

1 **Application of insects to wounds of self and others in chimpanzees in the wild**

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20 **In brief**

21           Medical practices characterize human societies and have been suggested to originate  
22 from observing the behavior of other animals. Mascaro and colleagues report that  
23 chimpanzees apply insects to their own and the open wounds of other conspecifics, thereby  
24 adding to the current debate on self-medicative and prosocial behaviours in nonhuman  
25 animals.

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31 Self-medication refers to the process by which a host suppresses or prevents the  
32 deleterious effects of parasitism and other causes of illness via behavioural means<sup>1</sup>. It has  
33 been observed across multiple animal taxa (e.g., bears, elephants, moths, starlings)<sup>2</sup>, with  
34 multiple case studies concerning great apes<sup>1,3</sup>. Although the majority of studies on self-  
35 medication in primates concern the ingestion of plant parts or non-nutritional substances to  
36 combat or control intestinal parasites<sup>4</sup>, more recent examples also report topical applications  
37 of leaves or other materials (including arthropods) to skin integuments<sup>3</sup>. Thus far, however,  
38 the application of insects or insect parts to an individual's own wound or the wound of a  
39 conspecific has never been reported in non-human primates

40 Here, we report the first observations of chimpanzees applying insects to their own  
41 wounds (N=19) and to the wounds of conspecifics (N=3, see table in the SI). Over a period of  
42 15 months (November 2019 - February 2021), we observed a total of 76 open wounds on 22  
43 different chimpanzees (eleven adult males, two adolescent males, one juvenile male, four  
44 adult females, two adolescent females, and two juvenile females; see table in the SI). In 19  
45 events, individuals (five adult males, one adult female, one juvenile female) applied an insect  
46 to one of their own wounds using the following behavioural sequence: (1) they first caught  
47 an insect, (2) immobilised it by placing and/or squeezing the insect between their lips, (3)  
48 placed the insect to an exposed surface of the wound and moved the insect on the surface  
49 using their fingertips or lips, and (4) extracted the insect from the wound with the mouth or  
50 their fingers (see figure 1, videos S1 and S2 and additional videos at  
51 <https://youtube.com/c/OzougaSociety>). Parts 3 and 4 are often repeated multiple times  
52 during each event. Though the insect species(') utilised has not yet been identified, there are  
53 several consistencies across all our observations: 1) the insect(s) appears to be a winged,  
54 flying insect, given the fast motion used to catch it; 2) the insect(s) is caught from under a leaf

55 or branch; 3) the insect(s) are small in size ~5mm and usually dark in colour and 4) there was  
56 no observation of insect ingestion.

57 In three other events, we observed different chimpanzees applying or moving an  
58 insect not to their own wound, but to the wound of another chimpanzee (see selected event  
59 descriptions in the SI). On November 13<sup>th</sup> 2019, an adult female, Suzee, caught an insect and  
60 applied it to an approximately 2cm open flesh wound on the foot of her adolescent son, Sia.  
61 Subsequently, she extracted and re-applied the insect two more times using both her mouth  
62 and fingers (see video S2). This was the only event of allo-application involving maternally  
63 related individuals.

64 On October 20<sup>th</sup> 2020, another adult female, Carol, had been grooming around the  
65 approximately 5cm open flesh wound on the calf of an adult male, Littlegrey. She then caught  
66 an insect, and Littlegrey took it from her fingers, put it between his lips and placed the insect  
67 to the surface of his open wound. Subsequently, Carol and another adult male, Thea, used  
68 their fingers to move the insect on the surface of the wound. A third adult male, Ngonde, then  
69 approached them, took the insect out of the wound, placed it between his lips, and re-applied  
70 it to the wound.

71 On January 29<sup>th</sup> 2021, another adult male, Arnold, caught an insect, moved it to his  
72 mouth, between his lips and then applied it to the surface of an approximately one cm open  
73 flesh wound on the right thumb of Littlegrey. He lip-smacked whilst moving the insect on the  
74 surface of the wound with his fingertips.

75 Given the unambiguous context in which the observed behaviour occurred (injured  
76 individuals with open flesh wounds), we suggest that these observations may represent  
77 another case of medicative behaviour in non-human animals<sup>2</sup>. Moreover, these observations  
78 expand the existing knowledge to include allo-medication of open wounds. However, further

79 systematic research is needed to elucidate the efficacy of the treatment associated with an  
80 improvement in healing of wounds, identification of insect species used, and the distribution  
81 and acquisition of this behaviour in the Rekambo community.

82 Furthermore, our observations contribute to the current debate on the existence of  
83 prosocial behaviours in non-human species (e.g.,<sup>5,6,7</sup>). Prosocial behaviours refer to actions  
84 that are intended to benefit another, and seem to be driven in humans by empathic concerns  
85 for each other<sup>6</sup>. Prosocial behaviours have long posed a problem for evolutionary theory,  
86 because it was not immediately clear why organisms might help others in the face of selection  
87 operating in the interest of self. Chimpanzees have been suggested as important candidates  
88 for studies into the evolution of prosocial behaviors because they participate in a variety of  
89 activities that benefit from cooperation, such as territorial patrols, coalitionary aggression,  
90 and hunting<sup>8</sup>. However, the literature remains controversial, with some evidence suggesting  
91 that chimpanzees lack prosocial behaviours involving the type of empathy that is thought to  
92 characterize humans (e.g.,<sup>7</sup>), while others argue that their prosocial tendencies exhibit  
93 characteristics consistent with empathy<sup>5</sup>. Hence, our observations may add another facet to  
94 the ongoing debate on prosocial behaviors and inspire future studies investigating the  
95 behaviours surrounding wound care and the potential medicative function of insect-  
96 application.

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108 **Author Contributions**

109 TD and SP direct the Ozouga Loango Chimpanzee Project and supervise the administrative  
110 and scientific work. AM and LMS collected the data. AM, LMS, and SP edited the data. AM  
111 wrote the first draft of the paper, and SP and LMS created the detailed event report. SP, LMS,  
112 TD and AM finalized the paper.

113 **Declaration of interest**

114 The authors declare no competing interests.

115 **Supplemental Information**

116 Supplemental data including methods (the study site description and data collection  
117 protocol), detailed descriptions of events and two video clips (see video S1 and S2) are  
118 available online at: xxx. Additional videos clips of insect application are available at  
119 <https://youtube.com/c/OzougaSociety>.

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121 **Figure 1. Application of insect to a wound**

122 Figure 1 shows the behavioral sequence of an adult chimpanzee male catching and applying  
123 an insect to a wound on his left shin in six frames (A-F). Red circles highlight the object or  
124 action of interest in specified frames. (A) The male captures an insect with his left hand; (B)  
125 He transfers the insect from the fingers of his left hand to his lips; (C) Keeping the insect  
126 between his lips, he moves his head and lips towards the wound; (D) The male applies the  
127 insect, which is still between his lips, onto an exposed surface of the open wound on his left  
128 shin; (E) He moves the insect on the surface of the wound with the index finger of his right  
129 hand; (F) The male closely inspects his wound and continues to groom around it with his left  
130 hand.

131 **Video S1. *Capture and self-application of an insect by an adult male, Freddy, to his own***  
132 ***open wound***

133 This video involves an adult male, Freddy, who has a day-old wound in the elbow crook of his  
134 left arm (for further details see event descriptions in the SI) and is resting close to another  
135 adult male. He pulls a shrub towards himself with his left foot, reaches out with his right hand  
136 and makes a quick catching movement thereby grabbing a leaf with his right hand. He then  
137 moves the leaf towards his mouth and uses his lips to pick up an unidentified insect from it.  
138 He takes the insect from his mouth with the thumb and index finger of his right hand and  
139 applies it to the wound on his left arm using his thumb to move the insect on the surface of  
140 the open wound. He then moves his head quickly towards the wound and picks up the insect  
141 again with his lips. Next, he again takes the insect with the thumb and index finger of his right  
142 hand from his mouth/lips and applies it again to the wound. He presses it softly with his  
143 thumb against the surface of the wound. Subsequently, he moved his fingers of his right hand

144 back to his mouth and seems to move and press the insect between his lips. He then applies  
145 it again to the wound with the thumb and index finger of his right hand. Overall, this video  
146 sequence shows a total of three applications of an unidentified insect to a wound.

147 **Video S2. Capture and allo-application of an insect from an adult female, Suzee, to a wound**  
148 **of her adolescent son, Sia**

149 This video shows an adult female, Suzee, resting with her infant, Sassandra, and her  
150 adolescent son, Sia (see SI for further information). Sia had a day-old open wound of  
151 approximately three cm on his left foot and is lying on his back in proximity to her. Sassandra  
152 is swinging playfully around her. Suzee sits up and reaches out with her right hand to catch  
153 an unidentified insect from under a leaf of a low hanging branch. She looks at it between her  
154 fingers and then places it carefully between her lips. Sassandra directly stops swinging, and  
155 jumps towards her mother and observed her behaviour. She stretches out her arms to be  
156 picked up but Suzee parries her off and moves closer to Sia whilst in parallel grabbing his left  
157 foot with her right hand. Sia moves the foot up in the air and disengages Suzee's grip while  
158 Suzee is still parrying off Sassandra. She then grabs Sia's foot with her left hand, hands it  
159 over to her right hand, takes the insect out of her mouth with the fingers of her left hand and  
160 applies it to the wound. Subsequently, she picks up the insect from the wound with her mouth  
161 and appears to keep it tightly pressed between her lips. She then moves the fingers of her left  
162 hand to her lips, takes the insect and applies it again to Sia's wound. An adult female, Joy,  
163 approaches Suzee, Sassandra and Sia to observe the behaviour and her positioning reduces  
164 the visibility of the observers. Suzee then again moves the fingers of her left hand from the  
165 wound back to her lips and then back to the wound. An adult male, Littlegrey, who had been  
166 in proximity approaches them and positions himself quadrupedally to look over Joy's shoulder



167 and observes Suzee's behaviour. Overall, this video sequence shows a total of three  
168 applications of an unidentified insect to the wound of a related individual.

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