dangers of crushing and the stresses of living in crowded and noisy conditions. For example, the dense crowding characteristic of collective events can increase stress and blood pressure [24]. So too, the loud noise levels that characterise mass gatherings, can increase stress and mental health symptoms [25].
However, an exclusive focus on the risks of participation may lead us to overlook the potential benefits that participation in mass gatherings can have. Although not specifically focussed on well-being, social anthropological theory has long argued that mass gatherings (e.g., carnivals and religious festivals) can be joyous occasions and involve a sense of intimacy even between people who do not know each other [26,27]. Moreover, such theory has spoken of the ways in which mass gatherings revivify social bonds and re-establish group identities. However, as several researchers lament, these more positive features of collective events are routinely overlooked in much contemporary academic research [28]. Indeed as Getz shows, even researchers interested in the tourism associated with mass events (e.g., sports events, cultural festivals, etc.) tend to overlook how participation may impact positively on participants’ well-being [29,30]. Instead, such research typically focuses on the economic and environmental impacts of these events or on issues of safety management.

In the research reported here we seek to rebalance the situation by addressing the neglected benefits of collective participation. Specifically we investigate how participation in one of the world’s largest collective events - the *Maha Kumbh Mela* at Allahabad in Northern India – impacts participants’ well-being [31]. Our data are quantitative and derived from an orally-administered questionnaire concerning well-being. These self-report data were obtained before and after the collective event, and from a sample attending the event and from a sample of controls (comparable others who did not attend). Before elaborating on our design and measures, we describe the context and nature of the event more fully.

**Setting**

Every year, in the Hindu month of *Magh* (mid-January to mid-February), pilgrims gather at the confluence of the Ganges and Yamuna rivers to perform a series of sacred rituals - notably to bathe in the rivers. The event is on a 12-year cycle. In the twelfth year (the *Maha Kumbh Mela*) it is claimed that up to 50 million people attend and over 10 million can be present on a single bathing day. Every six years (the *Ardh Kumbh Mela*), somewhere in the region of 20 million participate. Yet, even for the ‘routine’ yearly gatherings – the *Magh Mela* - millions attend, and hundreds of thousands undertake to remain for the full month.

Those pilgrims who stay for the whole month (known as Kalpwasis) live in conditions that are more difficult than those they experience at home. They live in rudimentary tents without heating, often without sanitary facilities, sleeping on the ground and experiencing night-time temperatures approaching zero centigrade. The event is also very crowded, and again this contrasts with life in the villages from which the pilgrims come. The crowds make walking to the bathing areas difficult and on days that bathing is judged particularly auspicious in terms of Hindu traditions, it can take several hours to walk a kilometre or so. Another striking feature of the event is its noise level. A vast array of competing loudspeakers broadcast religious discourses, songs, announcements and other administrative information throughout the day (and into the night). Our measurements show that on an ordinary day the noise level rarely falls below 75 dB and is often 80-85 dB. It is noteworthy that, according to the US National Institute on Deafness and Other Communication Disorders, exposure to 85 dB or more will cause hearing damage after 8 hours. Again, the contrast between this aspect of the environment and that of the pilgrims’ home villages is striking. All in all, life in the Mela is difficult and demanding.

Even if enduring hardship is integral to the act of pilgrimage [32] and even if such hardships do not deter pilgrims from attending, these various circumstances - unsanitary conditions, severe cold, dense crowding and intense noise - are all those that would be expected to be bad for well-being. But are they? We ask if, in the light of social psychological research identifying associations between involvement in social group-related activities and well-being, participation in this mass gathering could impact well-being positively. To find that participation in such an arduous mass gathering impacts well-being positively would be striking, and would underline the wider relevance and applicability of psychological research concerning the benefits associated with social participation in group activities.

**Methods**

We recruited a sample of those who participated in the Magh Mela for the full month-long festival (Kalpwasis) and a sample of comparable others who did not attend at all (Controls), and asked both about their well-being and their experience of various symptoms of ill-health. We gathered these data one month before the 2011 Magh Mela (Time 1 - T1) and one month after it had ended (Time 2 - T2), and explored the degree to which the Kalpwasis sample showed a longitudinal increase in reported well-being compared to the Controls.

**Participants**

The sample consisted of 543 respondents providing data at two time points: before (T1) and after (T2) the Mela. Of these, 416 were Kalpwasis who attended the Mela and 127 Control others who did not. In the first round of data collection (pre-Mela), the sample comprised a total of 792 respondents (604 planning to attend the Mela and 188 not). With attrition, 249 (31.44%) participants were lost giving an overall completion rate of 68.56%. Attrition was equivalent amongst those planning to attend (188 or 31.13%) and the controls (61 or 32.45%). Analyses of the pre-mela data show no differences in the socio-demographic attributes (age, gender, marital-status, educational level, and caste) of our final sample and those lost through attrition.

The final samples of Kalpwasis and Controls were comparable in their socio-demographic attributes: Age (Kalpwasis M = 64.38 years, SD = 9.32; Controls M = 60.90, SD = 13.44 years); Gender (Kalpwasis: 57.0% female; Controls 50.4% female); Caste (Kalpwasis: 92.3% General Caste, 7.7% Other Backward Caste; Controls: 85.8% General Caste, 14.2% Other Backward Caste). In all analyses involving comparisons between Kalpwasis and Controls, age, gender, caste, marital and educational-status were employed as covariates.

**Ethics statement**

This study was approved by the Ethics Committees of the University of Dundee and the University of Allahabad. When approaching potential participants, the researchers gave an overview of the questions to be asked. Participants gave informed consent to participate. As many were unable to read and write, this consent was oral. The decision to seek oral rather than written consent was approved by the above Ethics Committees. The procedure for documenting that oral consent was given was as follows. After explaining the research, participants were asked a formal consent question: ‘Do we have your consent to participate in this survey study?’ The researcher registered the answer as ‘Yes’ or ‘No’ on the response sheet. The researcher also signed their name on this response sheet.

**Procedure**

Data were gathered with a questionnaire administered orally in Hindi by a trained team of 10 Hindi-speaking field investigators at
participants’ homes which were within a radius of 100–120 KMs from Allahabad, India. As a sample from rural India has little (if any) experience of questionnaire surveys, and still less experience of using 5-point scales, we took considerable care to conduct the research in a manner that was intelligible. For example, to convey the concept of a 5-point scale, we showed participants drawings of five glasses containing increasing levels of water (ranging from empty to full) and used these to explain to participants how they could communicate their level of well-being and the degree to which they experienced symptoms of ill-health (see Figure 1). The survey took approximately 30 minutes to complete. To ensure the translation was conceptually appropriate, the questionnaire was translated and back-translated (English-Hindi-English) by two independent groups of translators. Any differences between the translations were resolved by improving the questionnaire items.

Before the survey was administered, the scales were piloted amongst both illiterate and literate Hindi-speaking participants. This ensured the items were clear and intelligible to participants of widely varying educational backgrounds.

The T1 survey was administered between December 1st and 15th, 2010 - one month before the beginning of the 2011 Magh Mela. The T2 survey was administered between March 3rd and 15th, 2011 - one month after the Mela’s conclusion. The average time difference between T1 and T2 was 90 days (SD = 3 days). An independent samples t-test revealed no significant difference between the Kalpwasis and Controls in the number of days between T1 and T2, t(541) = 1.23, p = .20, Cohen’s d = .11.

Measures

**Well-being.** Reports of well-being were obtained with three items from the core module of the Centers for Disease Control and Prevention Health Related Quality of Life Measure (CDC HRQOL-14) [33]: “Over the last week, how would you describe your physical health?”, “Over the last week, how would you describe your state of mind?”, “Over the last week, how would you describe your energy levels.” Responses were gathered on a 5-point scale illustrated with glasses containing varying levels of water. The empty glass (scored ‘1’) was anchored, “Very Poor”, the full glass (scored ‘5’) was anchored, “Very Good”. Item scores were averaged together such that a higher score indicated better well-being. The reliability (Cronbach’s alpha) of this scale was excellent (T1 Participants = .86; T1 Controls = .81; T2 Participants = .85; T2 Controls = .91).

Item scores were averaged together such that a lower score indicated less symptoms of ill-health. The reliability (Cronbach’s alpha) of this scale was excellent (T1 Participants = .81; T2 Participants = .85; T1 Controls = .84; T2 Controls = .84).

**Results**

Average levels of self-assessed Well-being and Symptoms of ill-health are reported for Kalpwasis and Controls before and after the Mela in Table 1.

**Well-being**

Participants’ levels of Well-being were inspected in a 2 (Condition: Kalpwasis/Controls) x 2 (Time: T1/T2) Mixed Factorial ANCOVA (in which age, gender, caste, marital and educational-status featured as covariates). This showed no effect of Time, F(1, 533) = .01, p = .93, \( \eta_p^2 < .001 \), and that Kalpwasis reported better well-being than Control participants, \( F(1, 533) = 6.05, p = .014, \eta_p^2 = .011 \). However, and most importantly, interpretation of this effect was qualified by an interaction, \( F(1, 533) = 6.23, p = .013, \eta_p^2 = .012 \). The relevant Estimated Marginal Means and Standard Errors are plotted in Figure 2. Decomposing this interaction shows that whereas there was no difference in well-being between Kalpwasis and Controls at T1 (Kalpwasis \( \text{EMM} = 3.35, \text{SE} = .04 \); Controls \( \text{EMM} = 3.30, \text{SE} = .08 \); F(1, 533) = .40, p = .53, \( \eta_p^2 = .001 \)), at T2 Kalpwasis reported better Well-being (Kalpwasis \( \text{EMM} = 3.62, \text{SE} = .04 \) than Controls (Kalpwasis \( \text{EMM} = 3.30, \text{SE} = .08 \); F(1, 533) = 11.71, p = .001, \( \eta_p^2 = .021 \). Moreover, inspecting the Kalpwasis’ data revealed an improvement in Well-being from T1 (Kalpwasis \( \text{EMM} = 3.35, \text{SE} = .04 \) to T2 (Kalpwasis \( \text{EMM} = 3.62, \text{SE} = .04 \); F(1, 415) = 31.25, p < .001, \( \eta_p^2 = .07 \). In contrast, there was no such improvement amongst Controls (T1: Kalpwasis \( \text{EMM} = 3.30, \text{SE} = .08 \); T2 \( \text{EMM} = 3.30, \text{SE} = .08 \); F(1, 126) = .001, p = .98, \( \eta_p^2 < .001 \).

**Symptoms of ill-health**

Participants’ reported symptoms of ill-health were inspected in a similar 2 (Condition: Kalpwasis/Controls) x 2 (Time: T1/T2) Mixed Factorial ANCOVA (with age, gender, caste, marital and educational-status featuring as covariates). This showed a similar pattern. There was no main effect of Time, F(1, 533) = 1.48, p = .23, \( \eta_p^2 = .003 \), and Kalpwasis reported less symptoms than Controls, \( F(1, 533) = 9.45, p = .002, \eta_p^2 = .017 \). However, interpretation of this main effect was again qualified by the predicted interaction, \( F(1, 533) = 4.23, p = .04, \eta_p^2 = .008 \). The relevant Estimated Marginal Means and Standard Errors are plotted in Table 1.

**Table 1.** Well-being and Symptoms of ill-health amongst Kalpwasis and Controls at T1 and T2.

|                  | Kalpwasis | Controls |
|------------------|-----------|----------|
|                  | T1        | T2       | T1        | T2       |
| **Well-being**   |           |          |           |          |
| EMM              | 3.35      | 3.62     | 3.30      | 3.30     |
| SE               | .04       | .04      | .08       | .08      |
| **Symptoms of ill-health** |           |          |           |          |
| EMM              | 2.04      | 1.66     | 2.16      | 1.96     |
| SE               | .04       | .04      | .07       | .07      |

Estimated Marginal Means (EMM) and Standard Errors (SE). doi:10.1371/journal.pone.0047291.t001

![Figure 1. Visual representation of 5-point scale employing glasses with varying levels of water.](https://doi.org/10.1371/journal.pone.0047291.g001)
Figure 3. Decomposing this interaction shows that whereas there was no difference between the two groups at T1 (Kalpwasis $EMM = 2.04, SE = .04$; Controls $EMM = 2.16, SE = .07$), $F(1, 533) = 2.03, p = .16, \eta^2_p = .004$, at T2 Kalpwasis reported significantly fewer symptoms ($EMM = 1.66, SE = .04$) than Controls ($EMM = 1.96, SE = .07$), $F(1, 533) = 15.02, p < .001, \eta^2_p = .027$. Moreover, for the Kalpwasis there was a sharper decrease in their reporting of symptoms from T1 ($EMM = 2.04, SE = .04$) to T2 ($EMM = 1.66, SE = .04$), $F(1, 415) = 88.35, p < .001, \eta^2_p = .176$, than amongst the Controls (T1 $EMM = 2.16, SE = .07$; T2 $EMM = 1.96, SE = .07$), $F(1, 126) = 6.67, p = .011, \eta^2_p = .05$.

Discussion

Our results reveal that whilst Kalpwasis and Controls had comparable pre-Mela scores on both of our measures (Well-being and Symptoms of Ill-health), their post-Mela scores diverge to show the Kalpwasis doing better. With regards to the Well-being measure, the Kalpwasis showed an improvement from before to after the Mela whereas the Controls did not. With regards to their reporting of Symptoms of Ill-health, the pattern is similar. Whilst there is some evidence that both groups improved (perhaps because the first measure was taken in the winter and the second...
was taken in spring) the improvement was greater for the benefits associated with such events. Such benefits may be diverse at such events is important. However, we also need to consider the planning for the control of disease and the through-flow of people. Certainly these risks are serious and should not be underplayed: gatherings. Such gatherings are judged as posing a variety of risks. Being able to follow one’s religious beliefs and enact religious rituals is likely to be identity-affirming and this may contribute to a sense of well-being. Moreover, the collective nature of this enactment is also likely to be important [36]. As discussed in the introduction, there is good evidence that a key ingredient in the association between well-being and religious belief/practice concerns the collective dimension to religious activity. This underlines the importance of considering how participation in group activities can be beneficial through leading people to feel supported by others and hence better able to control their everyday lives.

Our findings require that we reappraise the way we look at mass gatherings. Such gatherings are judged as posing a variety of risks. Certainly these risks are serious and should not be underplayed: planning for the control of disease and the through-flow of people at such events is important. However, we also need to consider the benefits associated with such events. Such benefits may be diverse [29,30]. Here we show they include well-being. Moreover, we found such benefits obtained even where the physical conditions are harsh (as they are in the collective event studied here). Recognizing the potential for such benefits is important. They help explain some of the attractions of such events and hence why people may be so determined to participate (of obvious importance for event-management). More generally our data provide distinctive evidence for the idea that participation in the social life of a group membership impacts well-being positively. As much work addressing the relationship between social group processes and well-being is cross-sectional in nature (rather than longitudinal) and derived from research conducted in Europe and North America, our data are particularly significant.

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Author Contributions

Conceived and designed the experiments: ST. Performed the experiments: ST. Analyzed the data: SK. Wrote the paper: NH SR NS ST.

References

1. Helliwell J F, Putnam R D (2004) The social context of well-being. Philos Trans R Soc Lond B 359: 1435–1446.
2. Cohen S (2004) Social relationships and health. Am Psychol 59: 676–684.
3. Walton G M, Cohen G L (2011) A brief social-belonging intervention improves academic and health outcomes of minority students. Science 331: 1447–1451.
4. James A, Wells A (2003) Religion and mental health: Towards a cognitive-behavioural framework. Br J Health Psychol 8: 359–376.
5. Seeman T E, Dubin L F, Seeman M (2003) Religiousity/spirituality and health: A critical review of the evidence for biological pathways. Am Psychol 58: 53–63.
6. George LK, Larson D B, Koenig H G, McCaulloch M E (2000) Spirituality and Health: What We Know, What We Need to Know. J Soc Clin Psych 19: 102–116.
7. Green M, Elliott M, Religion (2010) Religion, health and psychological well-being. J Rel Health 2010, 49: 149–163.
8. George L K, Ellison C G, Larson D B (2002) Explaining the relationship between religious involvement and health. Psychol Inq 13: 190–200.
9. Lim C, Putnam R D (2010) Religion, social networks and life satisfaction. Am Sociol Rev 75: 914–933.
10. Salm jan M, Brown T L, Brechting E H, Carlson C R (2005) The link between religion and spirituality and psychological adjustment: The mediating role of optimism and social support. Pers Soc Psychol Bull 31: 529–535.
11. Powell L H, Shahabi L, Thorsen C E (2003) Religion & spirituality and psychological adjustment: The mediating role of optimism and social support. Pers Soc Psychol Bull 31: 529–535.
12. Steffen R, Bouchana A, Johansson A, Drorak J, Isla N, et al. (2012) Non-communicable health risks during mass gatherings. Lancet Infect Dis 12: 66–74.
13. Wegger J, Van Diek R, Fisher G K, Wecking C, Moltzen K (2006) Work engagement and psychological well-being in call centre work. Work Stress, 20: 60–83.
14. Gleibs I H, Haslam S A, Jonsson A, Bouchana A, Drorak J, Isla N, et al. (2012) Non-communicable health risks during mass gatherings. Lancet Infect Dis 12: 142–149.
15. Paulus P, McCain G, Cox V (1978) Death rates, psychiatric commitments, blood pressure and perceived crowding as a function of institutional circumstances. Environ Psychol Non-Verbal Behav 3: 107–116.
16. Ising H, Kruppa B (2004) Health effects caused by noise: Evidence in the literature from the past 25 years. Noise Health 6: 5–13.
17. Goldthorpe J H, Ellul H, Wilmot J (2005) The Elementary Forms of Religious Life. Translated by K.E. Fields. New York: Free Press.
18. Turner V (1969) The Ritual Process: Structure and Anti-Structure. New York: Aldine De Gruyter.
19. Ehrenreich B (2006) Dancing in the streets. New York: Metropolitan.
20. Geertz D (2008) Event tourism: Definition, evolution, and research. Tourism Manage 29: 403–428.
21. Geertz D (2010) The nature and scope of festival studies. Int J Event Manage 5: 1–47.
22. Nicholls J (2002) The Kumh Mela. London: Indica Books.
23. Nordin A (2011) The Cognition of Harship Experience in Himalayan Pilgrimage. Numen 58: 632–673.
24. Measuring Healthy Days. Atlanta, Center for Disease Control and Prevention, 2000.
25. Rucklidge J, Begum H A, Shahnaz P, Pandey J (2002) Reactions to environmentally stressing: Gender differences in the slums of Dhaka and Islamabad. J Cross-Cult Psychol 33: 100–119.
26. Rucklidge J, Begum H A (1997) Urban stressors in South Asia: Impact on male and female pedestrains in Delhi and Dhaka. J Cross-Cult Psychol 28: 23–43.
27. Rucklidge J, Cullin J, Begum H A (1997) Urban stressors in South Asia: Impact on male and female pedestrains in Delhi and Dhaka. J Cross-Cult Psychol 28: 23–43.